

**NHSRCL Exam Pattern & Syllabus for the post of
Technician (S&T)
advertised against vacancy notice no. 04/2023**

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NHSRCL Exam Pattern

This examination will be conducted on Computer Based Mode. The paper will consist of Multiple-Choice questions of Objective Type. In this paper, question will be asked from General Awareness, General Intelligence, Reasoning, Quantitative Aptitude, General English and Knowledge of Discipline.

- There will a total of 120 question.
- Each question will carry equal mark.
- There will be negative marking for every wrong answer.
- 1/4 Mark will be deducted for wrong answer.
- Duration of paper will be 01 Hours 30 Minutes.

Exam Pattern

Subject	Maximum Question	Maximum Marks	Duration of Paper
General Awareness	15	15	01 Hour 30 Minutes
General English	15	15	
General Intelligence & Reasoning, Quantitative Aptitude	30	30	
Knowledge of Discipline	60	60	

Syllabus for Technician (S&T) Examination

General Awareness

- Current Affairs (National and International)
- Major Financial / Economic News
- About Group of Twenty (G20)
- Sports
- Books and Authors
- Awards and Honours
- Science – Inventions and Discoveries
- Abbreviations & Important Days
- General Information about High-Speed Railways.

General English

- Vocabulary & Grammar
- Antonyms & Synonyms and its correct usage.
- Basics of English Language.
- Sentence structure.
- Reading Comprehension

General Intelligence, Reasoning & Quantitative Aptitude

- Spatial Visualization.
- Visual Memory.
- Discrimination.
- Non-verbal series.
- Analogies.
- Observation.
- Coding and Decoding
- Arithmetic Number Series.
- Arithmetical Reasoning.
- Similarities and Differences
- Figures Classification.
- Relationship concepts.
- Spatial Orientation.
- Number System
- HCF, LCM
- Simplification
- Decimal Fractions
- Ratio & proportions
- Unitary Method
- Percentage, Time & Distance

- Time & Work
- Profit & loss
- Average
- Simple & Compound Interest
- Mensuration
- Algebra
- Data Interpretation

Knowledge of Discipline

Basics of AC and Electrical Cables

Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC & DC. Terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, P-P, Instantaneous value. Single phase and Three phase supply. Terms like Line and Phase voltage/ currents. Insulators, conductors and semiconductor properties.

Cells & Batteries:

Battery /Cells: construction, types of primary and secondary cells, materials used, Specification of cells and batteries. Series / parallel connection of batteries and purpose of such connections.

Passive Components:

Ohm's law and its variables. Resistors, Capacitors and Inductors. KVL& KCL with applications. Types of capacitors, Series parallel connection of capacitors. Capacitor behaviour with AC and DC. Concept of Resonance and its application in RC,RL& RLC series and parallel Types and circuit significance of electro magnetism, types of cores. Electromagnetic Relays.

Transformers

Working principle of a Transformer, Transformer construction, Types of cores used. Specifications of a transformer, Step-up, Step down and isolation transformers with applications.

Measuring Instruments:

AC & DC measurements - Introduction to electrical measuring instruments, Importance of meter, classification of meters, MC and MI meter, range extension, need of calibration, characteristics of meters and errors in meters. Multi meter, Use of CRO, Function generator, LCR meter.

Digital Storage Oscilloscope: Block diagram of DSO/CRO and applications of DSO/CRO application of digital CRO, block diagram of function generator. Differentiate a CRO with DSO. Advantages of DSO. Major features of DSO.

Rectifiers

Diodes, Zeners, PN Junction, Forward and Reverse biasing of diodes, Interpretation of diode specifications Forward current and Reverse voltage. Diode Bridge Modules. Rectifier configurations, their efficiencies, Filter components and their role in reducing

ripple. Working principles of Zener diode / specifications / applications, Varactor diode / Tunnel diode/ specifications with applications.

IC Regulators

Regulated Power supply using 78XX series, 79XX series, Op-amp regulator, 723 regulator, (Transistorized & IC based) voltage regulation.

Transistor

Construction, Working of a PNP and NPN Transistors. Purpose of E, B & C Terminals. Flow of currents into and out of terminals of PNP/ NPN Transistors and their relations. Significance of β of a Transistor Need for Biasing of Transistor junctions, Interpretation of main parameters of a Transistor. V_{BE} , V_{CB} , V_{CE} , I_C , I_B , Junction Temperature, junction capacitance, Frequency of operation, Discuss a Transistor application as a switch. Amplifiers- Transistor (CB, CE & CC) configurations and their characteristics and applications Transistor biasing circuits and stabilization Techniques. Classification of amplifiers according to frequency, mode of operation, methods of coupling, Voltage amplifiers- voltage gain, loading effect. Configuration of common emitter, common base, common collector transistor, their definition characteristics and applications. Single stage CE amplifier, (CC amplifier) emitter follower circuit and its advantages RC coupled amplifier, Distinguish between voltage and power amplifier, Push pull amplifier and class C tuned amplifier Alpha, beta, voltage gain, Concept of dB, dBm. Feedback and its types. Introduction to positive feedback and requisites of an oscillator, Study of Colpitts, Hartley, Crystal and RC oscillators. Types of multi vibrators. Op – Amp & Timer 555 Applications: Block diagram and Working of Op Amp, importance, Ideal characteristics, advantages and applications. Schematic diagram of 741, symbol, Non inverting voltage amplifier, inverting voltage amplifier, summing amplifier, Comparator, zero cross detector, differentiator, integrator and instrumentation amplifier, other popular Op-Amps. Block diagram of 555, functional description w.r.t. different configurations of 555 such as mono stable, Astable and VCO operations for various application.

Wave shaping circuits

Diode shunt clipper circuits and Clamping /limiting circuits and their applications. Schmitt trigger circuits.

Power Electronics

Construction of FET, differentiate it with BJT. Purpose of Gate, Drain and source terminals and voltage / current relations between them, Impedances between various terminals. Interpret the main parameters of the FET. Suitability of FET amplifiers in measuring device applications. Working of power electronic components such as SCR, TRIAC, DIAC and UJT. MOSFET & IGBT: Working of MOSFET, Power MOSFET and IGBT - their types, characteristics, switching speed, power ratings and protection. Differentiate FET with MOSFET, differentiate a Transistor with IGBT. SMPS, UPS and Inverters.

Opto Electronics:

Working and application of LED, IR LEDs, Photo diode, photo transistor, its characteristics and application, optical sensor, opto-couplers, circuits with opto isolators, characteristics of LASER diodes.

Digital Electronics:

Basic Gates: Difference between analog and digital signals, Logic families and their comparison, Logic levels of TTL and CMOS. Number systems (Decimal, binary, octal, Hexadecimal) BCD code, ASCII code and code conversions. Logic Gates and their truth tables. Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders, 2-bit and four bit full adders. Concept of encoder and decoder, Need for multiplexing of data. 1:4 line Multiplexer /Demultiplexer. Introduction to Flip-Flop. S-R Latch, Gated S-R Latch, D- Latch. Flipflop: Basic RS Flip Flop, edge triggered D Flip Flop, JK Flip Flop, T Flip Flop, Master-Slave flip flops and Timing diagrams, Basic flip flop applications like data storage , data transfer and frequency division. Basics of Counters, types of counters, two bit and three bit Asynchronous binary counters and decade counters with the timing diagrams. 3-bit Synchronous counters and synchronous decade counters. Types of seven segment display, BCD display, BCD to decimal decoder. BCD to 7 segment display circuits, Basics of Register, types and application of Registers.

Protection devices:

Fuse ratings, types of Fuses, Fuse bases, single/three phase MCBs, single phase ELCBs. Types of Contactors, contactor coils and working voltages, contactor contact currents, protection to contactors and high current applications.

Electrical control circuits:

Fundamentals of single phase Induction motors, synchronous speed, slip, rotor frequency, torque – speed characteristics, Starters used for Induction motors.

Communication electronics:

Radio Wave Propagation –Principle, Fading, Need for Modulation, types of modulation. Demodulation techniques.

Fundamentals of Antenna, various parameters, types of Antennas & application. Introduction to AM, FM & PM, SSB-SC & DSB-SC, block diagram of AM and FM transmitter. FM Generation & Detection, Radio Receivers: Types, Super heterodyne receiver Blocks, Principle, characteristics, advantages and disadvantages, Block diagram of FM Receives, RF, IF & AF Amplifier Sections, AM/FM, RF Alignment.

Sensors ,Transducers and Applications

Basics of passive and active transducers. Role, selection and characteristics. Working principles of RTD, PT-100 Thermocouple, Sensor voltage and current formats. Thermistors – salient features, operating range, composition, advantages and disadvantages.

Thermocouples – basic principle , commonly used combinations, operating range, advantages and disadvantages. Strain gauges – principle, gauge factor, types of strain gauges. Load cell –definition, uses, working of strain gauge load cell-Principle of operation of capacitive transducers,-advantages and disadvantages Principle of operation of inductive transducers,-advantages and disadvantages. Principle of operation of LVDT-its advantages and disadvantages. Proximity sensors – applications, working principles of eddy current , capacitive and inductive proximity sensors.

Fiber optic communication: Introduction to optical fiber as a transmission media, its advantages over other media, properties of optic fiber, testing, losses , types of fiber optic cables and specifications. Encoding of light. Fiber optic joints, splicing, testing and the related equipment's/measuring tools, precautions to be taken laying of cables, safety aspects while handling optical cables.

LCD and LED TV

Difference between a conventional CTV with LCD & LED TVs, Principle of LCD and LED TV and function of its different section. Basic principle and working of 3D TV. IPS panels and their features Different types of interfaces like HDMI, USB, RGB etc with latest TVs. TV Remote Control –Types, parts and functions, IR Code transmitter and IR Code Receiver, Working principle, operation of remote control. Different adjustments, general faults in Remote Control.

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Knowledge of Discipline	60	60	

Syllabus for Junior Engineer (S&T) Examination

General Awareness

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General English

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- Reading Comprehension

General Intelligence, Reasoning & Quantitative Aptitude

- Spatial Visualization.
- Visual Memory.
- Discrimination.
- Non-verbal series.
- Analogies.
- Observation.
- Coding and Decoding
- Arithmetic Number Series.
- Arithmetical Reasoning.
- Similarities and Differences
- Figures Classification.
- Relationship concepts.
- Spatial Orientation.
- Number System
- HCF, LCM
- Simplification
- Decimal Fractions
- Ratio & proportions
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- Time & Work
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- Data Interpretation

Knowledge of Discipline

Signaling:

- a) Signaling Relays: Working principle, types of relays
- b) Color light signals: types of color light signals, aspects
- c) Track circuit: Working principle, types of track circuit, bonds
- d) Axle Counter: Working Principles, types of Axle Counter
- e) Point Machine: Component of point, operation of point machine, types of point machine.
- f) Solid State Interlocking / Computer based interlocking: Knowledge of components of CBI/ SSI; principle of interlocking; Control /Route Table; concept of overlap, flank protection, route, track locking, approach locking etc.
- g) Automatic Control System: Cab signaling; on-board and trackside equipment, interface with Rolling stock; ETCS- Level 1,2,3, Grade of Automation; Concept of Fixed Block and Moving Block System; Communication Based Train Control System (CBTC)
- h) Centralized Traffic Control System
- i) Power Supply: UPS, Battery

Communication:

- a) Telephone Exchange and Despatcher Telephone
- b) Passenger Information Display system and Announce system
- c) Train Radio System: (GSM, LTE-R, TETRA)
- d) Data Transmission System and Networking
- e) Master Clock System
- f) CCTV system
- g) Optical Fiber Communication
- h) Cyber security

Ticketing System:

- a) Fare Media including National Common Mobility Cards
- b) Station level equipment (Automatic Gates, Ticket Reader, Ticket Operating Machines, Ticket Vending Machines)
- c) Station Computer
- d) Central Computer including CCHS

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General Awareness

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- Books and Authors
- Awards and Honours
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- General Information about High-Speed Railways.

General English

- Vocabulary & Grammar
- Antonyms & Synonyms and its correct usage.
- Basics of English Language.
- Sentence structure.
- Reading Comprehension

General Intelligence, Reasoning & Quantitative Aptitude

- Spatial Visualization.
- Visual Memory.
- Discrimination.
- Non-verbal series.
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- Arithmetic Number Series.
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- Percentage, Time & Distance

- Time & Work
- Profit & loss
- Average
- Simple & Compound Interest
- Mensuration
- Algebra
- Data Interpretation

Knowledge of Discipline

- Engineering Mathematics
- Theory of Structures
- Building Materials
- Estimating, Costing and Valuation
- Surveying
- Soil Mechanics
- Hydraulics
- Structural Engineering
- Water / Irrigation Engineering
- Transportation Engineering
- Environmental Engineering

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Syllabus for Assistant Manager (Planning) Examination

General Awareness

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General English

- Vocabulary & Grammar
- Antonyms & Synonyms and its correct usage.
- Basics of English Language.
- Sentence structure.
- Reading Comprehension

General Intelligence, Reasoning & Quantitative Aptitude

- Spatial Visualization.
- Visual Memory.
- Discrimination.
- Non-verbal series.
- Analogies.
- Observation.
- Coding and Decoding
- Arithmetic Number Series.
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Knowledge of Discipline

- Building Materials
- Estimating, Costing and Valuation
- Surveying
- Transportation Engineering
- Planning Methodologies and Analysis
- EOT Analysis and Conventions
- Health, Safety and Environment in Projects

**NHSRCL Exam Pattern & Syllabus for the post of
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General English	15	15	
General Intelligence & Reasoning, Quantitative Aptitude	30	30	
Knowledge of Discipline	60	60	

Syllabus for Assistant Manager (HR) Examination

General Awareness

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General English

- Vocabulary & Grammar
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General Intelligence, Reasoning & Quantitative Aptitude

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Knowledge of Discipline

- General Management
- Human Resource Management
- Human Resource Development
- Organizational Behaviour
- Industrial Relations
- Labour Legislation
- Labour Welfare
- Labour Laws
- DPE/DOPT guidelines on various rules like Leave Rules, TA Rules etc.
- IDA/CDA pay scales, various perks & allowances.
- Conduct, Discipline & Appeal Rules.

**NHSRCL Exam Pattern & Syllabus for the post of
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General Intelligence & Reasoning, Quantitative Aptitude	30	30	
Knowledge of Discipline	60	60	

Syllabus for Junior Manager (Civil) Examination

General Awareness

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General English

- Vocabulary & Grammar
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- Basics of English Language.
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General Intelligence, Reasoning & Quantitative Aptitude

- Spatial Visualization.
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Knowledge of Discipline

- Engineering Mathematics
- Theory of Structures
- Building Materials
- Estimating, Costing and Valuation
- Surveying
- Soil Mechanics
- Hydraulics
- Structural Engineering
- Water / Irrigation Engineering
- Transportation Engineering
- Environmental Engineering

**NHSRCL Exam Pattern & Syllabus for the post of
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Subject	Maximum Question	Maximum Marks	Duration of Paper
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General English	15	15	
General Intelligence & Reasoning, Quantitative Aptitude	30	30	
Knowledge of Discipline	60	60	

Syllabus for Junior Manager (Electrical) Examination

General Awareness

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General English

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General Intelligence, Reasoning & Quantitative Aptitude

- Spatial Visualization.
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Knowledge of Discipline

General Electrical Engineering & its Railway Applications

- Power System & Analysis
- Utilization of Electrical Energy.
- Power System Protection & Switch Gear.
- Electrical Machines.
- Electromagnetic Theory.
- Network Analysis.
- Electrical Instrumentation.
- Power Electronics & Drives.
- Control Systems.
- Building Electrical Works
- Railway Traction Power Supply System
- Various types of Overhead Equipments (OHE)