JTO SYLLABUS

Question Paper Pattern for JTOs(Telecom Engineering)
Section-I : Engineering stream: 50 questions
Section-II : Engineering stream: 50 questions
Section-III : General Ability Test: 20 questions

For JTOs (B.tech Electrical Engineering EE)
Section-I : Electrical Engineering stream : 50 questions
Section-II : Electrical Engineering stream: 50 questions
Section-III: General Awareness : 20 questions

For JTOs (B.tech Civil Engineering)
Section-I : Civil Engineering stream : 50 questions
Section-II : Civil Engineering stream: 50 questions
Section-III : General Ability Test : 20 questions

SYLLABUS: TELECOM ENGINEERING

SECTION - I

1. Materials and components
Structure and properties of Electronic Engineering materials, Conductors, Semiconductors and Insulators, Magnetic, Ferroelectric, Piezoelectric, Ceramic, Optical and Superconducting materials. Passive components and characteristics, Resistors, Capacitors and Inductors; Ferrites, Quartz crystal, Ceramic resonators, Electromagnetic and Electromechanical components.

2. Physical Electronics, Electron Devices and ICs
Electrons and holes in semiconductors, Carrier Statistics, Mechanics of current flow in a semi-conductor, Hall effect; Junction theory; Different types of diodes and their characteristics; Bipolar Junction transistor; Field effect transistors; Power switching devices like SCRs, CTOs, power MOSFETs; Basics of ICs-bipolar, MOS and CMOS types; Basics of Opto Electronics.

3. Network theory
Network analysis techniques: Network theorem, transient and steady state sinusoidal response, and Transmission criteria: delay and rise time Elmoreâ€™s and other definition, effect of cascading. Elements of network synthesis.

4. Electromagnetic Theory
Transmission lines: basic theory, standing waves, matching applications, micro strip lines; Basics of waveguides and resonators; Elements of antenna theory.

5. Electronic Measurements and instrumentation
Basic concepts, standards and error analysis; Measurements of basic electrical quantities and parameters; Electronic measuring instruments and their principles of working: analog and digital, comparison, characteristics, and applications. Transducers; Electronic measurements of non-

electrical quantities like temperature, pressure, humidity etc. Basics of telemetry for industrial use.

6. Power Electronics
Power Semiconductor devices, Thyristor, Power transistor, MOSFETs, Characteristics and operation. AC to DC converters; 1-Phase and 3-phase DC-to-DC Converters.
AC regulators. Thyristor controlled reactors, switched capacitor networks.
Inverters: Single-phase and 3-phase. Pulse width modulation. Sinusoidal modulation with uniform sampling. Switched mode power supplies.

SECTION-II

1. Analog Electronic Circuits
Transistor biasing and stabilization, Small Signal analysis. Power amplifiers. Frequency response, Wide band techniques, Feedback amplifiers. Tuned amplifiers. Oscillators. Rectifiers and power supplies. Operational Amplifier, other linear integrated circuits and applications. Pulse shaping circuits and waveform generators.

2. Digital Electronic Circuits
Transistor as a switching element; Boolean algebra, simplification of Boolean functions, Karnaugh Map and applications; IC Logic gates and their characteristics; IC logic families: DTL, TTL, ECL, NMOS, PMOS and CMOS gates and their comparison; Combinational logic circuits; Half adder, full adder; Digital Compartor; Multiplexer Demultiplexer; ROM and their applications. Flip-flops, R-S, J-K, D and T flip-flops; Different types of counters and registers; waveform generators. A/D and D/A convertors. Semiconductor memories.

3. Control Systems
Transient and steady state response of control systems; Effect of feedback on stability and sensitivity, Root locus techniques; Frequency response analysis. Concepts of gain and phase margins; Constant-M and Constant-N Nicholâ€™s Chart; Approximation of transient response from Constant-N Nicholâ€™s Chart; Approximation of transient response from closed loop frequency response; Design of Control Systems, Compensators; Industrial controllers.

4. Communication systems
Basic information theory: Modulation and detection in analogue and digital systems; Sampling and data reconstruction. Quantization & Coding; Time division and frequency division multiplexing; Equalisation; Optical Communication: in free space & fiber optic; Propagation of signals at HF, VHF, UHF and microwave frequency; Satellite communication.

5. Microwave Engineering
Microwave Tubes and solid state devices, Microwave generation and amplifiers, Waveguides and other Microwave Components and Circuits, Microstrip circuits, Microwave antennas, Microwave Measurements, MASERS LASERS; Microwave Propogation. Microwave Communication Systems-terrestrial and satellite based.

6. Computer Engineering
Number Systems; Data representation; Programming; Elements of a high level programming

language PASCAL/C; use of basic data structures; Fundamentals of computer architecture processor design; Control unit design; Memory organization. I/O System Organization. Personal computers and their typical uses.

7. Microprocessors
Microprocessor architecture - Instruction set and simple assembly language programming. Interfacing for memory and I/O. Applications of Microprocessors in Telecommunications and power system.

SECTION-III

General ability test
The candidateâ€™s comprehension and understanding of General English shall be tested through simple exercises. Questions on knowledge of current events and of such matter of everyday observation and experience in their scientific aspects as may be expected of an educated person. Questions will also be included on events and developments in Telecommunications, History of India and Geography. These will be of a nature, which can be answered without special study by an educated person.

SYLLABUS: CIVIL ENGINEERING STREAM

SECTION - I

1. BUILDING MATERIAL
Timber: Different types and species of structural timber, density-moisture relationship, strength in different directions, defects, influence of defects on permissible stress, preservation, dry and wet rots, plywood, codal provision for design.
Bricks: Types, Indian standard classification, absorption, saturation factor, strength in masonry, influence of mortar strength and masonary strength.
Cement: Compounds, different types, setting times, strength.
Cement Mortar: Ingredients, proportions, water demands, mortar for plastering and masonry.
Concrete: Importance of W/C ratio, strength, ingredients including admixtures, workability, testing, elasticity, non-destructive testing mix design method.

2. SOLID MECHANICS
Elastic constants, stress, plane stress, Mohrâ€™s circle of stress, strains, plain strain, Mohrâ€™s circle of strain, combined stress. Elastic theories of Failure, simple and shear bending, Torsion of circular and rectangular section and simple members.

3. STRUCTURAL ANALYSIS
Analysis of determinate structures- different methods including graphical methods. Analysis of indeterminate skeletal frames- moment distribution, slope deflection, stiffness and force methods, energy methods. Muller-Breslau principal and application. Plastic analysis of indeterminate beams and simple frames-shape factors.

4. DESIGN OF STEEL STRUCTURES
Principle of working stress method. Design of connections of simple members. Built up sections and frames. Design of Industrial roofs. Principles of ultimate load design. Design of members and frames.

5. DESIGN OF CONCRETE AND MASONRY STRUCTURES.
Limit state design for bending, shear, axial compression and combined forces, Codal provisions for slabs, beams, walls and footings. Working stress method of design of R.C. members.
Principles of prestressed concrete design, material, method of prestressing losses. Design of simple members and determinates structures. Introductions to prestressing of indeterminate structures.
Design of brick masonary as per I.S. codes.

6. CONSTRUCTION PRACTICE, PLANNING AND MANAGEMENT.

- Concreting Equipment
  Weight batcher, Mixer, vibrator, batching plant, concrete pump. Cranes, hoists, lifting equipment.
- Earthwork Equipment
  Power shovel, hoe, dozer, dumper, trailers and tractors, rollers, sheep foot rollers, pumps.
  Construction, planning and Management.
  Bar chart, linked bar chart, work break down structures, Activity-on-arrow diagrams.
  Critical path, probabilistic activity durations; Event-based networks.
  PERT network: Time-cost study, crashing; Resource allocation.

SECTION - II

1. (a) FLUID MECHANICS, OPEN CHANNEL, PIPE FLOW
Fluid properties, pressure, thrust, Buoyancy, Flow Kinematics, integration, of flow equation, Flow measurement, Relative motion, Moment of momentum, Viscosity, Boundary layer and control, Drag, Lift, Dimensional analysis, Modeling, Cavitations, Flow oscillations, Momentum and Energy principles, in open cannel flow, Flow control, Hydraulic jump, Flow section and properties, Normal flow, Gradually varied flow, Flow development and losses in pipe flows, Measurements, Siphons, Surges and Water hammer, Delivery of Power Pipe networks.
(b) HYDRAULIC MACHINES AND HYDROPOWER
Centrifugal pumps, performance parameters, scaling, pumps in parallel, Reciprocating pumps, air vessels, performance parameters.

2. (a) HYDROLOGY
Hydrological cycle, precipitation and related data analysis, PMP, unit and synthetic hydrographs, Evaporation and transpiration, floods and their management, PMG, Streams and their gauging, .River morphology. Rooting of floods, Capacity of reservoirs.
(b) WATER RESOURCES ENGINEERING
Water resources of the globe: Multipurpose uses of Water, Soil Plant water relationships, irrigation systems, water demand assessment, Storage and their yields, ground water yield and well Hydraulics, Water logging, drainage design, Irrigation revenue, Design of rigid boundary canals,

Laceyâ€™ and Tractive force concepts in canal design, lining of canals; Sediment transport in canals; Non-Overflow and overflow sections of gravity dams and their design, Energy dissipaters and tail water rating, Design of head works, distribution work, falls, cross-drainage work, outlets, River training.

ENVIRONMENT ENGINEERING

3. (a)WATER SUPPLY ENGINEERING

Sources of supply, yield, design of intakes and conductors, Estimation of demand, Water quality standards, Control of water born diseases. Primary and secondary treatment, detailing and maintenance of treatment units. Conveyance and distribution systems of treated water, leakage and control, Rural water supply, Institutional and Industrial water supply.

(b) WASTE WATER ENGINEERING

Urban rain water disposal, system of sewage collection and disposal, Design of sewers and sewerages systems, pumping, Characteristic of sewage and its treatment, Disposal of products of sewage treatment, stream flow rejuvenation, Institutional and industrial sewage management, plumbing system, Rural and semi-urban sanitation.

(c) SOLID WASTE MANAGEMENT

Sources, classification, collection and disposal, Design and Management of landfills.

(d) AIR AND NOISE POLLUTION AND ECOLOGY

Sources and effects of air pollution, monitoring of Air pollution, Noise-pollution and standards; Ecological Chain and balance, Environmental assessment.

4. (a)SOIL MECHANICS

Properties of soils, classification and interrelationship, Compaction behavior, method of compaction and their choice, Permeability and seepage, flow nets, Inverter filters, Compressibility and consolidation ,shearing resistance, stresses and failure, SO testing in laboratory and in-situ, Stress path and applications, Earth pressure theories, stress distribution in soil, soil exploration, samplers, load tests ,penetration tests.

(b) FOUNDATION ENGINEERING

Type of foundations, Selection criteria, bearing capacity, settlement, laboratory and field test, Types of piles and their design and layout, Foundations on expansive soils, swelling and it prevention , foundation on swelling soils.

5. (a) SURVEYING

Classification of surveys, scales, accuracy, Measurement of distances-direct and indirect methods, optical and electronic devices, Measurement of directions, prismatic compass, local attraction, Theodolites-types Measurment of elevations, Spirit and trigonometric leveling, Relief representation,Contours,Digital elevation modeling concept, Establishment of control by triangulations and traversing measurements and adjustment of observations, computation of coordinates, Field astronomy, concept of global positioning system, Map preparation by plane tabling and by photogrammetry, Remote sensing concepts, map substitutes.

(b) TRANSPORTATION ENGINEERING

Planning of highway systems, alignment and geometric design, horizontal and vertical curves, grade separation, Materials and construction methods for different surfaces and maintenance, Principles of pavement design, Drainage.

Traffic surveys, intersections, signaling, Mass transit systems, accessibility, networking. Planning

of railway systems, terminology and designs, relating to gauge, track controls, transits, rolling stock, tractive power and track modernization, Maintenance Appurtenant works, Containerization.

SECTION - III

GENERAL ABILITY TEST
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SYLLABUS: ELECTRICAL ENGINEERING

SECTION - I

1. EM Theory
Electric and magnetic fields. Gaussâ€™s Law and Amperes Law. Fields in dielectrics, conductors and magnetic materials. Maxwellâ€™s equations. Time varying fields. Plane-Wave propagating in dielectric and conducting media. Transmission lines.

2. Electrical Materials
Band Theory, Conductors, Semi-conductors. and Insulators. Superconductivity. Insulators for electrical and electronic applications. Magnetic materials. Ferro and ferri magnetism. Ceramics, Properties and applications. Hall effect alJd its applications. Special semi conductors.

3. Electrical Circuits
Circuits elements. Kirchoffâ€™s Laws. Mesh and nodal analysis. Network Theorems and applications. Natural response and forced response. Transient response and steady state response for arbitrary inputs. Properties of networks in terms of poles and zeros. Transfer function. Resonant circuits. Three phase circuits. Two-port networks. Elements of two-element network synthesis.

4. Measurements and Instrumentation
Units and Standards. Error analysis, measurement of current, Voltage, power, Power-factor and energy. Indicating instruments. Measurement of resistance, inductance, Capacitance and frequency. Bridge measurements. Electronic measuring instruments. Digital Voltmeter and frequency counter. Transducers and their applications to the measurement of non-electrical quantities like temperature, pressure, flow-rate displacement, acceleration, noise level etc. Data acquisition systems. AID and D/A converters.

5. Control System
Mathematical modelling of physical systems. Block diagrams and signal flow graphs and their reduction. Time domain and frequency domain analysis of linear dynamical system. Errors for

different type of inputs and stability criteria for feedback systems. Stability analysis using Routh-Hurwitz array, Nyquist plot and Bode plot. Root locus and Nicols chart and the estimation of gain and phase margin. Basic concepts of compensator design. State variable matrix and its use in system modelling and design. Sampled data system and performance of such a system with the samples in the error channel. Stability of sampled data system. Elements of non-linear control analysis. Control system components, electromechanical, hydraulic, pneumatic components.

SECTION - II

1. Electrical Machines and Power Transformers

Magnetic Circuits - Analysis and Design of Power transformers. Construction and testing. Equivalent circuits. Losses and efficiency. Regulation. Auto-transformer, 3-phase transformer. Parallel operation. Basic concepts in rotating machines. EMF, torque, basic machine types. Construction and operation, leakage losses and efficiency.

D.C. Machines. Construction, Excitation methods. Circuit models. Armature reaction and commutation. Characteristics and performance analysis. Generators and motors. Starting and speed control. Testing, Losses and efficiency.

Synchronous Machines. Construction. Circuit model. Operating characteristics and performance analysis. Synchronous reactance. Efficiency. Voltage regulation. Salient-pole machine, Parallel operation. . tiunting. Short circuit transients.

Induction Machines. Construction. Principle of operation. Rotating fields. Characteristics and performance analysis. Determination of circuit model. Circle diagram. Starting and speed control. Fractional KW motors. Single-phase synchronous and induction motors.

2. Power systems

Types of Power Stations, Hydro, Thermal and Nuclear Stations. Pumped storage plants. Economics and operating factors.

Power transmission lines. Modeling and performance characteristics. Voltage control. Load flow studies. Optimal power system operation. Load frequency control. Symmetrical short circuit analysis. ZBus formulation. Symmetrical Components. Per Unit representation. Fault analysis. Transient and steady-state stability of power systems. Equal area criterion.

Power system Transients. Power system Protection Circuit breakers. Relays. HVDC transmission.

3. Analog and Digital Electronics and Circuits

Semiconductor device physics, PN junctions and transistors, circuit models and parameters, FET, Zener, tunnel, Schottky, photo diodes and their applications, rectifier circuits, voltage regulators and multipliers, switching behavior of diodes and transistors.

Small signal amplifiers, biasing circuits, frequency response and improvement, multistage amplifiers and feed-back amplifiers, D.C.

amplifiers, Oscillators. Large signal amplifiers, coupling methods, push pull amplifiers, operational amplifiers, wave shaping circuits. Multivibrators and flip-flops and their applications. Digital logic gate families, universal gates-combination circuits for arithmetic and logic operational, sequential logic circuits. Counters, registers, RAM and ROMs.

4. Microprocessor

Microprocessor architecture-Instruction set and simple assembly language programming.

Interfacing for memory and I/O. Applications of Micro-processors in power system.

5. Communication Systems
Types of modulation; AM, FM and PM. Demodulators. Noise and bandwidth considerations. Digital communication systems. Pulse code modulation and demodulation. Elements of sound and vision broadcasting. Carrier communication. Frequency division and time division multiplexing, Telemetry system in power engineering.

6. Power Electronics
Power Semiconductor devices. Thyristor. Power transistor, GTOs and MOSFETS. Characteristics and operation. AC to DC Converters; 1phase and 3-phase DC to DC Converters; AC regulators. Thyristor controlled reactors; switched capacitor networks. Inverters; single-phase and 3-phase. Pulse width modulation. Sinusoidal modulation with uniform sampling. Switched mode power supplies.

SECTION - III

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