

**SYLLABUS FOR COMPUTER BASED TEST (CBT) FOR RECRUITMENT OF
MANAGEMENT TRAINEE (TELECOM)**

A. SUBJECT KNOWLEDGE (80%): 160 NOS. OF MULTIPLE CHOICE QUESTIONS (MCQS)		
SL. NO.	SUBJECT	TOPICS
1	LASER AND FIBRE OPTICS	ATOMIC EXCITATION AND ENERGY STATES, INTERACTION OF EXTERNAL ENERGY WITH ATOMIC ENERGY STATES, ABSORPTION, SPONTANEOUS EMISSION AND STIMULATED EMISSION, POPULATION INVERSION, PUMPING MECHANISM, OPTICAL PUMPING, ELECTRICAL PUMPING, COMPONENTS OF LASER SYSTEM, ACTIVE MEDIUM, POPULATION INVERSION, RUBY LASER, HELIUM-NEON LASER, SEMICONDUCTOR LASER (BASIC CONCEPTS, AND ENGINEERING APPLICATION ONLY), STRUCTURE OF OPTICAL FIBRE, PRINCIPLE OF PROPAGATION AND NUMERICAL APERTURE, ACCEPTANCE ANGLE, CLASSIFICATION OF OPTICAL FIBRE (SINGLE MODE AND MULTIMODE, SIN AND GRIN), FOCL (FIBBER OPTIC COMMUNICATION LINK)
2	DC & AC CIRCUITS CIRCUIT LAWS	FUNDAMENTALS OF ELECTRICAL CIRCUIT, OHM'S LAW, KIRCHOFF'S LAWS, SERIES AND PARALLEL CONNECTIONS, ANALYSIS OF CIRCUITS USING NODE VOLTAGE, MESH CURRENT, SUPERPOSITION, THEVENIN AND NORTON THEOREMS TO SOLVE SIMPLE CIRCUITS WITH DC EXCITATION. SINGLE PHASE CIRCUIT: SINGLE PHASE EMF GENERATION, REPRESENTATION OF SINUSOIDAL WAVEFORMS, AVERAGE, EFFECTIVE, PEAK AND RMS VALUES, J OPERATOR, RECTANGULAR AND POLAR REPRESENTATION OF PHASORS, REAL POWER, REACTIVE POWER, APPARENT POWER, POWER FACTOR. ANALYSIS OF SINGLE-PHASE AC CIRCUITS CONSISTING OF R, L, C, RL, RC, RLC COMBINATIONS (SERIES AND PARALLEL).
3	BASIC ELECTRONICS ENGINEERING	INTRODUCTION TO SEMICONDUCTORS, JUNCTION DIODE: PRINCIPLE OF DIODES, V-I CHARACTERISTICS OF JUNCTION DIODE, AC AND DC RESISTANCE OF DIODE, DIODE CURRENT EQUATION, EQUIVALENT CIRCUIT OF DIODE, BREAKDOWN MECHANISM, ZENER DIODE, RECTIFIER CIRCUIT, CLIPPER AND CLAMPER, AVALANCHE DIODE BIPOLAR JUNCTION TRANSISTOR: TRANSISTOR OPERATION, CURRENT EQUATION IN N-P- N &LIFIER; P-N-P TRANSISTORS, CB,CE,CC CONFIGURATIONS & THEIR CHARACTERISTICS, LOAD LINE ANALYSIS, DC BIASING (FIXED BIAS AND VOLTAGE DIVIDER), INTRODUCTION TO AMPLIFIERS. FIELD EFFECT TRANSISTOR: JFET-TYPES, OPERATIONS AND THEIR CHARACTERISTICS, MOSFETS-TYPES, OPERATIONS AND THEIR CHARACTERISTICS CMOS: BRIEF INTRODUCTION TO CMOS, PRINCIPLE OF OPERATION OF DIGITAL INVERTERS, VTC CHARACTERISTICS, OPERATIONAL AMPLIFIERS: THE IDEAL OP AMP, INVERTING AND NON – INVERTING CONFIGURATIONS, EQUIVALENT CIRCUIT MODEL, OP AMP APPLICATION IN INTEGRATION, DIFFERENTIATION AND SUMMING CIRCUITS.
4	DIGITAL ELECTRONIC PRINCIPLES	INTRODUCTION, BINARY DIGITS, LOGIC LEVELS AND DIGITAL WAVEFORMS, INTRODUCTION TO BASIC LOGIC OPERATION, NUMBER SYSTEM, DECIMAL NUMBERS, BINARY NUMBERS, DECIMAL-TO-BINARY CONVERSION, SIMPLE BINARY ARITHMETIC, LOGIC GATES, BOOLEAN ALGEBRA AND COMBINATIONAL LOGIC CIRCUITS: THE INVERTER, THE AND, OR, NAND NOR, EXCLUSIVE-OR AND EXCLUSIVE-NOR GATE, BOOLEAN OPERATIONS AND EXPRESSIONS, LAWS AND RULES OF BOOLEAN ALGEBRA, DE MORGAN'S THEOREM, BOOLEAN ANALYSIS OF LOGIC CIRCUITS, STANDARD FORMS OF BOOLEAN EXPRESSIONS, BOOLEAN EXPRESSION AND TRUTH TABLE. BASIC COMBINATIONAL LOGIC CIRCUITS,

		IMPLEMENTATION OF COMBINATIONAL LOGIC, THE UNIVERSAL PROPERTIES OF NAND AND NOR GATES, BASIC ADDERS.
5	DIGITAL ELECTRONICS	<p>NUMBER SYSTEM AND CODES, K MAP, GATE MINIMIZATION, BOOLEAN ALGEBRA, MINTERM, MAXTERM.</p> <p>LATCH, FLIP FLOP, SHIFT REGISTER, RAM, DIGITAL INTEGRATED CIRCUIT, RTL, DTL, ECL, MOS, TTL, CMOS, ETC</p> <p>DIGITAL SYSTEM DESIGN:</p> <p>REVISION OF NUMBER SYSTEM: INTRODUCTION TO VARIOUS NUMBER SYSTEMS AND THEIR CONVERSION. ARITHMETIC OPERATION USING 1'S AND 2'S COMPLIMENTS, SIGNED BINARY AND FLOATING POINT NUMBER REPRESENTATION INTRODUCTION TO BINARY CODES AND THEIR APPLICATIONS. REVISION BOOLEAN ALGEBRA AND LOGIC GATES: BOOLEAN ALGEBRA AND IDENTITIES, COMPLETE LOGIC SET, LOGIC GATES AND TRUTH TABLES. UNIVERSAL LOGIC GATES, ALGEBRAIC REDUCTION AND REALIZATION USING LOGIC GATES.</p> <p>COMBINATIONAL LOGIC DESIGN: SPECIFYING THE PROBLEM, CANONICAL LOGIC FORMS, EXTRACTING CANONICAL FORMS, EX-OR EQUIVALENCE OPERATIONS, LOGIC ARRAY, K-MAPS: TWO, THREE AND FOUR VARIABLE K-MAPS, NAND AND NOR LOGIC IMPLEMENTATIONS. LOGIC COMPONENTS: CONCEPT OF DIGITAL COMPONENTS, BINARY ADDERS, SUBTRACTION AND MULTIPLICATION, AN EQUALITY DETECTOR AND COMPARATOR, LINE DECODER, ENCODERS, MULTIPLEXERS AND DE-MULTIPLEXERS.</p> <p>SYNCHRONOUS SEQUENTIAL LOGIC DESIGN: SEQUENTIAL CIRCUITS, STORAGE ELEMENTS: LATCHES (SR, D), STORAGE ELEMENTS: FLIP-FLOPS INCLUSION OF MASTER-SLAVE, CHARACTERISTICS EQUATION AND STATE DIAGRAM OF EACH FFS AND CONVERSION OF FLIP-FLOPS. ANALYSIS OF CLOCKED SEQUENTIAL CIRCUITS AND MEALY AND MOORE MODELS OF FINITE STATE MACHINES.</p> <p>BINARY COUNTERS: INTRODUCTION, PRINCIPLE AND DESIGN OF SYNCHRONOUS AND ASYNCHRONOUS COUNTERS, DESIGN OF MOD-N COUNTERS, RING COUNTERS. DECADE COUNTERS, STATE DIAGRAM OF BINARY COUNTERS. SHIFT RESISTORS: PRINCIPLE OF 4-BIT SHIFT RESISTORS. SHIFTING PRINCIPLE, TIMING DIAGRAM, SISO, SIPO, PISO & PIPO RESISTORS. MEMORY AND PROGRAMMABLE LOGIC: TYPES OF MEMORIES, MEMORY DECODING, ERROR DETECTION AND CORRECTION), RAM & ROMS. PROGRAMMABLE LOGIC ARRAY, PROGRAMMABLE ARRAY LOGIC, SEQUENTIAL PROGRAMMABLE DEVICES.</p> <p>IC LOGIC FAMILIES: PROPERTIES DTL, RTL, TTL, I²L AND CMOS AND ITS GATE LEVEL IMPLEMENTATION. A/D CONVERTERS AND D/A CONVERTERS.</p>
6	NETWORK THEORY	<p>NETWORK THEOREMS: SUPERPOSITION THEOREM, THE VENIN THEOREM, NORTON THEOREM, MAXIMUM POWER TRANSFER THEOREM, RECIPROCITY THEOREM, COMPENSATION THEOREM. ANALYSIS WITH DEPENDENT CURRENT AND VOLTAGE SOURCES. NODE AND MESH ANALYSIS. CONCEPT OF DUALITY AND DUAL NETWORKS.</p> <p>SOLUTION OF FIRST AND SECOND ORDER NETWORKS:</p> <p>SOLUTION OF FIRST AND SECOND ORDER DIFFERENTIAL EQUATIONS FOR SERIES AND PARALLEL R-L, R-C, R-L-C CIRCUITS, INITIAL AND FINAL CONDITIONS IN NETWORK ELEMENTS, FORCED AND FREE RESPONSE, TIME CONSTANTS, STEADY STATE AND TRANSIENT STATE RESPONSE.</p>
7	SEMICONDUCTOR DEVICES	<p>INTRODUCTION TO THE QUANTUM THEORY OF SOLIDS: FORMATION OF ENERGY BANDS; THE K-SPACE DIAGRAM (TWO AND THREE DIMENSIONAL REPRESENTATION), CONDUCTORS, SEMICONDUCTORS AND INSULATORS.</p> <p>ELECTRONS AND HOLES IN SEMICONDUCTORS: SILICON CRYSTAL STRUCTURE;</p>

		<p>DONORS AND ACCEPTORS IN THE BAND MODEL; ELECTRON EFFECTIVE MASS; DENSITY OF STATES; THERMAL EQUILIBRIUM; AND FERMI-DIRAC DISTRIBUTION FUNCTION FOR ELECTRONS AND HOLES; FERMI ENERGY. EQUILIBRIUM DISTRIBUTION OF ELECTRONS & HOLES: DERIVATION OF N AND P FROM D (E) AND F (E), FERMI LEVEL AND CARRIER CONCENTRATIONS.</p> <p>THE NP PRODUCT AND THE INTRINSIC CARRIER CONCENTRATION. GENERAL THEORY OF N AND P; CARRIER CONCENTRATIONS AT EXTREMELY HIGH AND LOW TEMPERATURES:</p> <p>COMPLETE IONIZATION, PARTIAL IONIZATION AND FREEZE-OUT; ENERGY-BAND DIAGRAM AND FERMI-LEVEL, VARIATION OF E_F WITH DOPING CONCENTRATION AND TEMPERATURE. MOTION AND RECOMBINATION OF ELECTRONS AND HOLES: CARRIER DRIFT: ELECTRON AND HOLE MOBILITIES; MECHANISM OF CARRIER SCATTERING; DRIFT CURRENT AND CONDUCTIVITY.</p> <p>MOTION AND RECOMBINATION OF ELECTRONS AND HOLES (CONTINUED): CARRIER DIFFUSION: DIFFUSION CURRENT, TOTAL CURRENT DENSITY; RELATION BETWEEN THE ENERGY DIAGRAM AND POTENTIAL, ELECTRIC FIELD; EINSTEIN RELATIONSHIP BETWEEN DIFFUSION COEFFICIENT AND MOBILITY; ELECTRON-HOLE RECOMBINATION; THERMAL GENERATION. PN JUNCTION: BUILDING BLOCKS OF THE PN JUNCTION THEORY: ENERGY BAND DIAGRAM AND DEPLETION LAYER OF A PN JUNCTION, BUILT-IN POTENTIAL; DEPLETION LAYER MODEL: FIELD AND POTENTIAL IN THE DEPLETION LAYER, DEPLETION-LAYER WIDTH; REVERSE-BIASED PN JUNCTION; CAPACITANCE-VOLTAGE CHARACTERISTICS; JUNCTION BREAKDOWN: PEAK ELECTRIC FIELD. TUNNELING BREAKDOWN AND AVALANCHE BREAKDOWN; CARRIER INJECTION UNDER FORWARD BIAS-QUASI-EQUILIBRIUM BOUNDARY CONDITION; CURRENT CONTINUITY EQUATION; EXCESS CARRIERS IN FORWARD-BIASED PN JUNCTION; PN DIODE I-V CHARACTERISTIC, CHARGE STORAGE.</p> <p>THE BIPOLAR TRANSISTOR: INTRODUCTION, MODES OF OPERATION; MINORITY CARRIER DISTRIBUTION, COLLECTOR CURRENT, BASE CURRENT, CURRENT GAIN, BASE WIDTH MODULATION BY COLLECTOR CURRENT, BREAKDOWN MECHANISM, EQUIVALENT CIRCUIT MODELS – EBERS -MOLL MODEL.</p> <p>METAL-SEMICONDUCTOR JUNCTION: SCHOTTKY DIODES: BUILT-IN POTENTIAL, ENERGY-BAND DIAGRAM, I-V CHARACTERISTICS, COMPARISON OF THE SCHOTTKY BARRIER DIODE AND THE PN-JUNCTION DIODE; OHMIC CONTACTS: TUNNELING BARRIER, SPECIFIC CONTACT RESISTANCE.</p>
8	ANALOG ELECTRONICS	BJT, FET, DC BIASING, LOAD LINES FIXED BIAS, VOLTAGE DIVIDER BIAS, CE, CB, CC CONFIGURATION. FEEDBACK AND OSCILLATOR CIRCUIT.
9	POWER ELECTRONICS	<p>POWER SWITCHING DEVICES :</p> <p>DIODE, THYRISTOR, MOSFET, IGBT: I-V CHARACTERISTICS; FIRING CIRCUIT FOR THYRISTOR; VOLTAGE AND CURRENT COMMUTATION OF A THYRISTOR; GATE DRIVE CIRCUITS FOR MOSFET AND IGBT. THYRISTOR RECTIFIERS: SINGLE-PHASE HALF-WAVE AND FULL-WAVE RECTIFIERS, SINGLE-PHASE FULL-BRIDGE THYRISTOR RECTIFIER WITH R- LOAD AND HIGHLY INDUCTIVE LOAD; THREE-PHASE FULL-BRIDGE THYRISTOR RECTIFIER WITH R-LOAD AND HIGHLY INDUCTIVE LOAD; INPUT CURRENT WAVE SHAPE AND POWER FACTOR. DC-DC BUCK CONVERTER: ELEMENTARY CHOPPER WITH AN ACTIVE SWITCH AND DIODE, CONCEPTS OF DUTY RATIO AND AVERAGE VOLTAGE, POWER CIRCUIT OF A BUCK CONVERTER, ANALYSIS AND WAVEFORMS AT STEADY STATE, DUTY RATIO CONTROL OF OUTPUT VOLTAGE. DC-DC BOOST CONVERTER: POWER CIRCUIT OF A BOOST CONVERTER, ANALYSIS AND WAVEFORMS AT STEADY STATE, RELATION BETWEEN DUTY RATIO AND</p>

		AVERAGE OUTPUT VOLTAGE. SINGLE-PHASE VOLTAGE SOURCE INVERTER POWER CIRCUIT OF SINGLE-PHASE VOLTAGE SOURCE INVERTER, SWITCH STATES AND INSTANTANEOUS OUTPUT VOLTAGE, SQUARE WAVE OPERATION OF THE INVERTER, CONCEPT OF AVERAGE VOLTAGE OVER A SWITCHING CYCLE, BIPOLAR SINUSOIDAL MODULATION AND UNIPOLAR SINUSOIDAL MODULATION, MODULATION INDEX AND OUTPUT VOLTAGE POWER CIRCUIT OF A THREE-PHASE VOLTAGE SOURCE INVERTER, SWITCH STATES, INSTANTANEOUS OUTPUT VOLTAGES, AVERAGE OUTPUT VOLTAGES OVER A SUB-CYCLE, THREE-PHASE SINUSOIDAL MODULATION.
10	ELECTRONIC MEASUREMENT & MEASURING INSTRUMENTS	BASICS OF INSTRUMENTS, ACCURACY, PRECISION. DC BRIDGES, AC VOLTMETER, DIGITAL VOLTMETER, SIGNAL ANALYSIS, OSCILLOSCOPE, CRT ETC.
11	ANALOG AND DIGITAL COMMUNICATION	REVIEW OF SIGNALS AND SYSTEMS, FREQUENCY DOMAIN REPRESENTATION OF SIGNALS, PRINCIPLES OF AMPLITUDE MODULATION SYSTEMS- DSB, SSB AND VSB MODULATIONS. ANGLE MODULATION, REPRESENTATION OF FM AND PM SIGNALS, SPECTRAL CHARACTERISTICS OF ANGLE MODULATED SIGNALS. PULSE MODULATION. SAMPLING PROCESS. PULSE AMPLITUDE AND PULSE CODE MODULATION (PCM), DIFFERENTIAL PULSE CODE MODULATION. DELTA MODULATION, NOISE CONSIDERATIONS IN PCM, TIME DIVISION MULTIPLEXING, DIGITAL MULTIPLEXERS. ELEMENTS OF DETECTION THEORY, OPTIMUM DETECTION OF SIGNALS IN NOISE, COHERENT COMMUNICATION WITH WAVEFORMS- PROBABILITY OF ERROR EVALUATIONS. BASE BAND PULSE TRANSMISSION- INTER SYMBOL INTERFERENCE AND NYQUIST CRITERION. PASS BAND DIGITAL MODULATION SCHEMES- PHASE SHIFT KEYING, FREQUENCY SHIFT KEYING, QUADRATURE AMPLITUDE MODULATION, CONTINUOUS PHASE MODULATION AND MINIMUM SHIFT KEYING. DIGITAL MODULATION TRADE-OFFS. OPTIMUM DEMODULATION OF DIGITAL SIGNALS OVER BAND-LIMITED CHANNELS MAXIMUM LIKELIHOOD SEQUENCE DETECTION (VITERBI RECEIVER). EQUALIZATION TECHNIQUES. SYNCHRONIZATION AND CARRIER RECOVERY FOR DIGITAL MODULATION.
12	CONTROL SYSTEM	BASIC CONCEPT, OPEN LOOP & CLOSED LOOP, TIME DOMAIN ANALYSIS, FREQUENCY DOMAIN ANALYSIS, ROOT LOCUS, POLAR PLOT, BODE PLOT ETC.
13	ADVANCE ELECTRONIC CIRCUIT & MICROPROCESSOR	FILTERS, LOW PASS, HIGH PASS, BAND PASS OP AMP, VOLTAGE CONTROLLED OSCILLATORS, AMPLIFIERS ETC. MICROPROCESSOR- 8085 & 8086.
14	MICROWAVE ENGINEERING & SATELLITE COMMUNICATION	HIGH FREQUENCY TRANSMISSION AND WAVE GUIDE. MICROWAVE SOURCES ETC. SATELLITE COMMUNICATION.
15	COMPUTER NETWORK	OVERVIEW OF DATA COMMUNICATION, DATA LINK LAYER, NETWORK LAYER, PHYSICAL LAYER, APPLICATION LAYER ETC.
16	FIBER OPTICS & OPTO ELECTRONICS DEVICES	FUNDAMENTAL OF FIBER OPTICS, DIFFERENT GENERATIONS OF OPTICAL FIBER COMMUNICATION SYSTEMS. OPTICAL FIBER STRUCTURE, FIBER TYPES, STEP INDEX FIBER AND GRADED INDEX FIBER, RAY PROPAGATION, TOTAL INTERNAL REFLECTION, NUMERICAL APERTURE, ACCEPTANCE ANGLE. WAVE PROPAGATION IN A CYLINDRICAL WAVE GUIDES, MODAL CONCEPT, V-NUMBER, POWER FLOW IN STEP INDEX FIBER AND GRADED INDEX FIBER, ATTENUATION (ABSORPTION, SCATTERING AND BENDING) AND DISPERSION (INTER AND INTRAMODAL, CHROMATIC, WAVE GUIDE AND POLARIZATION) IN FIBER, DISPERSION SHIFTED AND DISPERSION FLATTENED FIBER.

		<p>FIBER FABRICATION, DOUBLE CRUCIBLE METHOD, FIBER OPTIC CABLES, CONNECTOR AND SPLICE. LOSSES DURING COUPLING BETWEEN SOURCES TO FIBER, FIBER TO FIBER. SCHEMES FOR COUPLING IMPROVEMENT. OPTOELECTRONIC SOURCES, LED, ILD, LIGHT SOURCE MATERIALS, RADIATION PATTERN MODULATION CAPABILITY OPTOELECTRONIC DETECTOR, PIN AND APD, RESPONSIVITY, BAND WIDTH, DETECTOR NOISE EQUIVALENT CIRCUIT AND SNR CALCULATION. OPTOELECTRONIC MODULATORS, BASIC PRINCIPLE, ELECTRO OPTIC AND ACOUSTOPTIC MODULATORS.</p> <p>OPTICAL AMPLIFIER, SEMICONDUCTOR OPTICAL AMPLIFIER AND ERBIUM DOPED FIBER AMPLIFIER.</p>
17	OPTICAL FIBER COMMUNICATION	<p>BASIC PRINCIPLE OF OPTICAL COMMUNICATION. COMPARE THE ADVANTAGE AND DISADVANTAGE OF OPTICAL FIBRES & METALLIC CABLES, ELECTROMAGNETIC FREQUENCY AND WAVE LINE SPECTRUM , TYPES OF OPTICAL FIBRES & PRINCIPLES OF PROPAGATION IN A FIBRE USING RAY THEORY , OPTICAL FIBER CONSTRUCTION , DEFINE TERMS: VELOCITY OF PROPAGATION, CRITICAL ANGLE, ACCEPTANCE ANGLE NUMERICAL APERTURE , OPTICAL FIBRE COMMUNICATION SYSTEM- BLOCK DIAGRAM & WORKING PRINCIPLE , MODES OF PROPAGATION AND INDEX PROFILE OF OPTICAL FIBER , TYPES OPTICAL FIBER CONFIGURATION: SINGLE-MODE STEP INDEX, MULTI-MODE STEP INDEX, MULTI-MODE GRADED INDEX , ATTENUATION IN OPTICAL FIBERS – ABSORPTION LOSSES, SCATTERING, LOSSES, BENDING LOSSES, CORE AND CLADDING LOSSES- DISPERSION – MATERIAL DISPERSION, WAVEGUIDE DISPERSION, INTERMODAL DISPERSION , OPTICAL SOURCES(TRANSMITTER) & TYPES – LED- SEMICONDUCTOR LASER DIODES , LASER -ITS WORKING PRINCIPLES, BLOCK DIAGRAM USING LASER FEEDBACK CONTROL CIRCUIT , OPTICAL DETECTORS – PIN AND APD DIODES &BLOCK DIAGRAM USING APD CONNECTORS AND SPLICES –OPTICAL CABLES - COUPLERS , OPTICAL REPEATER & SINGLE CHANNEL SYSTEM , APPLICATIONS OF OPTICAL FIBRES – CIVIL, INDUSTRY AND MILITARY APPLICATION CONCEPT OF WAVE LENGTH DIVISION MULTIPLEXING (WDM) PRINCIPLES.</p>

B. NUMERICAL / GK & REASONING (10%): 20 NOS. OF MULTIPLE CHOICE QUESTIONS (MCQS)

C. ENGLISH KNOWLEDGE (10%): 20 NOS. OF MULTIPLE CHOICE QUESTIONS (MCQS)

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