DETAILED SYLLABUS FOR THE POST OF DRAFTSMAN GRADE-I(ELECTRICAL) IN KERALA WATER AUTHORITY

CATEGORY NO.031/2025

(TOTAL 100 MARK)

Module : 1

Fundamentals of Electricity

Voltage, current, resistance, energy, power-definitions and units, ohm's law-statement, simple problems related to ohm's law, power and energy, Resistance in series and parallel-simple problems. Kirchhoff's laws-KCL and KVL

Electrostatics and electromagnetism
Laws of electrostatics, permittivity, electric flux, flux density, potential, potential difference – equations and simple problems, Lightning phenomenon, potential gradient, dielectrical strength, capacitors in series and parallel, energy stored in a capacitor. Coulomb's law, permeability, magnetic flux, flux density, reluctance, mmf, Faraday's law of electromagnetic induction, Lenz's law. self inductance, mutual inductance, energy stored in an inductor, Fleming's laws

(10 Marks)

Module : 2

SEMICONDUCTOR DIODES:

Energy band diagram of conductors, insulators, semiconductors, intrinsic & extrinsic semiconductors, doping, P&N type, majority & minority carriers. PN junction, drift & diffusion current, depletion layer, potential barrier, PN junction under forward & reverse bias, break down on diodes, Zener & avalanche breakdown. VI characteristic of PN junction diode, static and dynamic resistance, Different types of diodes – power, Zener, varactor and tunnel diodes - p-n junction diode, DC load line analysis, Half-wave rectifier, Full-wave rectifier, Bridge rectifier, Capacitor filter circuit, Zener diode- Regulator circuits.

TRANSISTORS -CB Configuration - CE configuration, current relation (Collector current in terms of base current & leakage current-Input & output characteristics, determination of input & output resistance. CC configuration – expression of emitter current in terms of base current and leakage current Comparison of CB, CE & CC, current gain, voltage gain & leakage current.
Transistor biasing techniques – DC load line – Fixing the operating point, Need for stabilization. Different biasing methods – Working of a single stage CE transistor amplifier.
JFET, P-channel and N-channel- FET- comparison with Bipolar Transistor-advantages and disadvantages - parameters of JFET - MOSFET -types - depletion and enhancement modes- UJT, VI characteristics – SMD- types of opto-electronic devices - photo resistors, photodiodes, phototransistors, photovoltaic cells, LEDs, LCDs, and Opto-couplers. Power electronics: UJT, FET, Principle and operation of JFET, Parameters of JFET- MOSFET, Depletion MOSFET, Enhancement MOSFET, Difference between JFET & MOSFET SCR, diac, triac, UJT, different commutation circuits, dc motor drives, LVDT, induction heating, di electric heating SCR - Integrated circuit technology- SMD, advantages.
Power supply – Voltage regulations – Line Regulation – Load regulation – Shunt voltage regulator – Series voltage regulator – Fixed and Variable power supplies – Protection circuits – Current Limiting – Fold Back limiting. SMPS- UPS different type – Online and off line.
(10 Marks)

Module : 3

Fundamentals of AC systems

Generation of ac voltage, equation of voltage, Basic terms-amplitude, frequency, cycle, time period, average value, instantaneous value, rms value, form factor, peak factor- equations and related simple problems, ac through resistance, inductance and capacitance, star and delta connections in 3 phase ac systems-line and phase relationship in star and delta systems.

Safety, first aid, batteries and solar cell

Basic safety requirements, electric shock-requirement for avoiding shock, first aid, installation, care and maintenance of batteries and solar cells, determination of total number of cells required for a given power requirements.

(10 Marks)

Module : 4

Operational Amplifiers:

Differential amplifier– parameters of op-amp – virtual ground –Input offset voltage, input offset current, input bias current, output offset voltage, CMRR, slew rate -Characteristics of ideal and actual op-amp – inverting amplifier, non-inverting amplifier, voltage follower, comparator, difference amplifier, summing amplifier, integrators, differentiators-Zero crossing detector, positive and negative voltage level detector – Schmitt trigger, window detector, logarithmic amplifier, antilog amplifier, Instrumentation amplifier - DAC and ADC: R-2R ladder type D to A converter, Counter type, dual slope integration and successive approximation type ADCs, Flash ADC- Half wave and full wave precision Rectifiers – Active filters –LPF, HPF, BPF filters– RC phase shift and Wien bridge oscillators, Astable and Monostable Multivibrators, Triangular wave generator- PLL principle of operation, lock range, capture range- Applications of PLL , VCO -LM 566 Timer- IC 555- working principle – Monostable and Astable multivibrators using IC 555

Oscillators:

Barkhausan criterion for oscillation- working of RC oscillators – RC phase shift oscillator and wein bridge oscillator- LC oscillators - Hartley and colpitt's oscillators - crystal oscillator -Multivibrators- Bistable multivibrator - synchronous and Asynchronous methods of triggering - monostable multivibrator using transistors - triggering methods of monostable multivibrators- operations of astable multivibrators using transistors- operation of Schmitt trigger circuit- UTP and LTP

(10 Marks)

Module : 5

Wiring Accessories
Various wiring systems
Wires-single strand and multistrand, current ratings. Fuses- cartridge and HRC. Switches- SPST, SPDT, TPTT, ICDP, ICTP, Toggle switch, Limit switch, safety devices- MCB,ELCB,RCCB,electrical illumination,Earthing-Pipe and Plate earthing.

Power Electronics
Half wave and full wave rectifiers with and without filters, UJT relaxation oscillator, FET, JFET,

Triac, Diac, IGBT, SCR, operation and maintenance of inverter, regulated dc power supply, battery charger, UPS.

(10 Marks)

Module : 6

Digital Electronics:

Number Systems: Decimal Number System, Binary Number System, Converting Decimal to Binary, Hexadecimal Number System: Converting Binary to Hexadecimal, Hexadecimal to Binary, Converting Hexadecimal to Decimal, Converting Decimal to Hexadecimal, Octal Numbers: Binary to Octal Conversion. decimal, binary, octal, hexa decimal systems, gray code, BCD code, Boolean algebra, Switching and Logic Levels, Boolean Algebra Theorems, De Morgan's theorem. Logic gates, NOT Gate, AND Gate, OR Gate, XOR Gate, NAND Gate, NOR Gate, X-NOR Gate, Half adder, Full adder, Flip-Flops : RS Flip-Flop, Gated Flip-Flops, JS Flip Flops, Counters, shift registers. Microcontroller: 8051 Architecture, features, flag registers, general purpose registers.

Logic families SSI, MSI, LSI, VLSI and ULSI - positive and negative logic- TTL and Schottky TTL, TTL inverter, Emitter Coupled Logic, CMOS logic family, features of CMOS logic gates, VIL, VH, VOL, VOH, noise margin, noise immunity, propagation delay, current sourcing and current sinking, fan in, fan out, power dissipation.

Semiconductor memory-

ROM and RAM - working of ROM- working of dynamic memory- Compare Static RAM, Dynamic RAM, Flash ROM and NVRAM - SD RAM and EDO RAM- secondary memory- Optical memory- Magnetic bubble memory

(10 Marks)

Module : 7

DC Machines
Dc generator- construction, working, classification, emf equation, wave and lap windings, characteristics, simple problems.
Dc motor- construction, working, types, emf equation, torque-simple problems, various starters, speed control, testing, MG set.

AC Machines
Transformer-construction, principle, types, emf equation, transformation ratio, losses and efficiency, all day efficiency-simple problems
Three phase induction motor- principle, construction, types, slip, torque, losses, efficiency, power

stages, speed control, three phase motor starters.

Alternators- construction, principle, emf equation, losses and efficiency,

Three phase synchronous motor.

Single phase and FHP motors-single phase induction motor, universal motor, ac series motor, servomotor, stepper motor, split phase motor.

(10 Marks)

Module : 8

Television:

Luminance, chrominance, compatibility, additive and subtractive mixing of colours –Colour TV camera- working, Delta gun, Trinitron colour picture tubes. Basic Colour TV systems – NTSC, SECAM and PAL system - Advantages and disadvantages of one over the other – PAL D-Coder-Frequency interleaving- PAL-D Colour TV Receiver – AFT-Colour encoder Colour killer - Colour controls, HDTV- Digital TV. NTSC, PAL, SECAM modes of transmission,Satellite TV receiving system – Antenna, LNA, LNB, FEC- Digital satellite receiver, CCTV, MATV, CATV systems.-Video recording – VHS and U-matic formats, VCD, DVD, MPEG.

Communication Systems:

EM waves, propagation of EM waves, Modulation: Amplitude Modulation, Frequency Modulation, Phase modulation, AM Detection, FM detection, Super hetero dyne receiver system, bandwidth requirements, PAM, PCM, , ASK,FSK, BPSK, QPSK, Offset PSK, BFSK, MSK.Noise in communication systems, different types of noise, signal to noise ratio, methods to improve signal to nose ratio. Antenna: Physical concepts of radiation of electromagnetic energy and radiation pattern, point source, gain, power gain, directivity, aperture, effective area, radiation pattern, beam width, radiation angle, radiation resistance. Types of Antennas -Half wave dipole, folded dipole, Yagi-Uda antenna, Marconi antenna, rhombic antenna, parabolic antenna, Antenna arrays – End fire array and broadside antenna.

(10 Marks)

Module : 9

Measurements and measuring instruments
Various types of electrical measuring instruments- voltmeter, ammeter, energy meter, wattmeter, single phase and three phase power measurement, measurement of resistance, inductance and capacitance, power factor meter, synchroscope, TOD meter, CRO, insulation megger and earth megger, multimeter, CT and PT.

Electronic measuring instruments:

Analog, digital meters, whetstones bridge, q meter, CRO, signal generator, recorders, analogue and

digital meters, Data acquisition systems.

(10 Marks)

Module : 10

Microcontroller :

Features – Architecture of 8051 – Memory organization – Program memory – Data memory -

Internal RAM structure – B register, Accumulator, Register Banks – Bit addressable area – Special

Function registers – Program Status Word – Flags – Architecture of Ports, Timer / Counter –

Different modes – Serial communication port – different modes – SBUF –Interrupts- External

ROM and RAM interfacing – Addressing Modes.

(10 Marks)

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.