

**FURTHER DETAILS REGARDING MAIN TOPICS OF
PROGRAMME NO. 04/2016 (Item No. 7)**

**VOCATIONAL TEACHER – MAINTENANCE &
REPAIRS OF RADIO & TELEVISION**

VOCATIONAL HIGHER SECONDARY EDUCATION

(CATEGORY No. 391/2013)

Part I a - Devices

PN junctions : Zener and avalanche break down, Linearly graded junction - electric field, built in potential, junction capacitance. Metal Semiconductor contacts, Energy band diagram of Ohmic and Rectifying Contacts, Current Equation, Comparison with PN Junction Diode. Hetero Junctions – Energy band diagram, Applications. Bipolar junction transistor - current components, Minority Carrier Distributions basic parameters, Evaluation of terminal currents and dc parameters, Switching, Base width modulation, Avalanche multiplication in collector-base junction, Punch Through, Base resistance, Static I-V characteristics of CB and CE configurations

Field Effect Transistors: JFET - principle of operation, current equation, static I-V characteristics, and device parameters. MOS Capacitor - Ideal MOS Capacitor, Energy Band Diagram, Carrier Concentrations in the Space Charge Region, C-V characteristics, threshold voltage, effect of real surfaces. MOSFET- Basic structure and principle of operation, I-V characteristics, Derivation of Drain Current and device parameters, Channel length modulation, Velocity saturation, Body effect, DIBL, Hot Electron Effect, Sub threshold Conduction. UJT, PNP diode, SCR, DIAC, TRIAC and IGBT – Principles of operation and static characteristics

Part I b - Circuits

Differential Amplifiers : BJT differential pair, large signal and small signal analysis of differential amplifiers, Input resistance, voltage gain, CMRR, non ideal characteristics of differential amplifier. Frequency response of differential amplifiers. MOS differential amplifiers, Current sources, Active load, cascode load, current mirror circuits, Wilson current mirror circuits. Small signal equivalent circuits, multistage differential amplifiers. Analysis of BJT tuned amplifiers, synchronous and stagger tuning. MOS Operational Amplifiers, single stage-cascode and folded cascode, two stage op-amp, op-amp with output buffer, frequency compensation and slew rate in two stage Op-amps. Ideal op-amp parameters, Non ideal op-amp. Effect of finite open loop gain, bandwidth and slew rate on circuit performance. Inverting and non-inverting

amplifier, summing amplifier, integrator, differentiator, Differential amplifiers, Instrumentation amplifiers, V to I and I to V converters, Comparators, precision rectifiers.

Feed back amplifiers : Properties of negative feed back.. Stability of feedback circuits, effect of feedback on amplifier poles, frequency compensation -Dominant pole and Pole-zero. Multistage amplifiers – cascade and cascode amplifiers and its dc analysis. Frequency response of cascade and cascode amplifiers. Bode plot of multistage Amplifier, Phase and gain margin.

Low frequency Oscillators : Barkhausen criterion, RC phase shift and Wien bridge oscillators - analysis. Analysis of High frequency oscillators- Hartley, Colpitts, Clapp, Crystal and UJT Oscillators.

Integrated Circuit technologies : Characteristics and Parameters. TTL Circuits – NOT, NAND, NOR, Open collector, tristate gates, positive and negative logic, ECL OR-NOR, CMOS- NOR, NOT, NAND, comparison. Differences between combinational and sequential circuits – sequential circuit models, flip flops – SR, JK, D, T, Master slave, characteristic equations, Flip-flop timing specifications. Binary counters – Synchronous and Asynchronous design, Counters for random sequence- design. Registers, Universal shift registers, Ring and Johnson counter.

D/A converters: DAC characteristics- resolution, output input equations, Weighted resistor, R-2R network, DAC 08. A/D converter: ADC characteristics, Types - Dual slope, Counter ramp, Successive approximation, flash ADC - AD670.

PLL : Basic PLL topology and principle, transient response of PLL, Linear model of PLL, Major building blocks of PLL – analog and digital phase detector, VCO, filter. Applications of PLL. Monolithic PLL - IC LM565 and CD4046 CMOS PLL.

EMI Environment : Sources of EMI, conducted and radiated EMI, Transient EMI, EMI-EMC definitions, units, parameters. EMI coupling principles-Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near field cable to cable coupling. Power mains and power supply coupling. EMI specifications, standards, limits - units of specifications, Civilian and Military standards

Part I c - Analog Communication

Amplitude modulation : Modulation Index, Modulation Index for Sinusoidal AM, Average power for sinusoidal AM, Effective Voltage and Current for Sinusoidal AM, Nonsinusoidal Modulation, DSBSC Modulation, Amplitude Modulator Circuits, Amplitude Demodulator Circuits, Diagonal Peak Clipping, AM Transmitters – Broadcast Transmitters. Receivers - Superhetrodyne Receivers, Tuning Range, Tracking, Sensitivity and Gain, Image Rejection, Adjacent Channel Selectivity, Automatic Gain Control, Double Conversion. Single Sideband Modulation - Principles, Balanced Modulators – Singly & Doubly Balanced Modulators, SSB Generation – Filter Method, Phasing Method & Third Method, SSB Reception, Modified SSB

Systems – Pilot Carrier SSB & ISB, Companded SSB. Pulse Modulation - PAM - TDM, PPM, PWM.

Angle Modulation : Frequency modulation, Sinusoidal FM, Frequency spectrum for sinusoidal FM, Average power in sinusoidal FM, Non-sinusoidal modulation-deviation ratio, Measurement of modulation index for sinusoidal FM. Phase modulation- Equivalence between PM and FM, Sinusoidal Phase Modulation, Digital Phase Modulation. Angle modulator Circuits – Varactor Diode Modulators, Transistors Modulators, FM Transmitters – Direct & Indirect Methods, FM Broadcast, Angle modulation detectors – Foster-Seeley discriminator, Ratio Detector, Quadrature Detector, PLL Demodulator, Automatic Frequency control, Amplitude Limiters, Pre-emphasis and De-emphasis, FM Broadcast Receivers, FM Stereo Receivers.

Part I d - Digital Communication

Pulse Modulation : Sampling process, Aliasing, Reconstruction, PAM, Quantization, PCM, Noise in PCM system, Modifications of PCM – Delta modulation, DPCM, ADPCM, ADM, Processing Gain. Base band Pulse Transmission – Matched filter, properties, Error rate due to noise, ISI – Nyquist criterion for distortion less transmission, Ideal solution, Raised cosine spectrum, Correlative level coding - Duobinary coding, precoding, Modified duobinary coding, Generalized Partial response signaling, Base band M-ary PAM transmission, eye pattern, optimum linear receiver. Adaptive Equalization.

Spread spectrum communication : Pseudo-noise sequences, Properties of PN sequences. Generation of PN Sequences, generator polynomials, Maximal length codes and Gold Codes. Spread spectrum communication– Notion of spread spectrum, Direct sequence spread spectrum with coherent binary phase shift keying, Signal space dimensionality and processing gain, Probability of error, Anti-jam Characteristics, Frequency Hop spread spectrum with MFSK, Slow and Fast frequency hopping. Multiple Access Techniques, multipath channels, classification, Coherence time, Coherence bandwidth, Statistical characterization of multi path channels, Binary signaling over a Rayleigh fading channel, Diversity techniques - Diversity in time, frequency and space. TDMA and CDMA – RAKE receiver. Source coding of speech.

Part I e - TV and Radio

Basic antenna parameters: gain, directivity, beam solid angle, beam width and effective aperture calculations. Effective height - wave polarization - antenna temperature - radiation resistance - radiation efficiency - antenna field zones - principles of reciprocity. Duality of antennas. Concept of retarded potential. Field, directivity and radiation resistance of a short dipole and half wave dipole. Measurement of radiation pattern, gain, directivity and impedance.

Radio wave propagation : Modes – structure of atmosphere – characteristics of ionized regions – sky wave propagation – effect of earth's magnetic field – MUF – skip distance –

virtual height – skip distance - Ionospheric abnormalities and absorption – space wave propagation – LOS distance – Effective earth's radius – Field strength of space wave - duct propagation – VHF and UHF Mobile radio propagation – Tropospheric Scatter Propagation – VLF and ELF propagation in sea water.

Television : Scanning, Blanking and synchronisation, Picture signal - composite video signal- Vestigial sideband transmission, Principle of CCD Camera - Monochrome picture tube- Monochrome TV receivers- RF tuner ,VHF tuner- Video amplifier, IF section, Vestigial sideband correction- Video detectors, Sound signal separation, AGC, sync separation, horizontal and vertical deflection circuits, EHT generation. Colour TV system: Principle of colour signal transmission and reception, PAL, NTSC, SECAM (block schematic description), Picture tube – delta gun.

Digital TV: Digitized Video, Source coding of Digitized Video – Compression of Frames – DCT based – (JPEG), Compression of Moving Pictures (MPEG). Basic blocks of MPEG2 and MPEG4. Digital Video Broadcasting (DVB) – Modulation: QAM – (DVB-S, DVB-C), OFDM for Terrestrial Digital TV (DVB –T). Reception of Digital TV Signals (Cable, Satellite and terrestrial). Digital TV over IP, Digital terrestrial TV for mobile. Display Technologies – basic working of Plasma, LCD and LED Displays. Basic principle of HDTV.

Light wave systems : Classification, Fibers- types and refractive index profiles, Mode theory of fibers- modes in SI and GI fibers. Impairments in fibers. Dispersion- Group Velocity Dispersion, modal, wave guide and Polarization Mode Dispersion. Attenuation- absorption, bending and scattering losses. Optical sources: LEDs and LDs, Structures, Characteristics, Modulators using LEDs and LDs. Coupling with fibers. Noise in Laser diodes, Relative Intensity Noise (RIN), Phase noise and Amplified Spontaneous Emission (ASE) noise. Effects of Laser diode nonlinearity and noise in fiber communications. Optical detectors:- types and characteristics- structure and working of PIN and APD. Noise in detectors and comparison of performance.

Part I f - Microcontrollers

Introduction to microcontrollers, general architecture of microcontrollers and microprocessors, types of microcontrollers, embedded processors. Overview of the 8051 family. 8051 architecture- memory organization, registers and I/O ports. Addressing modes , instruction sets, and assembly language programming. Introduction to C programming in 8051, Watchdog timer, Power down mode: idle/sleep mode.

Programming timer/counter. Interrupts- handling and programming. Serial communication using 8051- Interfacing with RS232. 8051 interfacing - keyboard, stepper motor, ADC , DAC, and LCD module interface. Applications - square wave and rectangular wave generation, frequency counter and temperature measurement. PIC microcontrollers - introduction, architecture. Memory organization, ports and timers in PIC 16F877.

Microcontroller RISC family-ARM processor fundamentals: Register Organisation ,pipeline, core. ARM instruction sets: data processing, branch ,load-store, interrupts & program status register instructions. Exceptions & interrupts: handling & priorities. Development &

Debugging tools for microcontroller based system design: software and hardware tools like {cross assembler, compiler, debugger, simulator, in-circuit emulator and logic analyser

Part I g - Signal Processing

The Discrete Fourier Transform : Frequency Domain Sampling, Properties of DFT, Linear Filtering Methods Based on the DFT, Frequency Analysis of Signals using DFT. Computation of DFT - FFT Algorithms .

Design of FIR Filters : Symmetric and Antisymmetric FIR Filters, FIR Filters using Window method and Frequency Sampling Method, Design of Optimum Equiripple Linear-Phase FIR Filters. Design of IIR Digital Filters from Analog Filters, IIR Filter Design by Impulse Invariance, IIR Filter Design by Bilinear Transformation, Frequency Transformations in the Analog and Digital Domain. Filter structures: FIR Systems- Direct Form, Cascade Form and Lattice Structure. IIR Systems - Direct Form, Transposed Form, Cascade Form and Parallel Form.

Analysis of finite word length effects- Quantization noise, round off errors, input and output quantization error, limit cycles in IIR filters, round off errors in FFT algorithm. Multi-rate Digital Signal Processing- Decimation and Interpolation (Time domain and Frequency Domain Interpretation), Sampling Rate Conversion, Multistage Implementation of Sampling-Rate Conversion, Applications of Multi-rate Signal Processing- Sub band Coding, Trans-multiplexers. Computer architecture for signal processing - Architecture of TMS320C6713 processor. Programming Tools for DSP Processors.

Part II - Electrical Drives and Control

DC machines : Principle of operation of dc generator, constructional details, emf equation, types of generators. Principle of operation of dc motors. Electrical and mechanical characteristics of dc series, shunt and compound motors, applications.

AC motors : Principle of operation, rotating magnetic field, single phase and three phase induction motors.

Power devices : power BJT, power MOSFET and IGBT - steady state and switching characteristics. Drive requirements. Design of simple drive circuits for power BJT, power MOSFET and IGBT. Principle of DC motor control. Principle of PWM switching control. Two quadrant, four quadrant converter circuit. Controlled rectifiers. Principle of phase controlled converter operation. Single phase half wave and full wave controlled rectifiers with R, RL and battery loads.

Basic configurations of switched mode inverter-principle of PWM switching schemes for square wave and sine wave output. Single phase inverters-half bridge, full bridge and push pull inverter, voltage source inverter. Block diagram of UPS Induction motor drives Speed control by varying stator frequency and voltage.

Principle of vector control. Comparison of vector control and scalar control. Voltage source inverter driven induction motor, application of PWM for induction motor drive.

Part III : General Knowledge, Current Affairs & Renaissance in Kerala

Salient Features of Indian Constitution

Salient features of the Constitution - Preamble- Its significance and its place in the interpretation of the Constitution.

Fundamental Rights - Directive Principles of State Policy - Relation between Fundamental Rights and Directive Principles - Fundamental Duties.

Executive - Legislature - Judiciary - Both at Union and State Level. - Other Constitutional Authorities.

Centre-State Relations - Legislative - Administrative and Financial.

Services under the Union and the States.

Emergency Provisions.

Amendment Provisions of the Constitution.

Social Welfare Legislations and Programmes

Social Service Legislations like Right to Information Act, Prevention of atrocities against

Women & Children, Food Security Act, Environmental Acts etc. and Social Welfare

Programmes like Employment Guarantee Programme, Organ and Blood Donation etc.

RENAISSANCE IN KERALA

Towards A New Society

Introduction to English education - various missionary organisations and their functioning- founding of educational institutions, factories, printing press etc.

Efforts To Reform The Society

(A) Socio-Religious reform Movements

SNDP Yogam, Nair Service Society, Yogakshema Sabha, Sadhu Jana Paripalana Sangham, Vaala Samudaya Parishkarani Sabha, Samathwa Samajam, Islam Dharma Paripalana Sangham, Prathyaksha Raksha Daiva Sabha, Sahodara Prasthanam etc.

(B) Struggles and Social Revolts

Upper cloth revolts. Channar agitation, Vaikom Sathyagraha, Guruvayoor Sathyagraha, Paliyam Sathyagraha. Kuttamkulam Sathyagraha, Temple Entry Proclamation, Temple Entry Act .Malyalee Memorial, Ezhava Memorial etc.

Malabar riots, Civil Disobedience Movement, Abstention movement etc.

Role Of Press In Renaissance

Malayalee, Swadeshabhimani, Vivekodayam, Mithavadi, Swaraj, Malayala Manorama, Bhashaposhini, Mathnubhoomi, Kerala Kaumudi, Samadarsi, Kesari, Al-Ameen, Prabhatham, Yukthivadi, etc

Awakening Through Literature

Novel, Drama, Poetry, *Purogamana Sahithya Prasthanam, Nataka Prashtanam*, Library movement etc

Women And Social Change

Parvathi Nenmenimangalam, Arya Pallam, A V Kuttimalu Amma, Lalitha Prabhu.Akkamma Cheriyan, Anna Chandi, Lalithambika Antharjanam and others

Leaders Of Renaissance

Thycaud Ayya Vaikundar, Sree Narayana Guru, Ayyan Kali.Chattampi Swamikal, Brahmananda Sivayogi, Vagbhadananda, Poikayil Yohannan(Kumara Guru) Dr Palpu, Palakkunnath Abraham Malpan, Mampuram Thangal, Sahodaran Ayyappan, Pandit K P Karuppan, Pampadi John Joseph, Mannathu Padmanabhan, V T Bhattathirippad, Vakkom Abdul Khadar Maulavi, Makthi Thangal, Blessed Elias Kuriakose Chaavra, Barrister G P Pillai, TK Madhavan, Moorkoth Kumaran, C. Krishnan, K P Kesava Menon, Dr.Ayyathan Gopalan, C V Kunjuraman, Kuroor Neelakantan Namboothiripad, Velukkutty Arayan, K P Vellon, P K Chathan Master, K Kelappan, P. Krishna Pillai, A K Gopalan, T R Krishnaswami Iyer, C Kesavan. Swami Ananda Theerthan , M C Joseph, Kuttippuzha Krishnapillai and others

Literary Figures

Kodungallur Kunhikkuttan Thampuran, KeralaVarma Valiyakoyi Thampuran, Kandathil Varghese Mappila. Kumaran Asan, Vallathol Narayana Menon, Ulloor S Parameswara Iyer, G Sankara Kurup, Changampuzha Krishna Pillai, Chandu Menon, Vaikom Muhammad Basheer. Kesav Dev, Thakazhi Sivasankara Pillai, Ponkunnam Varky, S K Pottakkad and others

GENERAL KNOWLEDGE AND CURRENT AFFAIRS

General Knowledge and Current Affairs

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.