070 – ELECTRONICS WORKS

EXAMINATION STRUCTURE

The trade will be examined under the following components or subject grouping: Electronic Devices and Circuit, Radio Communication and Television.

EXAMINATION SCHEME

070 – **Electronics**

This subject will consists of two papers:

71-1 – PAPER I : This will consists of two Parts, viz:

PART I: OBJECTIVE: this will be forty (40) multiple choice questions. Candidates will be required to answer all in 40 minutes. This section carries forty (40) marks.

PART II: ESSAY: this will comprise three sections to be answered in 2 hours. This Section carries sixty (60) marks.

Section A: **Electronic Devices and Circuit** – This will consists of three compulsory questions.

Section B: **Radio Communication** – This will consists of two questions from which candidates must attempt one.

Section C: **Television** – This will comprise two questions and candidates must attempt one.

71-2 PAPER II: PRACTICAL: This paper will comprise two questions to be attempted by the candidates in 3 hours.

SECTION A – RADIO COMMUNICATIONS (CRT 13 & 14)

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
1.	**Radio and Audio Frequency Amplifier** 1. Describe the operation, frequency response of various classes of amplifier. 2. Explain the basic concepts and effects of positive feedback on amplifiers. 3. Explain the functions of A.F.C. and A.G.C. in an amplifier circuit.	1. Amplifiers – Classes A. B. C.; AB and push pull and single ended. 2. Frequency response of amplifiers. 3. Difference between power and voltage amplifiers. 4. Operation of amplifiers – AF, IF. 5. Basic concept of feed-back on amplifiers. 6. Effects of positive feed-back on amplifiers: band width, noise, gain, distortion. 7. Automatic frequency control (A.F.C.) and gain control (A.G.C.) in amplifier circuit. 8. Types of amplifiers – Thermionic; Simi-Conductors.	1. Discuss the operation of the various classes of amplifier. 2. Build a simple power and voltage amplifier and compare its output characteristics on the C.R.O. 3. Discuss the effect of positive feedback on amplifiers. 4. Identify automatic frequency control and automatic gain control stages in amplifier circuit. 5. Construct a simple amplifier using Thermionic Device and Semi-Conductor Device. 6. Simple treatment of condition for stability to be made.
2.	**Radio Transmission** 1. Draw and explain with simple clock diagram the functions and the importance of carrier and modulation in radio transmitter and receiver. 2. Distinguish and explain the method of detection between A.M. and F.M. receiver limiter. 3. Diagnose fault, repair, maintain, align, dismantle and re-assemble a radio receiver. 4. Differentiate between domestic, communication receivers and various types of aerial used in radio and television reception. 5. Operate and use various electronic equipments to clear faults in a radio set.	1. Block diagram of: a. radio transmitter b. radio receiver 2. Carrier and modulation in transmitting and receiving radio signals. 3. Tuning and selectivity in a radio set. 4. Operation of each stage of a radio receiver. 5. Super heterodyne receiver: a. function of each block b. advantages of super heterodyne 6. Difference between A.M. and F.M. receiver-limiter (for city and long distances). 7. Basic principles of radio transmission. 8. Detection in A.M. and F.M. receiver limiter. 9. Difference between domestic receiver and communication receiver. 10. Fault diagnosis in radio receiver using fault finding techniques. 11. Fault diagnosis and repair in radio receiver observing safety precautions: a. short circuit b. open circuit (blown fuse) 12. Radio receiver alignment. 13. Dismantling and reassembling of radio receiver. 14. Interpretation of radio schematic diagram. 15. Types of aerials used in radio and television receptions. 16. Car radio – installation and maintenance.	1. Build a simple radio transmitter and/or receiver. 2. Discuss the importance of carrier and modulation in transmitting and receiving radio signals. 3. Select different wave bands by tuning in a radio set. 4. Visit a radio broadcasting station and observe the different modules in use.

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
		17. Fault clearing using: a. signal tracer b. signal generator c. IF sweep generator d. Meters e. Loop antenna f. Frequency counter.	
3.	**Modulation and Detection** Identify and explain the principles and purposes of modulation and demodulation in A.M. and F.M. radio sets.	1. Modulation and demodulation. 2. Modulation envelope. 3. Modulation and Demodulation circuits in A.M. and F.M. radio sets. 4. Signals detection: a. loud speaker b. micro-phone c.]tape recorder d. turn table e. public address system f. pick up	1. Discuss the principles of modulation and demodulation. 2. Discuss, using charts modulation envelope. 3. Demonstrate how to identify demodulation and modulation circuits in A.M. and F.M. radio sets. 4. Demonstrate the use of C.R.O. to detect signals in radio sets.

SECTION B – TELEVISION (CRT 15 & 16)

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
1.	**Sound and Picture Reproduction** 1. Explain how sound and picture are transmitted and received using a typical block diagram of a transmitter and a receiver set. 2. Explain how picture and sound signals are processed in different stages of a black and white T.V. and also the different terms used to illustrate picture quality.	1. Sound and picture signals in a television: a. transmission b. reception Block diagram of a T.V. Receiver: - flow of signal - function of each stage 2. Functions of a typical aerial receiver set. 3. Frequency channels VHF and UHF bands and the tuner. 4. picture signals – formation 5. Scanning and synchronisation 6. Different terms used in picture quality: a. brightness b. contrast c. picture detail d. aspect radio e. viewing distance 7. Video signals – production of good picture quality. 8. Processing of picture and sound signals in different stages of a black and white television set. 9. Controls of a T.V. Receiver	1. Visit a television station and observe the transmitter and receiver networks. 2. Examine the frequency channels in a T.V. Receiver using V.H.F. and U.H.F. bands. 3. Examine scanning and synchronization on a complete frame of a T.V. receiver. 4. Discuss hoe picture and sound signals are processed in a black and white television. 5. Observe the action of the control on television receiver.
2.	**Principle of Operation of Television Production** Describe the principles of operation of the various stages of a television	1. Principles of operation of: a. Power Supply b. R.F. Amp c. Mixer and Local Oscillation d. IF Amp Stages including Circuit. e. Sychronising Stages f. Vertical and Horizontal Deflection Circuits g. Sound IF Stage including Speaker Sound Detector h. Sound Detector i. AF Amplifier Stages in a T.V. Receiver. j. Video Amplifier	Discuss applications of these in a TV receiver.
3.	**Diagnosis and Repair** 1. Identify the symptoms, and clear faults common to tuner, I.F., amplifier, video, amplifier, CRT, synchronizing stages. 2. Operate various electronic instruments to clear faults in a television set.	1. Symptoms at each stage of a television set. 2. Faults common to tuner, IF and amplifier stages. a. Raster (No picture, no sounds) b. Weak picture and sound on different channels c. Interrupted operation of picture and sound on different channels d. Interrupted operation of picture and sound. 3. Faults common to video, AMP and CRT circuit. a. poor picture quality no picture (but normal sound) b. titled picture c. low brightness and contrast	1. Test for the symptoms at each stage of a television set. 2. Diagnose and clear faults common to the tunner, IF and amplifier stages. 3. Diagnose and clear faults common to the AMP and CRT circuit. 4. Diagnose and clear faults common to the synchronizing stage. 5. Demonstrate the use of different instruments to clear faults. 6. Demonstrate the removal, installation and

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
		4. Faults common to synchronizing stages. a. simultaneous vertical/horizontal OSC output. b. High voltage section. 5. Use of different instrument for clearing faults. a. pattern generator b. IF sweep generator c. Dual trace oscilloscope d. EHT meter e. TV analyser 6. Cathode Ray Tube a. remove b. install] c. adjust 7. Pre-set and no-preset controls on a television receiver. 8. Investigation: a. synchronizing pulse separator stage b. field time base of a television c. line time base of a television	adjustment of the cathode ray Tube (CRT) 7. Demonstrate the setting of preset and non-preset controls on a television receiver. 8. Investigate on the CRO: a. Synchronising pulse separator stage. b. Field time base of a television. c. Line time base of a television.
4.	**Introduction to Colour of T.V.** State the primary and complementary colours of a coloured T.V.	1. Primary colours of a coloured T.V. – red, green blue. 2. Complimentary colours – magenta, cyan, yellow, white. 3. Picture and sound signals. 4. Use of colour decoder: a. chrominance amplifier b. burst gate amplifier c. phase detector d. colour killer e. delay line f. phase shift network g. colour difference demodulator h. RGB matrix and associated circuit. 5. Colour mixing.	1. Identify and discuss the complimentary colours in a coloured television. 2. Discuss how picture and sound signals are processed in different stages of a coloured television set.
5.	**Diagnosis and Repair** 1. Difference between static and dynamic colour convergence and operate the colour bar generator to test signal. 2. Identify the symptoms and clear faults common to each stage of a coloured T.V. Set.	1. Static and dynamic colour convergence – comparism 2. Colour bar generator – signal tester 3. Symptoms of a coloured television. 4. Fault clearing	1. Compare and discuss static and dynamic colour convergence. 2. Demonstrate the operation of the colour bar generator to test signal. 3. Demonstrate how to identify the symptoms in each stage of a coloured television. 4. Demonstrate with the use of a multi-meter and CRO how to clear faults common to each of the stages.

SECTION C – ELECTRONIC DEVICES AND CIRCUITS (CRT 12)

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
1.	**Simplified Semi-Conductor Theory** 1. Explain simplified outline of atomic structure 2. Differentiate between intrinsic and extrinsic semi-conductors 3. Explain formation of P.N. Junction	1. Structure of an atom 2. Intrinsic semi-conductor 3. Extrinsic semi-conductor 4. Basic concepts of semi-conductors: a. Energy band theory b. Formation of P-type and N-type semi-conductors. c. Germanium and Silicon d. Doped semi-conductor e.g. Ge+ Ga; Ge + As. e. Formation of p-n junction f. Characteristics of p-n junction g. Forward bias	1. Identify the orbital arrangement of the atom. 2. Mention the effect of heating on intrinsic semi-conductors. 3. Examine and identify the polarities and symbol of p-n junction. 4. Determine the I-V characteristics of a p-n junction: 1. a. in the forward bias 2. b. in the reverse bias
2.	**Electronic Devices** 1. Identify and explain the various types of diodes. 2. Explain the characteristics, operations and limitations of the various types of diodes. 3. Describe the rectifying action of diodes. 4. Explain and state the characteristics, operations and limitations of the triode value, transistor and photo electric devices. 5. Describe the construction, application of gas filled devices, cathode ray tube, and special solid state devices. 6. Interpret and identify IC circuit symbols and pins.	1. Types of diodes – Thermionic diode, Semi-conductor diodes. 2. Description of vacuum valve. 3. Characteristics, operations and limitations of Semi-Conductors and Themionic diodes 4. Diode Rectifiers 5. Effect of filter elements on d.c. output for Half wave; Full wave and Ripple. 6. Rectifying action of Thermionic Diodes; Semi-Conductors. 7. Characteristics, Operation and limitations of diodes and transistors. 8. Graphical representation of the characteristics of triode and transistor I-V. variation of gain with load. 9. Use of Heat sink 10. Graphical effect of load on gain triode and transistor. 11. Transistor parameters – equivalent replacement using transistor manual 12. vacuum diodes a. operation b. characteristics c. parameter. 13. Characteristics of triodes and transistors: a. IV variation of gain with load b. Common base c. Common emitter d. Common collector e. (Emitter follower) 14. Characteristics of photo-electric devices 15. Gas filled devices 16. cathode ray tube 17. solid state devices: a. zener diode b. tunnel diode c. field effect transistor. 18. IC circuit and symbols 19. IC pins 20. Impurities – Donor (N-type), Acceptor	1. Identify the various thermionic and semi-conductor diodes used in electronic systems. 2. Examine a Vaccum Valve. 3. Discuss the I.V. characteristics of semi-conductors and thermionic diodes. 4. Examine and discuss the effect of load on the characteristics of: a. semi-conductors b. thermionic diodes. 5. Build a simple diode rectifier 6. Examine the effect of filter elements on d.c. output for half wave, full wave and ripple on CRO 7. Discuss the comparison of the rectifying action of thermionic and semi-conductor diodes. 8. Discuss the comparison of the rectifying action of thermionic and semi conductor diodes. 9. Determine the I.V. characteristics of a triode p.n.p. and n.p.n. transistor in three modes. 10. The development of the triode to be explained. 11. Discuss the graphical representation of triode and transistors. 12. Emphasize seriously the need for a heat sink in the continuous use of

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
		(P- type) 21. Types of Semi-conductor devices 22. Wave forms 23. Oscilloscope	transistor. 13. Discuss the need for a heat sink in the use of transistor. 14. Demonstrate graphically athe effect of load on gain of a triode or transistor. 15. Identify and explain transistor parameters equivalent replacements using transistor manual . 16. Examine vacuum devices that operate on electronic devices. 17. Determine the I.V characteristics of a triode value. I.V. characteristics of PnP and nPn transistor. 18. Build a simple photo electric device. 19. Examine a Gas filled device. 20. Examine the various parts of a cathode ray tube. 21. Identify and discuss the various types of solid state devices 22. Interpret and explain IC circuit and symbol. 23. Identify IC pins 24. Discuss the difference between donor and acceptor impurities. 25. Identify different types of semi-conductors. 26. Demonstrate the use of Oscilloscope to determine various wave forms. 27. Demonstrate the use of Oscilloscope to determine various wave forms. 28. Examine and Explain the functional parts of the oscilloscope. 29. Briefly mention Lassajous figures.
3.	**Power Supply** 1. Identify, construct and describe the principles of operation of a power	1. Power supply 2. Power supply in a schematics diagram 3. Stabilized low-voltage d.c. power supply 4. Rectification: half wave, full wave.	1. Draw circuits of power supply with Smothering, Multi state smothering circudit

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
	supply unit. 2. Identify and differentiate between half and full wave rectifiers and state their advantages. 3. Explain the difference between regulator and stabilizers.	5. Difference between half and full wave rectifiers: a. Advantages b. Disadvantages 6. Effect of capacitor and inductor in a power supply. 7. Power supply wave forms 8. Difference between regulators and stabilizers. 9. power supply: c. with transformer d. without transformer	2. Identyify power supply in a schematic diagram. 3. Build a stabilized low-voltage d.c. power supply unit. 4. Build a simple half and full wave rectifier. 5. Demonstrate the difference between half and full wave rectifiers. 6. show the effects produced by capacitor and inductor in a power supply. 7. Use the CRO to determine the wave form at various points of power supply. 8. Build simple regulators and stabilizers. 9. Build a power supply with transformer and power supply without transformer. 10. stress the fact that the power supply is the only means of energizing an electronic system.
4.	**<u>Electronic Circuits</u>** 1. Explain the basic principles, design and application of various simple electronic circuits. 2.	1. Simple electronic circuit: Oscillation, Multi-vibrators. 2. Application of electronic circuits 3. Difference between differentiating and integrating. 4. Principles of Oscillation 5. Types of Oscillators: a. LC Oscillator b. Hartlery c. Colpitt d. Crystall control e. Tuned anode f. R-F oscillators g. Multi-Vibrators 6. Signal injector 7. Types of Multi-vibrators: a. Astable b. Bi-stable c. Mono-stable 8. Binary numbers in electronic circuits 9. Logic circuits: a. AND', b. 'OR',	1. Identify and discuss the oscillator and multi-vibrator in electronic circuits. 2. Discuss the application of simple electronic circuits. 3. Examine the differentiating integrating circuit. 4. Explain Oscillation. 5. Build a simple Oscilator. 6. Built a simple signal injector using a multi-vibrator circuit. 7. Build a stable multi-vbibrator and determine the output from the CRO 8. Use switches and electric bulb to demonstrate the operation of a bistable multi-vibrator. 9. Discuss the use of binary numbers in electronic circuit. 10. Write truth tables for the 'AND', 'OR', 'NOR' gate. Qualitative

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
			treatments only.