Q. P
Level : 3
JT (ECE)

Level 3 – Trade/Practical Test

Junior Technician

Department of Electronics and Communication Engineering

Instructions to the Candidates

A. Answer all questions provided in the question paper.

B. Each question carries 2 marks. The detailed distribution of marks is specified within each question.

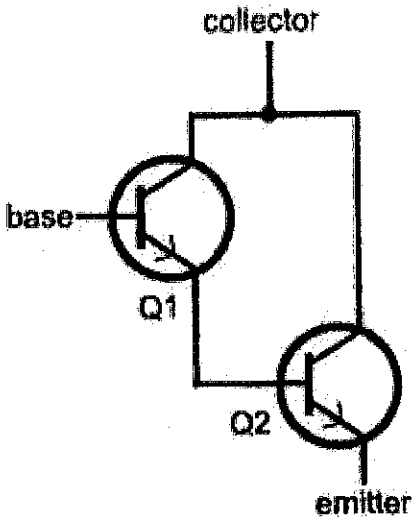
C. After completing each Practical Demonstration, the procedure and results must be verified and authenticated by the examiner.

Total Marks: 20 X 2 = 20 marks **Total Time: 120 Minutes**

S. No.	Question	Marks
1	Select an appropriate device/component that generates two outputs with magnitude of 9V AC each but 180° out of phase (with respect to each other) from a 230V AC mains power supply. Perform a laboratory experiment to verify the device output voltages using an oscilloscope. Clearly document the experimental procedure, including A. Device Selection, (0.5 Marks) B. Oscilloscope settings, (0.5 Marks) C. Waveforms observed, (0.5 Marks) and D. Interpretation of results. (0.5 Marks)	2
2	Design and build a power supply circuit to convert 230V AC mains voltage into a regulated 5V DC output. Perform a step-by-step verification of the output voltage at different stages of the circuit using both a multimeter and an oscilloscope. Document the A. Circuit Diagram, (0.5 Marks) B. Circuit Connection, (0.5 Marks) C. Measurements Using Oscilloscope (0.5 Marks) and D. Measurements Using Multimeter (0.5 Marks)	2
3	Explain how to check the functioning of a diode: A. When the diode is connected in a circuit B. When the diode is not connected in any circuit Include the methods for both cases (1 Marks1 Marks)	2
4	A company manufactures single-phase 1 HP motors in two different models: A. Model A with a power factor of 0.85 B. Model B with a power factor of 0.6 Which motor would you select for laboratory use? Provide your reasoned choice considering the particular motor	2
5	Conduct an experiment to control the brightness of an LED (having Constant Voltage Source = 5 V) using suitable electronic components. Explain the working principle (1 Mark), describe the circuit connections (0.5 Mark), and demonstrate how adjusting the components affects LED brightness (0.5 Mark).	2
6	Conduct an experiment to obtain the following output voltage relationships using op-amp(s) 1. $V_o = -3V_i$ 2. $V_o = 2V_i$	2

<table>
<tr><td></td><td>Design the circuits (0.5 Mark +0.5Mark) and verify the output using multimeter (0.5Mark + 0.5 mark)</td><td></td></tr>
<tr><td>7</td><td>Draw and explain a circuit that converts the changing resistance of a PT100 sensor (Resistance Temperature Detector - RTD) into a corresponding voltage output. Describe the working principle and how the resistance variation translates into a measurable voltage signal.
A. Circuit Diagram – 1 Mark
B. working principle – 1 Mark</td><td>2</td></tr>
<tr><td>8.</td><td>Draw the circuit diagram of a half adder and conduct an experiment to verify its operation. Explain how the half adder adds two single-bit binary inputs to produce the SUM and CARRY outputs. Record the truth table and observe the outputs using LEDs or logic probes.
A. Circuit Diagram – 0.5 Mark
B. Truth Table – 0.5 Mark
C. Circuit Connection and Output of the circuit – 1 Mark</td><td>2</td></tr>
<tr><td>9</td><td>A. What is the purpose of modulation in communication systems? - 1 Mark
B. Explain how Amplitude Modulation (AM) and Frequency Modulation (FM) are performed, highlighting the key differences between these modulation techniques – 1 Mark</td><td>2</td></tr>
<tr><td>10</td><td>Using Excel, find and plot the relationship between temperature and voltage of the given sensor (e.g., Thermocouple). Use the sensor's voltage-temperature characteristic to data represent the variation graphically – 2 marks

Sensor's voltage-temperature characteristic data
<table>
<tr><th>S. No.</th><th>Temperature (°C)</th><th>Voltage (mV)</th></tr>
<tr><td>1</td><td>0</td><td>0.000</td></tr>
<tr><td>2</td><td>25</td><td>1.000</td></tr>
<tr><td>3</td><td>50</td><td>2.000</td></tr>
<tr><td>4</td><td>75</td><td>3.000</td></tr>
<tr><td>5</td><td>100</td><td>4.096</td></tr>
<tr><td>6</td><td>125</td><td>5.100</td></tr>
<tr><td>7</td><td>150</td><td>6.100</td></tr>
<tr><td>8</td><td>175</td><td>7.100</td></tr>
<tr><td>9</td><td>200</td><td>8.100</td></tr>
</table></td><td>2</td></tr>
</table>

11	Calculate the approximate total current gain of the below configuration Consider the current gain of $Q_1 = \beta_1$ and gain of $Q_2 = \beta_2$  	2
12	Calculate the resolution of a 10-bit ADC where the maximum operating voltage is 5 V, and the reference voltage (V_{ref}) provided to the ADC is 3.3 V.	2
13.	A balanced three-phase Load is connected in Star (Y) configuration to a 400 V supply. The phase current drawn by the load is 10 A. A. Calculate the phase voltage (V_L) and line current (I_L) for the Star connection.(0.5 Mark +0.5 Mark) B. Calculate the phase current (I_L) and line voltage (V_L) if the same load is connected in Delta configuration to the same supply voltage.(0.5 Mark +0.5 Mark)	2
14	Select appropriate equipment or component and demonstate to vary the brightness of an incandescent lamp with the following specifications: • Input supply: 230 VAC, 50 Hz • Incandescent lamp: 30W/60W	2
15	Demonstrate follwing Multimeter functions Note: Necessary precautions to be taken for accurate measurement. A. DC Current Measurement – 100 mA B. hFE Measurement of a Transistor C. Voltage Measurement (100 mV) D. Resistance Measurement (1 kΩ)	2
16	A communication system has a signal power of 20 mW and noise power of 0.2 mW. Calculate the Signal-to-Noise Ratio (SNR) in decibels (dB).	2
17	A. Convert the decimal number 345 into its binary B. Convert the binary number 1011101 to its hexadecimal equivalent.	2

18	Design a Schmitt Trigger circuit using an op-amp with positive feedback having the following specifications: • Upper threshold voltage (UTP) = 3 V • Lower threshold voltage (LTP) = 2 V • Saturation voltage V_{sat} = ±10 V • Feedback resistor $R_2 = 22\ k\Omega$ Calculate the required values of input resistor R_1 and reference voltage V_r to achieve the desired thresholds. Use the superposition theorem to derive the formulas and solve for R_1 and V_r.	2
19	Indentification of compnent, Value its terminal 1. Compenent 1: Value (0.5 Marks) 2. Component 2: Terminal (0.5 Marks) 3. Compenent 3: Speciffication and Terminal (0.5 Marks) 4. Compnent 4: Value (0.5 Marks)	2
20	Create a professional report document on "List of Electronics Componnets in the Lab" that includes the following features: 1. Use Headers and Footers with the document title and page numbers. (0.5 Marks) 2. Insert at least one table summarizing inventory data. (1.5 Marks) Table should contains A. S. No. B. Component Name C. Quantity D. Specification and E. Location in Lab	2