B.E. MECHANICAL ENGINEERING FIRST YEAR FIRST SEMESTER SUPPLEMENTARY EXAM - 2024

ELECTRONICS

Time : 3 hrs   **Full Marks: 100**

Answer any five questions.

1. Draw the block diagram of a zero-crossing detector and explain the functions of individual blocks.   20

2. a) Explain the operation of a positive diode clipper circuit.   10

   b) Discuss cutoff, active and saturation states of a transistor.   10

3. a) Explain with a circuit diagram the use of a zener diode as a voltage regulator.   10

   b) Draw any transistor biasing circuit, find its Q-point and plot it on the load line.   10

4. a) Draw the circuit diagram of a half wave rectifier and explain its operation.   10

   b) An amplifier has an open-circuit voltage gain of 5, an input resistance of 1 kΩ, and an output resistance of 10 Ω. The amplifier is connected to a sinusoidal voltage source of 1V rms, which has an output resistance of 100 Ω, and to a load resistance of 50 Ω. What will be the rms value of the output voltage?   10

5. a) Draw the circuit diagram of a practical CE amplifier and obtain the expression for the voltage gain and the input impedance.   12

b) Draw the circuit diagram of an OP AMP non-inverting amplifier and derive the expression for the voltage gain.   8

6. Write notes on the following: 4x5=20
    (a) Sensors and Actuators
    (b) Ripple factor and Rectification efficiency
    (c) Op-amp voltage follower
    (d) Frequency response of an amplifier

7. a) Obtain the truth table for the following function: $f = A + BC$ 6

b) Implement the following logic function using MOS transistors: $f = AB+C$ 6

c) Implement the following Boolean function using (i) only NAND gates and (ii) only NOR gates: $f = AB + C$ 8

8. a) Express the following function in minterm and maxterm forms.   10

$$f(A,B,C) = (A + B)\, C$$

b) Simplify the following Boolean function using K-map.   10

$$f(A,B,C,D)=\Sigma(0,\ 1,\ 3,7,8,9,11,15)$$