Reg. No.															

Question Paper Code	13971

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Third Semester

Mechanical and Automation Engineering

24ESEI302 - BASIC ELECTRONICS AND CONTROL SYSTEM

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	The band gap in silicon is about___ . (a) 1.1 eV (b) 0.7 eV (c) 3 eV (d) 5 eV	1	K1	CO1
2.	Common collector configuration is also known as: (a) Emitter follower (b) Base follower (c) Voltage amplifier (d) None	1	K1	CO1
3.	The drain current in JFET is controlled by___ . (a) Gate-source voltage (b) Drain voltage (c) Source voltage (d) Supply	1	K1	CO2
4.	UJT acts as a___ . (a) Relaxation oscillator (b) Amplifier (c) Rectifier (d) Diode	1	K1	CO2
5.	The phase shift between input and output in inverting amplifier is____ . (a) 180° (b) 0° (c) 90° (d) 270°	1	K1	CO3
6.	A Crystal Oscillator uses: (a) Quartz crystal as resonant element (b) LC tank circuit (c) R-C phase shift network (d) Wien bridge network	1	K1	CO3
7.	A peak detector circuit stores: (a) The instantaneous value (b) The minimum value (c) The maximum value of the input voltage (d) The average value	1	K1	CO4
8.	The fastest type of ADC is: (a) Flash type ADC (b) Dual slope type ADC (c) Ramp type ADC (d) SAR type ADC	1	K1	CO4
9.	The effect of adding feedback makes the system (a) Linear (b)Non linear (c) Time variant (d) Time invariant	1	K1	CO5
10.	The time constant (T) of a first-order system is the time required for the response to reach: (a) 37% of final value (b) 63.2% of final value (c) 50% of final value (d) 90% of final value	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

		Marks	K – Level	CO
11.	Explain why silicon is considered more suitable than germanium for semiconductor devices.	2	K2	CO1
12.	Describe how a Zener diode is used in voltage regulation applications.	2	K2	CO1
13.	Explain the concept of Pinch-off Voltage in a JFET and its significance in device operation.	2	K2	CO2
14.	Describe the reason behind the occurrence of negative resistance in a UJT.	2	K2	CO2
15.	Explain what an instrumentation amplifier is and discuss two of its main advantages.	2	K2	CO3
16.	Interpret the Barkhausen criterion and explain how it ensures sustained oscillations in a circuit.	2	K2	CO3
17.	Explain the need for using a sample and hold circuit before an ADC in data acquisition systems.	2	K2	CO4
18.	Determine the resolution of an 8-bit ADC with a 10 V reference and explain what the result implies.	2	K2	CO4
19.	Relate the mechanical elements (mass, damping, spring) to their electrical analogs in the force-voltage analogy.	2	K2	CO5
20.	Explain Mason's Gain Formula and its role in analyzing signal flow graphs.	2	K2	CO5

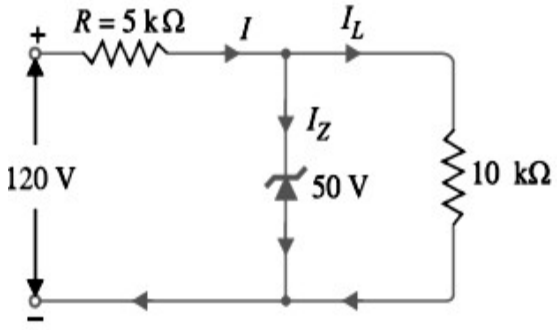
K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

21.	Discuss how the damping ratio affects the transient and steady-state response of a system.	2	K2	CO6
22.	Explain what is meant by the time response of a control system and what information it provides about system behaviour?	2	K2	CO6

PART - C (6 × 11 = 66 Marks)

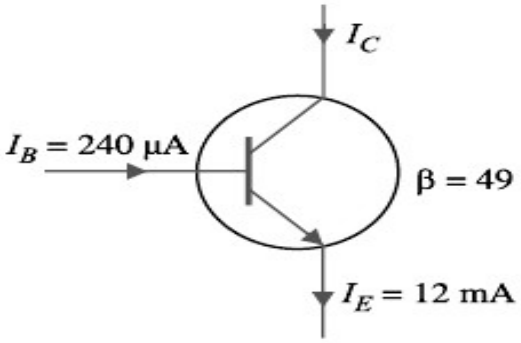
Answer ALL Questions

23.	a) (i)	Explain the operation and characteristics of PN junction diode.	8	K2	CO1
	(ii)	For the circuit shown in Figure find, (i) voltage across 10K resistor (ii) the current through zener diode. (iii) voltage across 5K resistor.	3	K3	CO1



OR

	b) (i)	Explain the construction and working Bipolar Junction Transistor (BJT) in Common Emitter configuration.	8	K2	CO1
	(ii)	Find α of the transistor shown in Figure. Also determine the value of I_C using both α and β rating of the transistor.	3	K3	CO1



24.	a)	Explain the construction and working of enhancement MOSFET, with its characteristic graph.	11	K2	CO2

OR

	b)	Describe the construction, working principle of Silicon Controlled Rectifier (SCR) with its characteristic graph.	11	K2	CO2

25.	a) (i)	For an Op-Amp integrator with R=100 MΩ and C=1μF, an input of 2sin(1000t) is applied. Determine the value of Vo.	3	K3	CO3
	(ii)	With a neat diagram and derivation explain the working of three op-amp based instrumentation amplifier.	8	K2	CO3

OR

	b) (i)	A Hartley oscillator uses L1 = 2 mH and L2 = 1.5 mH. Find the range of capacitances (C_{min} and C_{max}) so that the frequency of oscillation can be varied between 1000 kHz to 2000 kHz.	3	K3	CO3

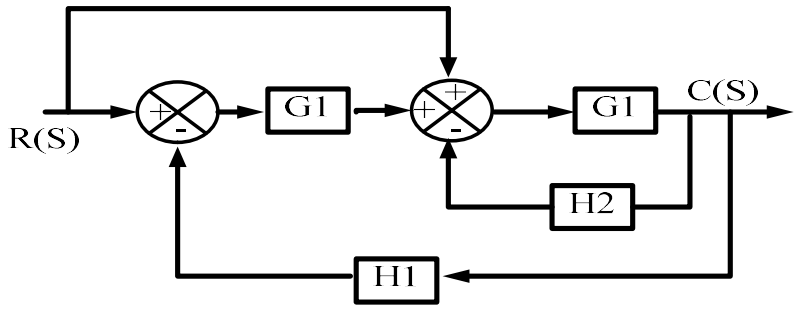
(ii) Explain the working principle of a Wien Bridge Oscillator. Derive the expression for its frequency of oscillation. *8 K2 CO3*

26. a) Apply the working principle of a Successive Approximation ADC to explain how it converts an analog input into a digital output, using a suitable numerical example. Reframe. *11 K3 CO4*

OR

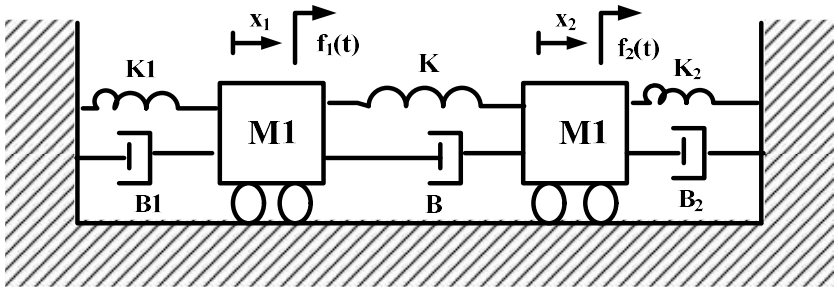
b) Apply the working principle of an R/2R Ladder DAC to explain how it converts a digital input into an analog output, and derive the expression for its output voltage. *11 K3 CO4*

27. a) Simplify the following circuit by applying the block diagram reduction technique and find the closed-loop transfer function C(s) / R(s) of the system. *11 K4 CO5*



OR

b) Analyze the given mechanical system shown in the figure and develop the differential equations governing them. Draw the Torque-voltage analogous circuit by applying Mesh and Nodal equations. *11 K4 CO5*



28. a) Analyze the output response of a second order system for a unit step input. Derive the expression and draw the response of second order system for an under damped case. *11 K4 CO6*

OR

b) Analyze the output response of a second order system for a unit step input. Derive the expression and draw the response of second order system for an critically damped case and over damped case. *11 K4 CO6*