Reg. No. : | | | | | | | | | | | | |

Question Paper Code:R3B04

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

Third Semester

Biomedical Engineering

R21UBM304- SEMICONDUCTOR DEVICES AND CIRCUITS

(Regulations R2021)

Duration: Three hours | Maximum: 100 Marks

Answer All Questions

PART A - (10x 2 = 20 Marks)

1.	For a fixed bias circuit having RC=2Kohm and VCC=60V, IB=0.25mA and S=101, find VCE.	CO2 App
2.	What are the definitions and differences between static and dynamic resistance?	CO1 U
3.	How does a JFET function as a resistor in a particular region of its operation?	CO1 U
4.	What roles do latching current and holding current play in the operation of a thyristor or SCR?	CO1 U
5.	What are the input and output impedances, voltage gain, and current gain of a common emitter amplifier using h-parameters for a fixed bias configuration?	CO1 U
6	Given a 12V supply and a peak output of 12V, how can we find the efficiency of a transformer-coupled class A amplifier with a 10 Ω load?	CO2 App
7	What is the condition for sustained oscillation according to the Barkhausen criterion, and what happens when the loop gain exceeds 1?	CO1 U
8	Can you list the advantages of incorporating negative feedback in amplifier circuits?	CO1 U
9	What is the significance of the name "555" in the 555 timer IC?	CO1 U
10	What is the duty cycle if the square wave period is 1 ms, with an ON time of 0.75 ms and an OFF time of 0.25 ms?	CO2 App

PART – B (5 x 16= 80 Marks)

11.	(a)	How do you calculate the DC current gain (αdc and βdc) of a transistor given its reverse leakage currents in CB and CE configurations? Specifically, with a reverse leakage current of 0.2 μA in CB and 18 μA in CE, and assuming IB = 30 mA.	CO1- U	(16)
		Or		
	(b)	What is the method to calculate the junction capacitance of a PN junction, and what are the values for a silicon junction at 300 K with Na = 10^16 cm^{-3} and Nd = 10^15 cm^{-3} at VR = 1V and VR = 5V?	CO1- U	(16)
12.	(a)	(i) How can I design a self-biasing circuit for a JFET with a gate-source cutoff voltage (VGS(th)) of -2V and a maximum drain current (IDSS) of 10mA?	CO2- App	(8)
		(ii) Explain the design and functionality of an n-channel enhancement MOSFET.		
		Or		
	(b)	(i) Given a class B amplifier supplying a 20V peak signal to a 16Ω load and powered by a 30V supply, how can I determine the input power, output power, and circuit efficiency?	CO2- App	(8)
		(ii) What are the characteristics and operation of a class-B push-pull amplifier, and how do you derive its efficiency expression?	CO2- App	(8)
13.	(a)	Sketch a transistor amplifier circuit that meets the following criteria: good voltage gain, 180° phase shift, medium input impedance, and high output impedance. Also, derive its AC h-parameter equivalent and compute the input and output impedances, voltage gain, and current gain.	CO4- App	(16)
		Or		
	(b)	Describe the characteristics of a Common Emitter (CE) amplifier circuit with an un bypassed emitter resistor. Can you sketch its AC h-parameter equivalent and derive expressions for input impedance, output impedance, and voltage gain	CO4- App	(16)
14.	(a)	Describe the voltage series feedback amplifier's operation with a diagram, and derive expressions for gain without feedback, gain with feedback, feedback factor, and the input and output impedances.	CO1- U	(16)
		Or		

	(b)	Describe the operation of an RC Phase Shift Oscillator with a neat circuit diagram, and derive the frequency of oscillation.	CO1- U	(16)
15.	(a)	Explain the various types of RC wave shaping circuits, including high-pass filters, low-pass filters, and differentiators, along with their primary functions in signal processing?	CO1- U	(16)
		Or		
	(b)	Explain how an astable multivibrator functions, supported by a circuit diagram and corresponding waveforms. What are some practical applications of this circuit?	CO1- U	(16)