Reg.No.:												

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
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Question Paper Code: 120015

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. /DEC. 2024
Third Semester
Biomedical Engineering
U23BM304 – FUNDAMENTALS OF CIRCUITS AND DEVICES
(Regulation 2023)

Time: Three Hours Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Two 50 Ω resistors are connected in series. When a resistor R is connected across one of them, the equivalent circuit resistance is 60 Ω. Calculate the unknown resistance, R.	2	K1	CO1
2.	Compare the phase relationships between current and voltage in purely resistive, inductive, and capacitive circuits.	2	K2	CO1
3.	Define the Zener breakdown voltage and how it differs from avalanche breakdown.	2	K1	CO2
4.	List the key differences between diffusion capacitance and transition capacitance in a PN junction.	2	K1	CO2
5.	Recall the biasing arrangement for an NPN transistor to operate in the cut-off and saturation region.	2	K1	CO3
6.	A JFET has a driven current of 4mA. If I_{DSS}=8mA and $V_{GS(off)}$=-6V. Find V_{GS} and V_P.	2	K3	CO3
7.	List the key components in a MOSFET small-signal model.	2	K1	CO4
8.	Outline the significance of the bypass capacitor in a common-emitter amplifier.	2	K2	CO4
9.	List the basic conditions required for oscillations in an electronic circuit.	2	K1	CO5

10.		In a Weinbridge oscillator, if the values of resistance, R=100KΩ and the frequency of oscillation is 10KHz, find the value of the capacitor, C.	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	A network has been shown in Fig. 1. Apply Kirchoff laws to determine mesh currents, I_1, I_2, and I_3.	13	K3	CO1

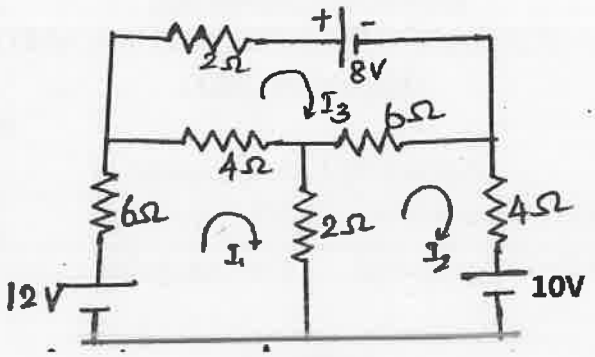

Fig. 1

(OR)

	b)	Apply Kirchhoff current law to determine the voltage drop across 6Ω and 5Ω resistors for the circuit shown in Fig. 2.	13	K3	CO1

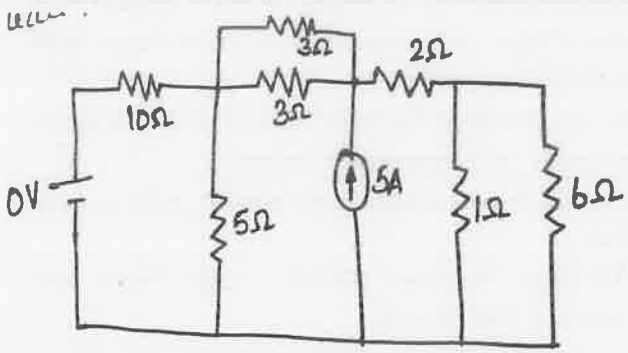

Fig. 2

12.	a)	Discuss the working principle of a full-wave rectifier and explain how the addition of a capacitive filter reduces the ripples. Use diagrams and equations to support the explanation of ripple reduction.	13	K2	CO2

(OR)

	b)	Explain the working of the PN junction diode with neat sketches and analyze the V-I characteristics of the PN junction diode under forward and reverse bias conditions with neat sketches.	13	K2	CO2

13.	a)	Configure a PNP transistor circuit under common base mode and interpret the input and output characteristics of the transistor with proper explanation.	13	K2	CO3
		(OR)			
	b)	Sketch and explain the typical shape of drain characteristics of JFET for $V_{GS}=0$ with an indication of four regions clearly. Also, discuss the transfer characteristics of JFET.	13	K2	CO3
14.	a)	With an AC equivalent circuit, analyze the common source amplifier and derive the equation for voltage gain, input resistance and output resistance.	13	K3	CO4
		(OR)			
	b)	Discuss in detail about the low frequency and high frequency models of a CE amplifier. Using the model, plot the frequency response and find the slope of the curve.	13	K3	CO4
15.	a)	Draw the block diagram of a voltage series feedback amplifier and discuss the effect of negative feedback upon input and output resistances for a voltage series feedback amplifier.	13	K2	CO5
		(OR)			
	b)	Draw the circuit of the Hartley oscillator and explain its working. Derive the expressions for the frequency of oscillation and the condition required for starting the oscillation.	13	K2	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.			Questions	Marks	KL	CO
16.	a)	i.	Discuss the V-I characteristics of a Zener diode and explain how the Zener diode functions as a voltage regulator.	10	K4	CO2
		ii.	Analyze the differences in light emission between an LED and a Laser diode in terms of the recombination process in the semiconductor.	5	K4	CO2
			(OR)			
	b)	i.	Compare the characteristics of positive feedback with negative feedback circuits.	5	K4	CO5
		ii.	Design a circuit model for a phase-shift oscillator that operates at a 5 KHz frequency. Ensure that your design meets the conditions for oscillation and explain the rationale behind your component selection.	10	K4	CO5