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International Islamic University Chittagong

Department of Computer Science & Engineering

B. Sc. in CSE Semester Final Examination, Spring-2024

Course Code:EEE-1221Course Title: Electronics

Total marks: *50* Time: *2* hours*30* minutes

[Answer ***all*** the questions. Figures in the right hand margin indicate full marks. Separate answer script must be used for Group A and Group B]

Group-A

1.	a)	What is pinch-off voltage in MOSFETs? Explain the operation of n-channel enhancement mode MOSFET.	CLO2	U	5
		OR,			
		What is JFET? Draw the symbol of N-Channel JFET and P-Channel JFET. Describe the working principle of N-Channel JFET.			
	b)	A JFET has a drain current of 5mA. If I_{DSS} =10 mA and $V_{GS(off)}$ = -6V, Find the value of i) V_{GS} and ii) V_P	CLO3	An	5
2.	a)	How many types of switching circuits are there? Describe the switching action of a transistor, illustrating the 'OFF' region, 'ON' region, and 'Active' region on its output characteristics?	CLO2	Ap	5
		OR,			
		Design a Multivibrator circuit that can generate square wave output with no stable state. Explain its operation.			
	b)	Fig. 2(b) shows the transistor switching circuit. Given that R_B = 2.7 kΩ, V_{BB} = 2V, V_{BE} = 0.7V and V_{knee} = 0.7V. i) Calculate the minimum value of β for saturation. ii) If V_{BB} is changed to 1V and transistor has minimum β = 50, will the transistor be saturated.	CLO3	An	5

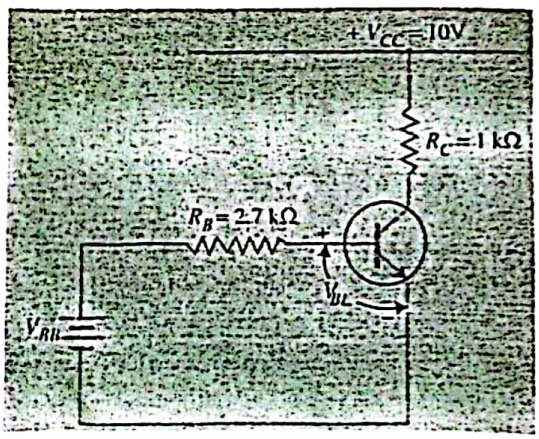

Fig. 2(b)

Group-B

3.	a)	Sketch a neat diagram and derive an expression for the voltage gain of a non-inverting amplifier.	CLO2	U	5
	b)	Find the output voltage with proper mathematical expression for the circuit given below	CLO3	An	5

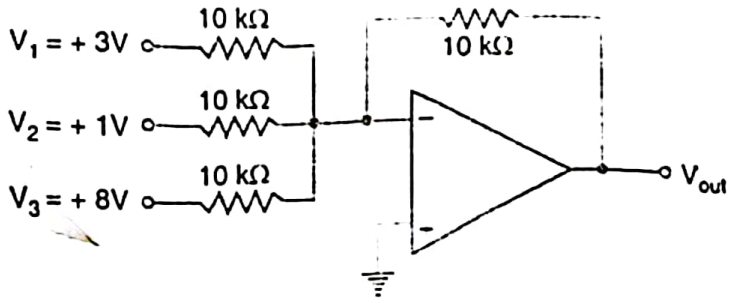

Fig. 3(b)

4.	a)	What is negative feedback? Derive the gain of negative feedback in amplifier.	CLO2	Ap	5

OR,

Show that the input impedance of amplifier increases due to negative voltage feedback.

	b)	When negative voltage feedback is applied to an amplifier of gain 100, the overall gain falls to 50.	CLO3	An	5
		(i) Calculate the fraction of the output voltage feedback			
		(ii) If this fraction is maintained, calculate the value of the amplifier gain required if the overall stage gain to be 75.			

5.	a)	What is Oscillator? Briefly explain damped and undamped oscillations with proper illustrations.	CLO2	U

OR,

Briefly explain the working principle of Heartly oscillator with proper circuit diagram.

	b)	Explain the diagram of Peak Detector circuit in details.	CLO3	U

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Time: 2 hours 30 minutes Full Marks: 50

The figures in the right-hand margin indicate full marks

Part A

[Answer the questions from the followings]

1.	a)	What is JFET? Draw the symbol of N-Channel JFET and P-Channel JFET. Describe the working principle of (N-Channel JFET). i) When drain-source voltage (V_{DS}) is applied at constant gate-source voltage (V_{GS}) OR, What are the main differences between enhancement-mode and depletion-mode MOSFETs? Explain the operation of n-channel enhancement mode MOSFET.	CO4	U	5
1.	b)	A JFET has a drain current of 5mA. If I_{DSS}=10 mA and $V_{GS(off)}$ = -6V, Find the value of i) V_{GS} and ii) V_P	CO4	An	5
2.	a)	Describe the switching action of the transistor by showing the 'OFF' region, 'ON' region, and 'Active' regions on its output characteristics. OR, Suppose you have given two transistors with few other passive elements, design a Multivibrator having no stable state. Explain its operation when a square wave will generate as Output.	CO4	U	5
2.	b)	Fig. 2(b) shows the transistor switching circuit. Given that R_B = 2.7 kΩ, V_{BB} = 2V, V_{BE} = 0.7V and V_{knee} = 0.7V. i) Calculate the minimum value of β for saturation. ii) If V_{BB} is changed to 1V and transistor has minimum β = 50, will the transistor be saturated.	CO4	An	5

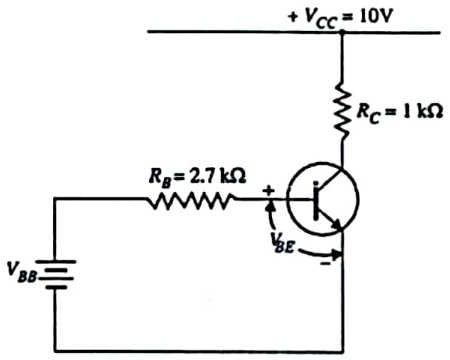

Fig. 2(b)

Part B

[Answer the questions from the followings]

3.	a)	What is an operational amplifier (OP-amp)? Draw the schematic symbol of an operational amplifier indicating the various terminals.	CO5	R	3
3.	b)	Sketch a neat diagram and derive an expression for the voltage gain of a non-inverting amplifier.	CO5	U	4
3.	c)	Illustrate the output voltage waveform with proper mathematical expression for the circuit given below	CO5	An	3

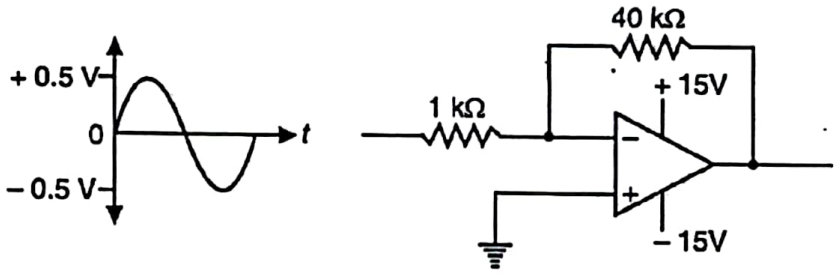

Fig. 3(c)

4.	a)	What is negative feedback? Explain the principle of negative feedback in amplifier.	CO5	U	6
		OR			
		What is feedback? Explain the principle of negative feedback in amplifier.			
4.	b)	When negative voltage feedback is applied to an amplifier of gain 100, the overall gain falls to 50. (i) Calculate the fraction of the output voltage feedback. (ii) If this fraction is maintained, calculate the value of the amplifier gain required if the overall stage gain to be 75.	CO5	An	4
5.	a)	What is Precision Rectifier? Explain Precision Rectifier with proper circuit diagram.	CO5	U	4
		OR			
		Show that the output is the integral of the input with an inversion and scale multiplier of 1/RC.			
5.	b)	Explain the diagram of Peak Detector circuit	CO5	U	3
5.	c)	Fig.5 (c) shows the OP-amp integrator and the square wave input. Find the output voltage and output wave shape.	CO5	An	3

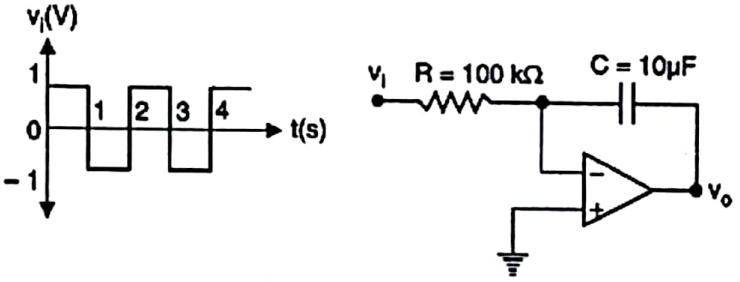

Fig. 5 (c)

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[Answer ***all*** the questions. Figures in the right hand margin indicate full marks. Separate answer script must be used for Group A and Group B]

Group-A

1.	a)	What is JFET? Draw the symbol of N-Channel JFET and P-Channel JFET. Describe the working principle of N-Channel JFET.	CLO2	U	5
		OR,			
		What is threshold voltage in MOSFETs? Describe the basic working principle of an enhancement-mode N-channel MOSFET.			
	b)	Sketch the transfer characteristics curve of n-channel enhancement type of MOSFET if $V_T = 2V$ and $k = 0.5 \times 10^{-3}$ A/V^2.	CLO3	An	5
2.	a)	Design a Multivibrator circuit that can generate square wave output with no stable state. Explain its operation.	CLO2	Ap	5
		OR,			
		What is a switching circuit? Explain the switching action of a transistor with the help of output characteristics.			
	b)	In an astable multivibrator, $R_2 = R_3 = 10$ kΩ and $C_1 = C_2 = 0.01$ μF. Determine the period and frequency of the square wave.	CLO3	An	5

Group-B

3.	a)	What is an operational amplifier (op-amp)? Derive the expression for the voltage gain of an inverting amplifier.	CLO2	U	5
	b)	Draw the output voltage waveform with proper mathematical expression for the circuit given in Fig. 3(b).	CLO3	An	5

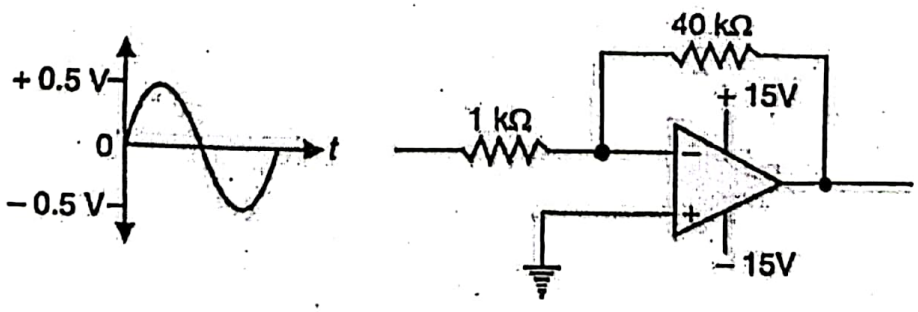

Fig. 3(b)

4.	a)	Show that output is the differentiation of the input with an inversion and scale multiplier of RC.	CLO2	Ap	5
		OR,			
		What is negative feedback? Explain the principle of negative feedback in amplifier.			
	b)	When negative voltage feedback is applied to an amplifier of gain 200, the overall gain falls to 100. (i) Calculate the fraction of the output voltage feedback. (ii) If this fraction is maintained, calculate the value of the amplifier gain required if the overall stage gain to be 150.	CLO3	An	5
5.	a)	Write a short note on comparator circuit and characteristics of it with proper diagram.	CLO3	U	5
		OR,			
		Design and explain a circuit that can detect the peak value of an incoming unknown varying signal.			
	b)	What is Precision Rectifier? Explain Precision Rectifier with proper circuit diagram.	CLO3	An	5