

[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 threshold voltage in MOSFETs? Describe the basic working principle of an enhancement-mode N-channel MOSFET.

CLO4 U 5

OR

What is pinch off voltage? Discuss the operation of an n-channel JFET that has Pinch off voltage of 4V with neat diagrams.

1. b) Identify the differences between JFET and BJT? A JFET has a drain current of 5mA. If  $I_{DSS} = 10mA$  and  $V_{GS(off)} = -6V$ , find the value of (i)  $V_{GS}$  and (ii)  $V_P$ .

CLO4 An 5

2. a) What is a multivibrator in electronics? With neat diagram explain the operational principles of an multivibrator which produces square wave as output.

CLO4 Ap 5

OR

Illustrate the concept of "saturation" and "cutoff" when referring to a transistor's switching behavior by interpreting the transistor Characteristics curve?

2. b) Fig-2(b) shows the transistor switching circuit. Given that  $R_B = 2.7 k\Omega$ ,  $V_{BB} = 2V$ ,  $V_{BE} = 0.7V$  and  $V_{Knee} = 0.7V$ .

CLO4 An 5

- (i) Calculate the minimum value  $\beta$  for saturation.  
(ii) If  $V_{BB}$  is changed to 1V and the transistor has minimum  $\beta = 50$ , will the transistor be saturated.

$V_{BE} = 0.7V$   
 $I_{B(sat)} = \frac{V_{BB} - V_{BE}}{R_B}$

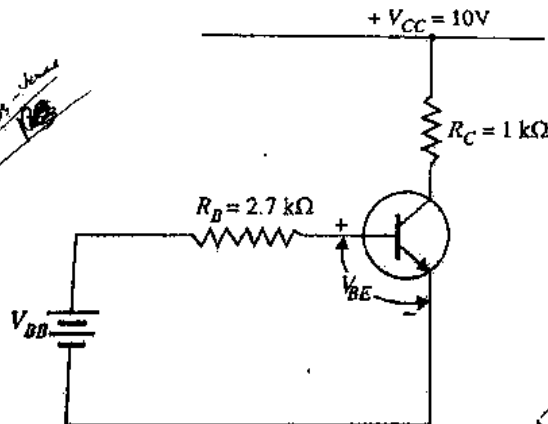


Fig. 2(b)



### Group-B

3. a) Can you explain what an operational amplifier (op-amp) is, and could you derive the expression for voltage gain in an inverting amplifier? CLO5 U 5
3. b) Illustrate the output voltage waveform with proper mathematical expression for the circuit given below CLO5 An 5

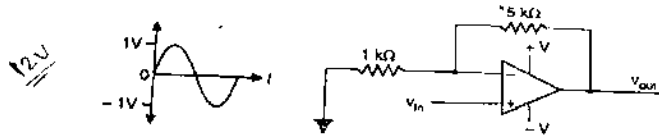


Fig. 3(b)

4. a) Can we use positive feedback to cancel noise? If not, which feedback is feasible for that purpose? Derive the negative voltage feedback gain ( $A_v$ ) of an operational amplifier. CLO5 An 5

OR,

- ✓ How does a Differentiator amplifier configuration works using an op-amp? Derive the formula for calculating the gain in this configuration.
4. b) When negative voltage feedback is applied to an amplifier of gain 100 the overall gain falls to 50. Calculate the fraction of the output voltage feedback. 0.5
- ii) If this fraction is maintained, calculate the value of the amplifier gain required if the overall stage gain is to be 75. 300

5. a) Write a short note on comparator circuit and characteristics of it with proper diagram. CLO5 U 5

OR,

How is the peak detector used to find peaks in a signal? Elaborate the methodology.

5. b) Analyze the output voltage in the context of Fig. 5(b), where an op-amp integrator is connected to a square wave input. CLO5 An 5

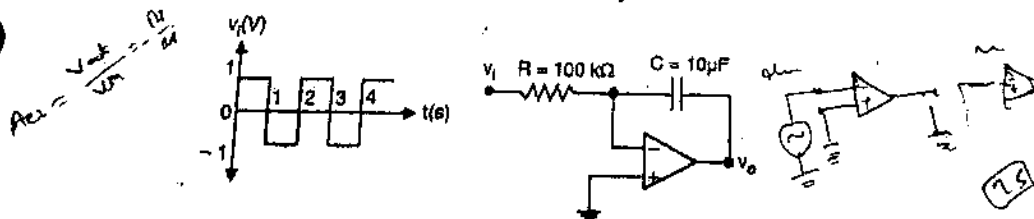


Fig: 5(b)

$$V_{out} = -\frac{1}{R} \int_0^t v_{in} dt$$

$$V_o = -\frac{1}{R} \int_0^t v_{in} dt$$



# International Islamic University Chittagong

Department of Computer Science and Engineering

B. Sc. in CSE

Final Exam, Spring-2023

Course Code: **EEE-1221**

Time: 2 hours 30 minutes

Course Title: **Electronics**

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. CO4 U 5  
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.

1. b) A JFET has a drain current of 5mA. If  $I_{DSS} = 10$  mA and  $V_{GS(off)} = -6$  V, CO4 An 5  
Find the value of i)  $V_{GS}$  and ii)  $V_P$

2. a) Describe the switching action of the transistor by showing the 'OFF' region, CO4 U 5  
'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.

2. b) Fig. 2(b) shows the transistor switching circuit. Given that  $R_B = 2.7$  k $\Omega$ , CO4 An 5  
 $V_{BB} = 2$  V,  $V_{BE} = 0.7$  V and  $V_{knee} = 0.7$  V.  
i) Calculate the minimum value of  $\beta$  for saturation.  
ii) If  $V_{BB}$  is changed to 1 V and transistor has minimum  $\beta = 50$ , will the transistor be saturated.

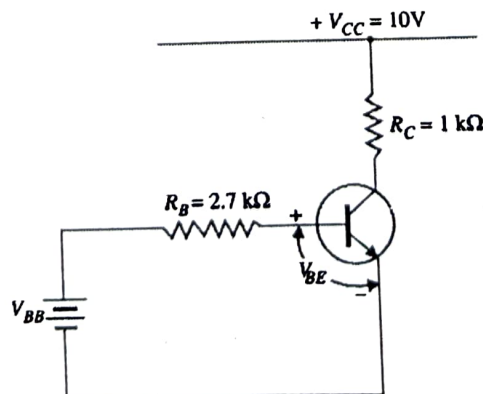


Fig. 2(b)

## 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 |

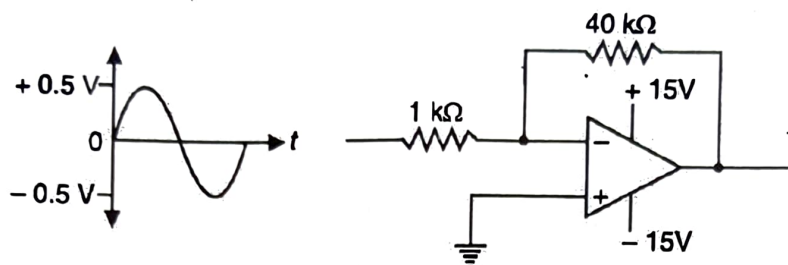


Fig. 3(c)

- |    |  |     |   |   |
|----|--|-----|---|---|
| 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.<br>(i) Calculate the fraction of the output voltage feedback.<br>(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 |

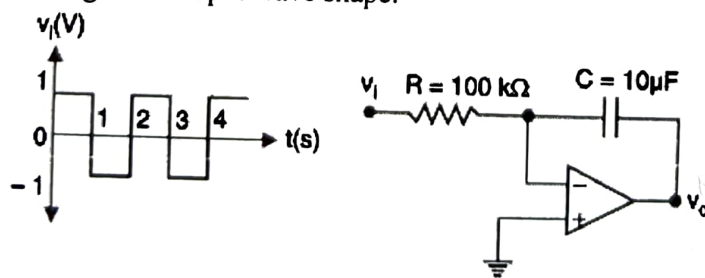


Fig. 5 (c)

**International Islamic University Chittagong**

Department of Computer Science and Engineering

B. Sc. in CSE

Final Exam, Autumn-2022

Course Code: **EEE-1221**

Course Title: **Electronics**

Time: 2 hours 30 minutes

Full Marks: 50

(i) The figures in the right-hand margin indicate full marks

(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

Course Outcomes (COs) of the Questions	
CO1	Describe the fundamentals of solid state electronics
CO2	Sketch the output wave-shape of different diode circuits
CO3	Differentiate the types of generated and filtered wave-shapes
CO4	Understand the basics of transistor and switching circuits
CO5	Analyze different operational amplifier circuits and their applications

Bloom's Levels of the Questions						
Letter Symbols	R	U	App	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

**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), When gate-source voltage ( $V_{GS}$ ) is applied and drain-source voltage is zero i.e.  $V_{DS} = 0V$ . CO4 U 5

OR,

With proper diagrams, describe the construction and working principle of an n-channel enhancement-type MOSFET.

- X. b) Sketch the transfer and drain characteristics of n-channel enhancement type MOSFET if  $V_T = 4V$  and  $k = 0.5 \times 10^3 A/V^2$ . CO4 A 5

2. a) Describe the switching action of the transistor by showing the 'OFF' region, 'ON' region, and 'Active' regions on its output characteristics. CO4 U 5

OR,

Suppose you have given two transistors with few other passive elements, design a Multivibrator having one stable state. Explain its operation when a square wave will generate as Output.

2. b) Determine the minimum high input voltage (+V) required to saturate the transistor switch shown in Fig.2 (b). CO4 A 5



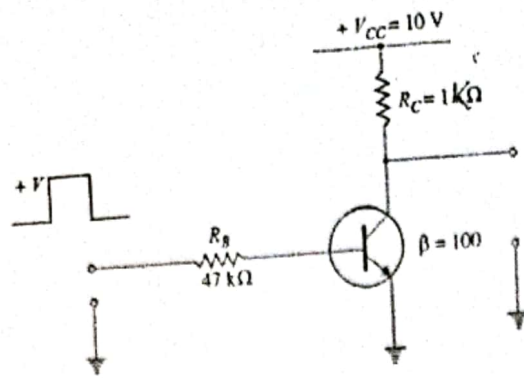
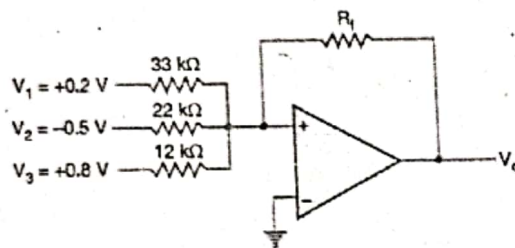


Fig. 2(b)

### 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) Show the voltage gain of an inverting op-amp is equal to  $-R_f/R_{in}$ . CO5 U 5  
CO5 A 2
3. c) If  $R_f = 68 \times 10^3 \Omega$ , calculate the value of the output voltage of the following circuit:



4. a) Describe the principle of a negative feedback amplifier and hence derive an expression for its gain. CO5 U 6

OR

Show that output is the differentiation of the input with an inversion and scale multiplier of  $RC$ .

4. b) Fig. 4(b) shows the square wave input to a differentiator circuit. Find the output voltage if input goes from 0V to 5V in 0.1 ms. CO5 A 4

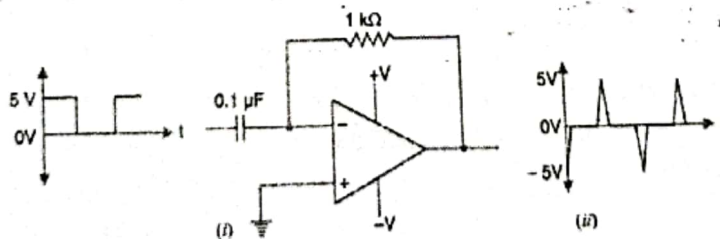


Fig.4(b)

5. a) What is an oscillator? With the help of a neat diagram, describe the circuit operation of a Hartley oscillator. CO5 U 5

OR

Show that for an op-amp with unity gain, the output voltage is the algebraic sum of the input voltages.

5. b) Write short on (i) Comparators and (ii) Precision rectifiers. CO5 U 5

# International Islamic University Chittagong

Department of Computer Science and Engineering

B.Sc. in CSE, Final Examination, Spring 2022

Course Code: **EEE-1221**

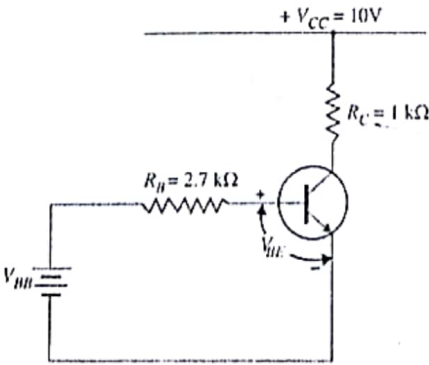
Course Title: **Electronics**

Time: **2 hours 30 minutes**

Full Marks: **50**

(i) The figures in the right-hand margin indicate full marks

(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

Part A					
[Answer all the questions from the followings]					
1.	a)	Write down the difference between JFET and BJT. Describe its construction and working principle of (N-Channel JFET).  i) When gate-source voltage ( $V_{GS}$ ) is applied and drain-source voltage is zero i.e. $V_{DS} = 0V$ .  ii) When drain-source voltage ( $V_{DS}$ ) is applied at constant gate-source voltage ( $V_{GS}$ )	CO4	U	7
		Or,			
		What is MOSFET? What are the different types of MOSFET? With a neat diagram, explain the working principle of an n-channel enhancement type MOSFET.			
1.	b)	A JFET has the following parameters: $I_{DSS} = 32 \text{ mA}$ ; $V_{GS(off)} = -8V$ ; $V_{GS} = -4.5 \text{ V}$ . Find out the value of drain current.	CO4	A	3
2.	a)	What is a multivibrator? Mention different types of multivibrators with proper waveshapes. With neat diagrams, explain the working of an astable multivibrator.  Or,  What is an oscillator? What are the essentials of an oscillator? With the help of a neat diagram, describe the circuit operation of a Hartley oscillator.	CO4	U	5
2.	b)	Fig. 2(b) shows the transistor switching circuit. Given that $R_B = 2.7 \text{ k}\Omega$ , $V_{BB} = 2V$ , $V_{BE} = 0.7V$ and $V_{knee} = 0.7V$ . i) Calculate the minimum value of $\beta$ for saturation. ii) If $V_{BB}$ is changed to $1V$ and transistor has minimum $\beta = 50$ , will the transistor be saturated.	CO4	A	5
					
Fig. 2(b)					

# Part B

[Answer the questions from the followings]

3. a) Show that when the gain of summing amplifier is unity, the output voltage is the algebraic sum of the input voltages with proper circuit diagram.  
Or,  
Show that the output is the integral of the input with an inversion and scale multiplier of  $1/RC$ .

CO5

A

6

3. b) Determine the output voltage from the circuit shown in Fig. 3(b) for each of the following input combinations:

CO5

A

4

$V_1(V)$	$V_2(V)$	$V_3(V)$
+10	0	+10
0	+10	+10
+10	+10	+10

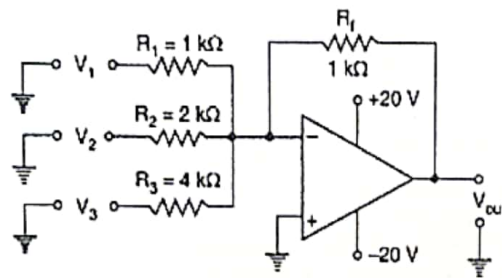


Fig. 3(b)

4. a) What is negative feedback? Show that the input impedance of an amplifier increases due to negative feed.

CO5

U

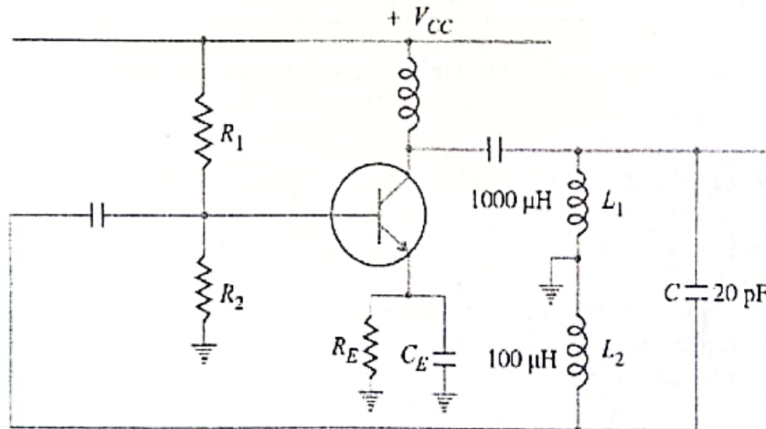
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4. b) Calculate the operating frequency and feedback fraction of the following oscillator where the mutual inductance between two coils is  $20\mu H$ .

CO5

A

4



5. a) What is negative feedback? Show that the input impedance of an amplifier increases due to negative feed.

CO5

U

5

5. b) Write short on :  
i) Precision Rectifiers  
ii) Comparators

CO5

U

5

Or,

What is an operational amplifier? Draw the circuit diagram of non-inverting OP-AMP with indicating different terminals. Also show the voltage gain of a non-inverting amplifier is

$$1 + \frac{R_f}{R_i}$$

5a) Why negative is used in amps, derive the principal and gain of negative feedback.