B.TECH/AEIE/3RD SEM/AEIE 2101(BACKLOG)/2021

ANALOG ELECTRONICS
(AEIE 2101)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) RC coupled amplifier having
(a) both upper and lower cut-off (b) no upper and lower cut-off
(c) only lower cut-off (d) only upper cut-off Frequency.

(ii) The 'slew rate' of an operational amplifier indicates
(a) how fast its output current can change
(b) how fast its output impedance can change
(c) how fast its output power can change
(d) how fast its output voltage can change when a step input signal is given.

(iii) BJT operates in the saturation region when
(a) both the junctions are forward biased
(b) both the junctions are reversed biased
(c) both the junctions are shorted
(d) both the junctions are opened.

(iv) When a step-input is given to an op-amp integrator, the output will be
(a) a ramp (b) a sinusoidal wave
(c) a rectangular wave (d) a triangular wave with dc bias

(v) In class C power amplifier, the conduction angel is
(a) Equal to zero (b) Equal to 1800
(c) Less than 1800 (d) greater than 1800.

(vi) The open-loop gain of an op-amp available in the market may be around
(a) 10^{-1} (b) 10^{-5} (c) 10^{5} (d) 10^{12}

(vii) With a capacitor connected across the output, the ripple in a half-wave rectifier is _____ the ripple in a full-wave rectifier.
(a) greater than (b) less than
(c) exactly half of (d) equal to

(viii) Wien bridge oscillator can typically generate frequencies in the range of
(a) 1KHz – 1MHz (b) 1 MHz – 10MHz
(c) 10MHz – 100MHz (d) 100MHz – 150MHz

(ix) A differential amplifier, amplifies
(a) and mathematically differentiates the average of the voltages on the two input lines
(b) and differentiates the input waveform on one line when the other line is grounded
(c) the difference of voltages between the two input lines
(d) and differentiates the sum of the two input waveforms.

(x) An Astable multivibrator having
(a) Two stable state (b) One stable state
(c) No stable state (d) None of the above.

Group- B

2. (a) Explain the operation of Zener Diode? [(CO1) (Understand /LOCQ)]
(b) Explain the operation of the given circuit (Figure 1) and draw the output voltage waveform. [(CO1) (Apply/IOCQ)]

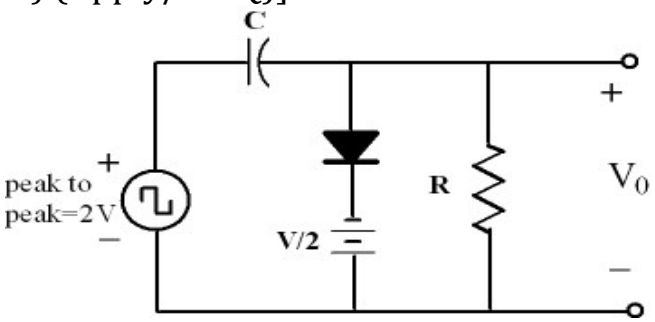


Fig.1

5 + 7 = 12

3. (a) Determine the range of R_L and I_L that will result the load voltage being constant at 10V for the given circuit (Figure 2).
[(CO1)(Apply/IOCQ)]

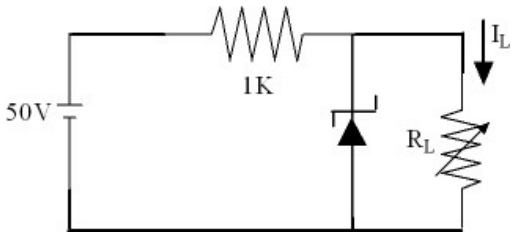


Fig.2

(b) Draw the transfer characteristic of the given circuit (Figure 3) where V_{in} is sinusoidal with peak to peak value is 8V. [(CO1) (Apply/IOCQ)]

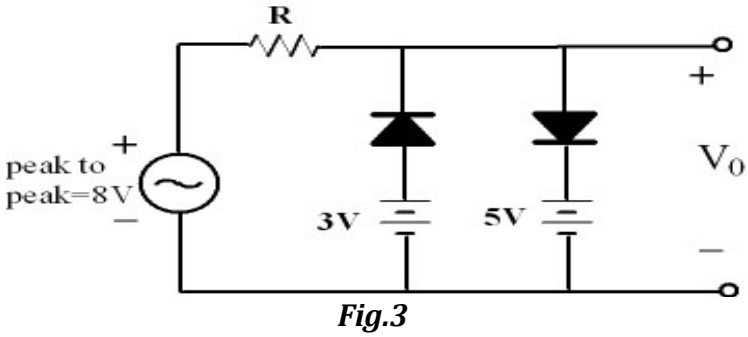


Fig.3

6 + 6 = 12

Group - C

4. (a) Why input current decreases with the increase of output voltage in CE configuration of a BJT? Discuss the causes for bias stability in a transistor. [(CO2)(Understand/LOCQ)]
   (b) Calculate input impedance (Zi) and overall voltage gain (Avs) of a common emitter transistor amplifier with emitter bypass capacitor and voltage divider biasing method. [(CO2) (Remember/LOCQ)]

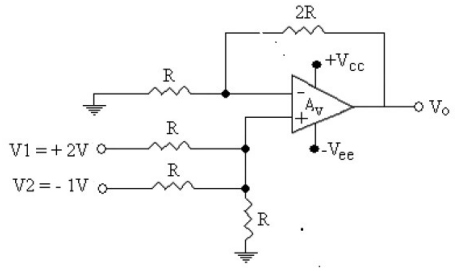
(3 + 3) + (3 + 3) = 12

5. (a) Distinguish between class A, class B, class AB and class C amplifier. [(CO2) (Understand/LOCQ)]
   (b) What is Barkhausen criterion? Discuss about the operation of Wien bridge oscillator with neat circuit diagram. [(CO4) (Remember /LOCQ)]

6 + (2 + 4) = 12

Group - D

6. (a) Describe a method for measuring and calculating CMRR of an op-amp. [(CO3)(Remember /LOCQ)]
   (b) Find out the output voltage of the given circuit. [(CO3)(Apply/IOCQ)]



6 + 6 = 12

7. Write a short note on any three of the following. **(3 × 4) = 12**
   (i) constant current source (ii) Differentiator
   (iii) Comparator (iv) Divider. [(CO3) (Remember/LOCQ)]

Group - E

8. (a) What do you mean by precision rectifier? Explain full wave precision rectifier. [(CO3) (Understand /LOCQ)]
   (b) Explain the following Op-amp circuits with a neat circuit diagram.
   (i) Instrumentation amplifier (ii) Voltage to current converter.
   [(CO3) (Understand/LOCQ)]

6 + (3 + 3) = 12

9. (a) Draw a circuit diagram to use IC555 timer as an Astable multi-vibrator and describe its operation. [(CO5) (Understand/LOCQ)]
   (b) Write a short note on zero crossing detector. [(CO3) (Understand/LOCQ)]

(3 + 5) + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	73.95%	26.04%	

Course Outcome (CO):

After the completion of the course students will be able to

1. Apply the knowledge of semiconductor fundamentals to analyze simple electronic circuits based on diodes and transistors with special focus on designing different biasing methods of BJT.
2. Design and analyze BJT amplifiers for small and large signal.
3. Learn basic function of operational amplifier, ideal and practical characteristics and their mathematical applications.
4. Design and compare between different types of Oscillators to meet the specified needs with appropriate consideration.
5. Design, analyze and understand the application of different types of multivibrators with and without IC 555.
6. Analyze and design analog electronic circuits using discrete components with specified needs for the betterment of human living.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

Department & Section	Submission Link
AEIE	https://classroom.google.com/c/NDA1MjIyNTMwNjY3/a/NDY4MTY3OTAxODcx/details