7. Write a short note on any three of the following: **(3 × 4) = 12**
   (i) Constant current source (ii) Differentiator (iii) Comparator (iv) Divider.

Group – E

8. (a) What do you mean by precision rectifier? Explain full wave precision rectifier circuit.

   (b) Explain the following Op-amp circuits with a neat circuit diagram.
   (i) Peak detector (ii) Instrumentation amplifier (iii) Voltage to current converter.

   2 + 4 + 6 = 12

9. (a) Give a neat circuit diagram for IC 555 timer connected as an astable multi-vibrator and describe its operation.

   (b) Write a short note on zero crossing detector.

   8 + 4 = 12

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) Space charge region around a p-n junction
   (a) does not contain mobile carriers
   (b) contains both free electrons and holes
   (c) contains one type of mobile carriers depending on the level of doping of the p or n regions
   (d) contains electrons only as free carriers

   (ii) The 'slew rate' of an operational amplifier indicates _____ when a step input signal is given.
   (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

   (iii) The pick inverse voltage across the diodes in a full-wave rectifier made with two diodes and a centre-tapped transformer is _____ that in a bridge rectifier.
   (a) equal   (b) double   (c) half   (d) not related to

   (iv) 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

   (v) 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.

(vi) In the common-emitter configuration, if the transistor is in the active region, then
(a) $I_C = \beta I_E$ (b) $I_C = \alpha I_B$ (c) $I_B = \beta I_C$ (d) $I_C = \beta I_B$

(vii) Adding an emitter resistor to a common-emitter amplifier causes
(a) the voltage gain to increase and the input resistance to decrease
(b) the voltage gain to decrease and the input resistance to increase
(c) the current gain to increase and the output resistance to decrease
(d) the current gain to decrease and the output resistance to increase.

(viii) Compensation techniques, for maintaining a stable dc operating point in a transistor circuit, use
(a) resistors in biasing circuit that provide negative feedback
(b) coupling capacitors to provide stability
(c) temperature sensitive device to offset the temperature variations in transistor parameters
(d) feed forward compensation to cause pole-zero cancellation.

(ix) In a differential amplifier, if the emitter resistor is replaced by an ideal current source, then the CMRR becomes infinite because
(a) an ideal current source provides a very high slew rate
(b) the differential mode gain becomes zero
(c) the ideal current source offers an infinite source resistance which makes the common mode gain zero
(d) the differential mode gain becomes infinite.

(x) Hysteresis is desirable in Schmitt-trigger, because
(a) energy is to be stored/discharged in parasitic capacitances
(b) effects of temperature would be compensated
(c) devices in the circuit should be allowed time for saturation and desaturation
(d) it would prevent noise from causing false triggering.

Group – B

2. (a) A centre tapped full wave rectifier is to deliver 0.1 A and 15 V (avg.) to the load. The input signal is 120 V (rms) at 60 Hz and the ripple voltage is 0.4 V (peak to peak). Determine the required turns ratio of the transformer and PIV of the diode. (consider diode drop is 0.7 V and ignore the forward resistance of the diode)

(b) Explain the circuit shown in Fig.1 and draw the output voltage waveform.

Fig.1
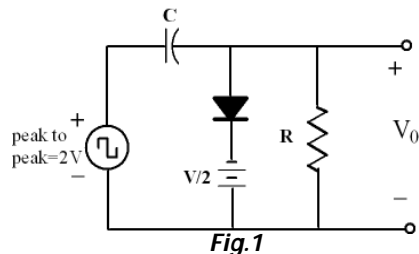
7 + 5 = 12

3. (a) Determine the range of R_L and I_L that will result the load voltage being constant at 10 V for the circuit shown in Fig.2.

Fig.2

(b) Draw the transfer characteristic of the circuit shown in Fig.3 where, V_{in} is sinusoidal with peak to peak value is 8 V.
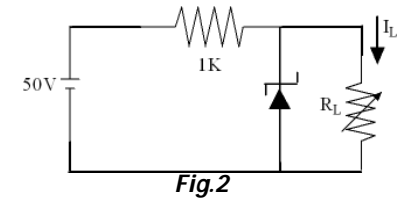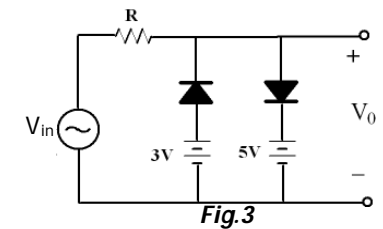

Fig.3

8 + 4 = 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.

(b) Calculate input impedance (Z_i) and overall voltage gain (A_{vs}) of a common emitter transistor amplifier with emitter bypass capacitor and voltage divider biasing method.

(3 + 3) + 6 = 12

5. (a) Distinguish between class A, class B, class AB and class C amplifier.

(b) What is Berkhausen criterion? Discuss about the operation of Wein bridge oscillator with neat circuit diagram.

4 + (2 + 6) = 12

Group – D

6. (a) Describe a method of measuring and calculating CMRR of an op-amp.

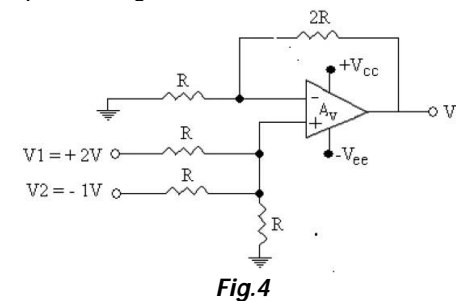(b) Find out the output voltage of the circuit shown in Fig.4.

Fig.4

7 + 5 = 12