Group – D

6. (a) Write a note on the use of an op-amp as a practical Integrator.

(b) Design and explain the operation of a full wave precision rectifier. What is the necessity of a precision rectifier?

5 +(5 + 2) =12

7. (a) Show how an amplifier with exponential output can be designed using an op-amp. What happens if the diode and resistor of your designed circuit are interchanged?

(b) What is the Schmitt trigger? Draw schematically a Schmitt trigger with op-amp and explain its operation. Name an application of the Schmitt trigger.

(3 +2) + (1 + 4 + 2) =12

Group – E

8. (a) Design and explain the operation of Wien-bridge oscillator. What criterion has to be made for sustained oscillation?

(b) Write a short note on Instrumentation amplifier.

7 + 5 =12

9. (a) Design a circuit diagram using IC555 timer operating as an astable multi-vibrator where duty ratio is greater than 50% and describe its operation.

(b) Write a short note on open loop voltage comparator.

8 + 4 = 12

ANALOG ELECTRONIC CIRCUITS
(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) Placing a bypass capacitor, in common-emitter configuration, is necessary to
(a) prevent the fall of mid-band voltage gain
(b) achieve a stable Q point
(c) prevent thermal runway
(d) none of the above.

(ii) An op-amp has
(a) equal input and output resistances
(b) small input and large output resistances
(c) large input and small output resistances
(d) None of above.

(iii) Frequency response of an op- amp consists
(a) both lower and upper cut-off frequency
(b) only upper cut-off frequency
(c) only lower cut-off frequency
(d) none of the above.

(iv) In a two stage cascade amplifier, if the gain of each stage is 10dB and 20 dB then
(a) overall gain is 200 dB   (b) overall gain is 50 dB
(c) overall gain is 30 dB   (d) None of (a), (b) and (c).

(v)   The slew rate of an amplifier is
(a) the highest frequency at which the output can change without distortion
(b) the highest possible rate of change of the output voltage with respect to time
(c) the slowest rate of change of the input voltage
(d) the rate of change of the bias current of the differential amplifier.

(vi)   The gain of the amplifier in a wien-bridge oscillator is greater than _____.
(a) 1   (b) 2   (c) 3   (d) 0.

(vii)   A Schmitt trigger uses
(a) positive feedback   (b) negative feedback
(c) compensating capacitors   (d) pull up resistors.

(viii)   In a CE amplifier, the phase difference between i/p and o/p signal is
(a) 90⁰   (b)45⁰   (c) 0⁰   (d) 180⁰.

(ix)   An ideal op-amp is an ideal
(a) voltage controlled current source
(b) voltage controlled voltage source
(c) current controlled current source
(d) current controlled voltage source.

(x)   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

Group – B

2. (a)   Using the approximate h- parameter model, obtain the expression for a CE amplifier circuit for (i) A_i; (ii) R_i.

(b)   In the small signal amplifier of Fig. 1, $h_{fe}=80$, $h_{ie}=500\Omega$, h_{re} & h_{oe} are negligible.
(i) Design the h- parameter equivalent circuit for the amplifier.
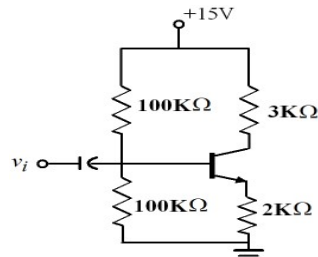(ii) Calculate the input and Output impedances, and the Voltage gain of the amplifier.

Fig. 1

6 + 6 = 12

3. (a)   Determine the output voltage of the differential amplifier shown in fig. 2.

(b)   Find the range of input voltage for which the op- amp with AOL=105, shown in fig. 3, will operate in the linear region. Draw the output characteristics of the amplifier.
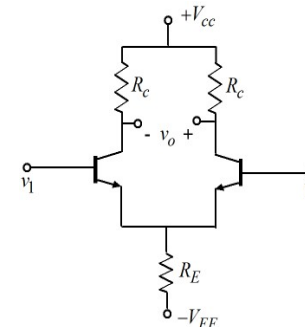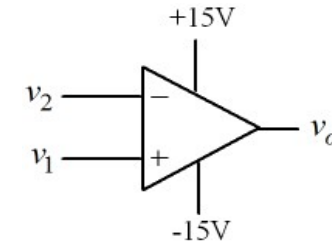

Fig. 2   **Fig. 3**

7 + (3 + 2) =12

Group – C

4. (a)   An op-amp inverting amplifier has an input resistor of 10KΩ and a feedback resistor of 50KΩ. If the input voltage is 0.5V, find the output voltage and input current.

(b)   How do the characteristics of a practical op-amp amplifier differ from those of an ideal op-amp?

(c)   Describe the use of an op-amp as an adder.

4+ 4 + 4=12

5. (a)   Determine the output voltage of the circuit, shown In fig. 4, when
(i) $V_{in}=V_m S_{in} \omega t$ (ii) $V_{in}= 0.5V$

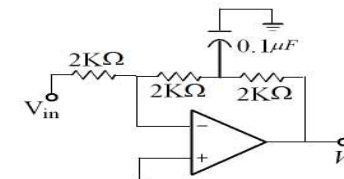**Fig. 4**

(b)   Define any two of the following terms in connection with an Operational amplifier:
(i)   Input offset voltage
(ii) Slew rate
(iii) Common- mode rejection ratio

8 + 4 = 12