

- (vii) Astable multivibrator has
  - (a) one stable state
  - (b) two stable states
  - (c) two quasi stable states
  - (d) one quasi stable state.
- (viii) Generally the gain of the transistor amplifier falls at high frequencies due to the
  - (a) coupling capacitor at the input
  - (b) internal capacitor of the device
  - (c) coupling capacitor at the output
  - (d) skin effect.
- (ix) The 555 timer IC consists of
  - (a) SR flip-flop
  - (b) JK flip-flop
  - (c) D flip-flop
  - (d) T flip-flop.
- (x) The voltage follower has a
  - (a) closed-loop voltage gain of unity
  - (b) small open-loop voltage gain
  - (c) closed-loop bandwidth of zero
  - (d) large closed-loop output impedance.

**Group - B**

- 2. (a) What is a load line? Explain the concept of Q-point.
- (b) For CE configuration prove that  $I_C = \beta I_B + (1+\beta)I_{CO}$ , where the symbols have their usual meaning.
- (c) In a collector to base bias circuit indicated in Fig.2, a transistor with  $\beta = 50$  is used. Supply voltage  $V_{CC} = 10V$ ,  $V_{BE} = 0.7V$ , collector resistor  $R_C = 2k\Omega$ . The bias is obtained by connecting  $100k\Omega$  resistor  $R_B$  from collector to base. Find the Q-point and stability factor.

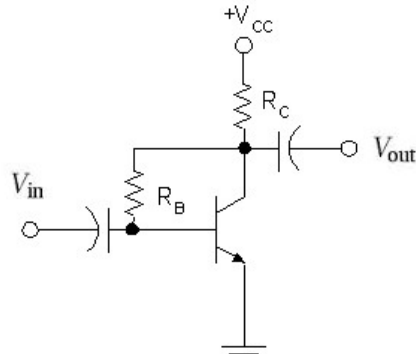


Fig.2

4 + 3 + 5 = 12

- 3. (a) Draw the hybrid parameter model of a bipolar junction transistor. Define the four hybrid parameters.
- (b) Assuming a BJT in CE mode, find the voltage gain, current gain, input impedance, output impedance using h-parameter model.

5 + 7 = 12

**Group - C**

- 4. (a) Derive the equation  $A_f = \frac{A}{1+A\beta}$  where the symbols have their usual meaning.
- (b) List the advantages of negative feedback.
- (c) Explain how the input and output impedance of a feedback amplifier can be modified by the application of negative feedback.

4 + 3 + 5 = 12

- 5. How are oscillators classified? Sketch the circuit diagram of a Colpitts oscillator. Calculate the frequency of the oscillation and the condition for sustained oscillation.

(2 + 10) = 12

**Group - D**

- 6. (a) Modify the simple logarithmic amplifier using op-amp to reduce the effect of temperature.
- (b) What is a comparator?
- (c) The circuit shown in Fig.3,  $R_1 = 100\Omega$ ,  $R_2 = 56k\Omega$ ,  $V_i = 1V$  pp sine wave, and the op-amp is type 741C with supply voltages =  $\pm 15V$ . Determine the upper and lower threshold voltages and draw the output waveform.

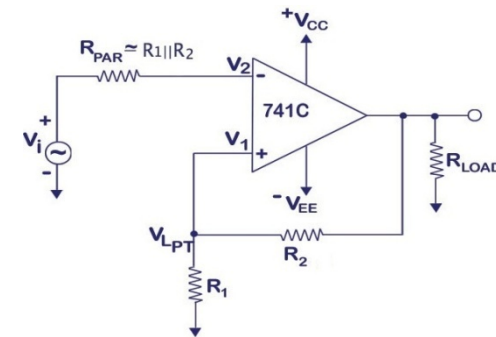


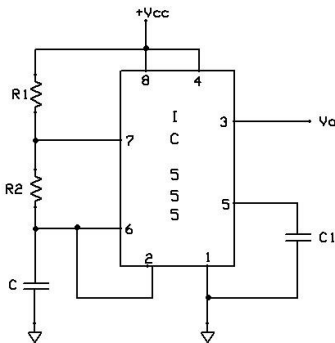
Fig.3

5 + 2 + 5 = 12

7. (a) Explain the basic operation of an instrumentation amplifier.
  - (b) With the help of circuit diagram, explain a full-wave precision rectifier circuit.
  - (c) Design a logarithmic amplifier by using basic op-amps.
- 3 + 4 + 5 = 12**

**Group - E**

8. (a) Explain the operation of a class-B amplifier and hence prove that the maximum efficiency in class-B configuration can't exceed 78.5%.
  - (b) What are the advantages of push-pull amplifier?
- 7 + 5 = 12**
9. (a) Draw the circuit diagram and explain the operation of a monostable multivibrator using a 555 timer IC. Derive the expression for output pulse width.
  - (b) In the astable multivibrator of the circuit shown in Fig.4,  $R_1 = 2.2k\Omega$ ,  $R_2 = 3.9k\Omega$ , and  $C = 0.1\mu F$ . Determine the positive pulse width  $T_1$ , negative pulse width  $T_2$ , free-running frequency  $f_0$ , and percentage of duty cycle.



**Fig. 4**

**6 + 6 = 12**

**ANALOG ELECTRONICS CIRCUITS  
(ECEN 2101)**

**Time Allotted : 3 hrs**

**Full Marks : 70**

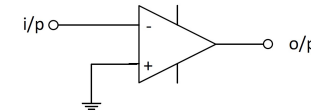
*Figures out of the right margin indicate full marks.*

*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) Maximum efficiency of transformer coupled class-A power amplifier is  
(a) 78.5%      (b) 50%      (c) 25%      (d) 100%.
  - (ii) If the input to the circuit of the following Fig.1 is a sine wave, the output will be



**Fig.1**

- (a) a half-wave rectified sine wave
  - (b) a full-wave rectified sine wave
  - (c) a triangular wave
  - (d) a square wave.
- (iii) In a bipolar transistor which current is the smallest?
 

(a) Collector current	(b) Base current
(c) Emitter current	(d) Any of the above.
  - (iv) In which mode of BJT operation are both the junctions reversed biased?
 

(a) Active	(b) Saturation
(c) Cut-off	(d) Reversed active.
  - (v) A Wein-bridge oscillator has a frequency expressed by
 

(a) $\frac{1}{2\pi\sqrt{RC}}$	(b) $\frac{1}{\sqrt{RC}}$	(c) $\frac{1}{2\pi RC}$	(d) none of these.
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  - (vi) Which of the following has the highest mobility?
 

(a) Positive ions	(b) Negative ions
(c) Electrons	(d) Holes.