

Duration: 3 hours

Max marks: 100

N.B.:

1. Q 1 is compulsory
2. Answer any four out of remaining six questions
3. Assumptions made should be clearly stated
4. Assume any suitable data wherever required but justify the same

- Q.1 Answer the following (20)
- (i) Explain the operation Colpitts oscillator with the help of suitable diagram. State the condition for sustained oscillations and the frequency of oscillations.
 - (ii) Explain the effect of cascading two stages of amplifier on the performance of overall amplifier in the context of bandwidth, voltage gain.
 - (iii) In op-amp circuits, input impedance of non-inverting amplifier is much higher than that of inverting amplifier. Justify the statement.
 - (iv) Show that the maximum efficiency of a Class A transformer coupled amplifier is 50%.
- Q.2 (a) What are the different types of coupling used in BJT amplifiers? Draw the frequency response of BJT amplifiers and explain why the gain is dropping at low and high frequencies. (10)
- (b) Draw the neat diagram of an UJT relaxation oscillator. Explain its operation. Derive the expression for frequency of output signal. Draw various waveforms. (10)
- Q.3 (a) Design a two stage CE amplifier using BC147B transistors, with following specifications: (16)
- | | | | |
|------------------------------|-----------|----------------------------------|------------|
| Voltage gain (A_v) | = 12000 | Supply Voltage (V_{cc}) | = 15 volts |
| Overall stability factor (S) | ≤ 10 | Lower cutoff freq. (f_{low}) | = 50Hz |
- Assume the resistive load (R_L) is 5 kohms. The specifications of BC147B are as given below:
- | | | | |
|-----------------------------|--------------------------------|-----------------------------|----------------------------|
| $h_{FE \text{ typ}} = 290$ | $h_{fe \text{ typ}} = 330$ | $h_{fe \text{ min}} = 240$ | $h_{fe(\text{max})} = 500$ |
| $h_{ie} = 4.5 \text{ kohm}$ | $h_{oe} = 30 \text{ micromho}$ | $h_{re} = 2 \times 10^{-4}$ | |
- (b) If the CE amplifier designed in part (a) of this question need to feed the output to another identical stage, the what will be the impact on the performance of the first stage amplifier specifically on A_v , output voltage V_o . (04)
- Q.4 (a) Draw the circuit diagram of a Single Input Balanced Output differential amplifier and derive the relevant AC parameters for it. (10)
- (b) Describe the following application of op-amp in short. (Any Two) (10)
- (i) Sample and hold circuit
 - (ii) Adder
 - (iii) Schmitt trigger
- Q.5 (a) With the help of a neat circuit diagram, explain the working of a gyrator circuit. (08)
- (b) What are active filters? Explain the classifications of active filters with their frequency response curve. (12)
- Q.6 (a) Compare the performance of a class A, class B, and class AB power amplifier. (06)
- (b) Write short notes on following w.r.t power amplifiers. (14)
- (i) Crossover distortion
 - (ii) Thermal design
 - (iii) Need for transformer Coupling
- Q.7 (a) Compare the RC oscillators with LC oscillators. Describe in short a Hartley oscillator with the help of suitable schematic. (10)
- (b) What is a Darlington pair? What are its features? Derive the expression for voltage and current gain of the Darlington pair emitter follower circuit? (10)