

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) Direct coupled amplifier has
 - (a) both upper and lower cut-off frequencies
 - (b) no upper and lower cut-off frequencies
 - (c) only lower cut-off frequencies
 - (d) only upper cut-off frequency.
- (ii) In CE configuration the output V- I characteristics are drawn by taking
 - (a) V_{CE} vs. I_C for constant value of I_E
 - (b) V_{CE} vs. I_C for constant value of I_B
 - (c) V_{CE} vs. I_C for constant value of V_{CB}
 - (d) none of these.
- (iii) The voltage divider biasing circuit is used in amplifiers quite often because it
 - (a) limits the AC signal going to base
 - (b) reduces the cost of the circuit
 - (c) reduces the DC base current
 - (d) makes the operating point almost independent of β .
- (iv) Frequency response of an op-amp consists of
 - (a) both lower and upper cut-off frequencies
 - (b) upper cut-off frequency
 - (c) lower cut-off frequency
 - (d) none of the above.
- (v) In CE configuration the phase difference between input and output voltage is
 - (a) 0°
 - (b) 90°
 - (c) 180°
 - (d) none of these.

- (vi) In a two-stage cascade amplifier, if the gain of each stage is 20dB and 30 dB then the overall gain is
 - (a) 600 dB
 - (b) 50 dB
 - (c) 500 dB
 - (d) 60 dB.
- (vii) For an op-amp with $A_{OL} = 10^5$, $+V_{CC} = +10V$ and $-V_{EE} = -10V$, the range of input voltage for linear operation of the op-amp is
 - (a) 100 mV
 - (b) $100 \mu V$
 - (c) 10 mV
 - (d) $10 \mu V$.
- (viii) Maximum efficiency that can be achieved under Class A category amplifier is
 - (a) 25%
 - (b) 78.5%
 - (c) 50%
 - (d) 30%.
- (ix) A Schmitt trigger uses
 - (a) positive feedback
 - (b) negative feedback
 - (c) compensating capacitors
 - (d) pull up resistors.
- (x) In a CC amplifier, the phase difference between input and output signal is
 - (a) 90°
 - (b) 45°
 - (c) 0°
 - (d) 180° .

Group - B

2. (a) Design a circuit using diode to shift an input voltage waveform by a fixed DC value of $-V_r$. Explain the operation of the circuit.
- (b) Compare between full wave bridge and centre tapped transformer type rectifier.

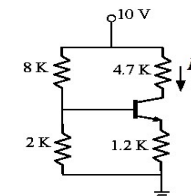
(5 + 4) + 3 = 12

3. (a) What is load regulation? What is required for an ideal power supply?
- (b) Determine the dynamic resistance of the diode at $27^\circ C$. Consider the standard values for all the necessary parameters.
- (c) What is avalanche breakdown?

(2 + 2) + 4 + 4 = 12

Group - C

4. (a) In the given figure, find the percentage change in I_C if β changes from 100 to 350.



- (b) Sketch the circuit of a phase-shift oscillator and explain its operation. Find an expression for the frequency of oscillations and the condition for sustained oscillation.

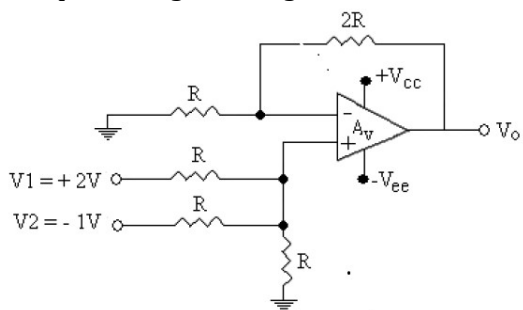
7 + 5 = 12

5. (a) What are the reasons to change the operating point of a transistor? How to stabilize the operating point of a transistor in the amplifier circuit?
- (b) Explain the operation of differential amplifier using BJT. Determine the output voltage for dual input and balanced output condition.

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

Group - D

6. (a) Design and explain the operation of a full wave precision rectifier.
- (b) Find out the output voltage of the given circuit



7 + 5 = 12

7. (a) Design and explain an astable multivibrator circuit having duty cycle ratio of less than 50%.
- (b) Design an amplifier circuit of which output voltage is a logarithmic function of the input voltage.

8 + 4 = 12

Group - E

8. (a) Design and explain the operation of Wien-bridge oscillator. What criterion has to be met for sustained oscillation?
- (b) Write a short note on Instrumentation amplifier.

7 + 5 = 12

9. (a) Explain using neat circuit diagram and waveforms, the application of timer IC555 as an astable multivibrator.
- (b) Write a short note on exponential amplifier.

8 + 4 = 12