B.Tech Even Semester Examination, May, 2025

Electronics & Communication Engineering

(4th Semester)

Course No: ECE-403

(Analog Electronic Circuit)

Full Marks: 70

Pass Marks: 28

Time: 3 hours

Note:

1. Attempt any five questions taking one from each unit.
2. Begin each answer in a new page
3. Answer parts of a question at a place
4. Assume reasonable data wherever required
5. The figure in the right margin indicates full marks for the question
6. All the mathematical symbols and abbreviations have their usual meanings.

UNIT-I

1. (a) State the bias conditions for the operation of the BJT in the cutoff, saturation, and linear regions.

(b) Draw the circuit diagram of emitter bias configuration of a BJT and explain.

(c) Derive the expression for base current for the emitter bias configuration.

(d) Determine the following for the fixed-bias configuration. I_B, I_C, V_{CE}, V_B, V_C, V_{BC}.

Given: V_{CC} = 12 V, V_{BE} = 0.7 V, R_B = 220 kΩ, R_C = 2.2 kΩ, β = 60. 3+4+3+4=14

2. (a) Draw the circuit diagram of voltage divider bias configuration of a BJT and explain.

(b) Derive the expression for base current for the voltage divider bias configuration.

(c) Derive the expression for $S(I_{CO})$ for collector feedback bias circuit.

(d) Calculate $S(I_{CO})$ for $\beta = 100$, $R_C = 2$ kΩ, and $R_F = 10$ kΩ. 4+4+4+2=14

UNIT-II

3. (a) Draw the block diagram of a voltage series feedback amplifier and derive the expressions for voltage gain, input impedance and output impedance.

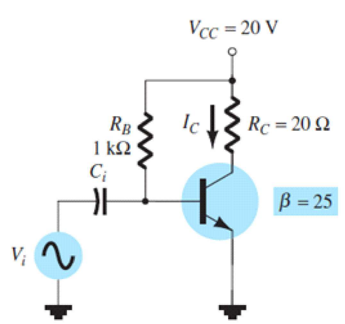
(b) Draw the circuit diagram of a cascade amplifier and explain its working principle.

(c) Draw the hybrid pi model of a BJT and explain the model parameters. 6+4+4=14

4. (a) Draw the circuit diagram of a class A power amplifier and explain its working principle.

(b) Show that maximum power efficiency of a class A power amplifier is 25%.

(c) Calculate the input power, output power, and efficiency of the amplifiercircuit in following Figure for an input voltage that results in a base current of 10 mA peak. 6+4+4=14



(c) Find out the Full Scale Output (FSO) voltage for 3-bit weighted resistor DAC with $V_{ref} = -5V$ and $R_f = R$. 6+4+4=14

10. (a) Draw the circuit diagram of the dual slope A/D converter and explain its working principle.

(b) Derive the expression for total conversion of the dual slope ADC.

(c) An 8-bit DAC has a step size of 5 mV. Calculate the full-scale output voltage and percentage resolution. 6+4+4=14

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UNIT-III

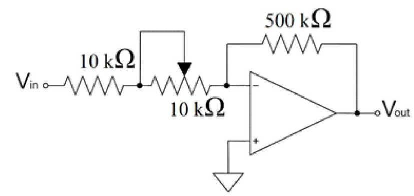
5. (a) Write the characteristics of an ideal OPAMP.

(b) An OPAMP has differential mode gain of 100 and common mode gain of 0.01. Calculate its CMRR in dB.

(c) Draw the circuit diagram of an inverting amplifier and derive the expression for gain of the amplifier.

(d) What is the range of the voltage gain adjustment in the following circuit?

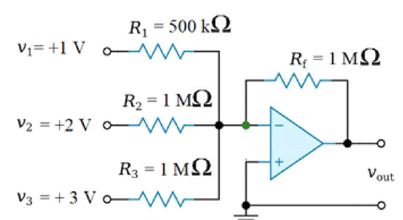
2+2+6+4=14



6. (a) Draw the circuit diagram of a summing amplifier using OPAMP and explain its working principle.

(b) Derive the expression for the output voltage of a 3-input summing amplifier.

(c) Calculate the output voltage of the following summing amplifier.



(d) Draw the circuit diagram of an integrator circuit using OPAMP and derive the expression of the output voltage.

3+4+3+4=14

UNIT-IV

7. (a) What is an oscillator?

(b) Derive the condition for sustained oscillation.

(c) Draw the circuit diagram of phase shift oscillator and explain its working principle.

(d) Explain the operation of Colpitts oscillator with circuit diagram.

(e) Determine (i) operating frequency (ii) feedback fraction, and (iii) minimum gain to sustain oscillations of a Colpitts oscillator.

Given: L = 100 μH, C1 = 0.001 μF and C2 = 0.01 μF.

1+2+4+4+3=14

8. (a) Discuss the different types of multivibrators.

(b) Draw the circuit diagram of monostable multivibrator and explain its working principle.

(c) Derive the expression for time duration for which the circuit will remain in unstable state.

(d) Design an astablemultivibrator using 555 IC to generate a square wave of 10 kHz with 60% duty cycle. Use a capacitor of 500 pF.

2+6+4+2=14

UNIT-V

9. (a) Draw the circuit diagram of a weighted resistor D/A converter and explain its working principle.

(b) Derive the expression for analog output voltage.