30

EE-101: Basic Electronics
Midsemester Examination

Set Code: **EE-101/2019/RC/MS** Max. Time: **120 min** Max. Marks: **30**

Tutorial Group: T- 18 **Roll no.:** 190123046 **Name:** Pradnesh P. Kalkar

Invigilator's Signature: Pinal.

Instructions

- Write the answers neatly with **appropriate SI units in the spaces provided**
- All answers should be rounded up to the **third decimal point.**
- **Exchange** of Calculators or any other material is not allowed.
- **Mobile phones** are not allowed inside the examination hall.

1. Consider the circuit shown in Fig. 1 with an NPN silicon transistor. For this, find (a) the Bias Point (Q-Point) in terms of V_{CE}, I_C and I_B and (b) The value of r_e to be used in the small-signal model. (Assume V_T=26 mV). **[1+1+1+2]**

Solution: (a)(i) V_{CE} = ~~2.12V~~ 1·74 V **(ii)** I_C = 1·436 mA **(iii)** I_B = 0·072 mA

(b) r_e = 17·241 Ω

2. Consider the transistor amplifier shown in Fig. 2 with an NPN transistor which has **β=99** and $r_e = 0.02\ K\Omega$. Neglect r_o . For this, find (a) Voltage Gain A_V , (b) Input Impedance R_i and (c) Output Impedance R_O. **[2+2+1]**

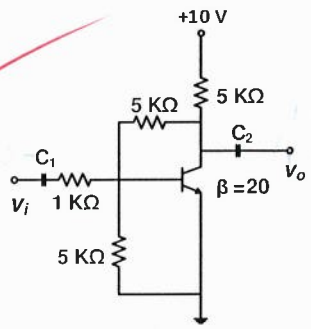

Fig. 1

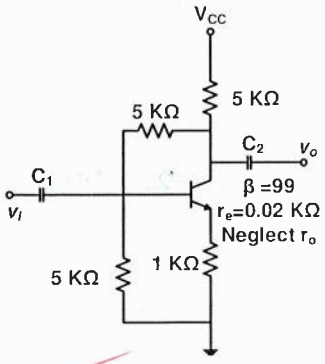

Fig. 2

Solution: (a) A_V = −1·926 **(b)** R_i = 1·258 kΩ **(c)** R_o = 2·5 kΩ

3. For the circuit shown in Fig. 3, using ideal opamps, calculate **(a)** $A_{VL} = \frac{V_L}{V_i}$ and **(b)** $A_{VO} = \frac{V_O}{V_i}$. **[2.5+2.5]**

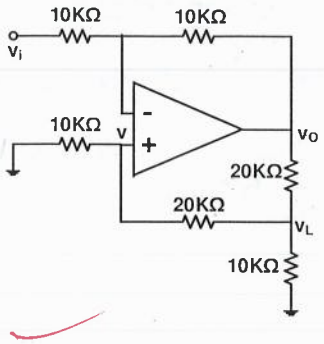

Fig. 3

Solution: (a) A_{VL} = −0.333 **(b)** A_{VO} = −1.222

4. Consider the circuit shown in Fig. 4, where R1 = 3 Ω, R2 = 4 Ω and Vs = 5 V. Find
(i) the current **I** when **only the independent current source is set to ZERO,**
(ii) the current **I** when **only the independent voltage source is set to ZERO,**
(iii) the voltage **Vx** when both the independent sources are present in the circuit. **[1+2+2]**

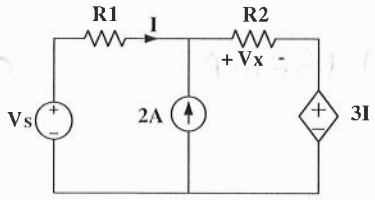

Fig. 4

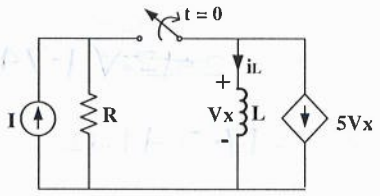

Fig. 5

Solution: (i) I = 0.500 A **(ii) I =** −0.800 A **(iii)** V_x = ~~6.8V~~ 6.800 V

5. For the circuit shown in Fig. 5, I = 2.5 A, R = 3.5 Ω, L = 1 H, The switch was closed for a long time before opening at t = 0. Find (i) $i_L(0^+)$ (ii) $i_L(t)$ for t >0 and (iii) Vx(t) for t >0. **[1+2+2]**

Solution: (i) $i_L(0^+)$ = 2.500 A **(ii)** $i_L(t)$ = $2.5e^{-0.2t}$ A **(iii)** $V_x(t)$ = $-0.5e^{-0.2t}$ V

6. An electrical appliance is drawing a real power of 1050 kW at 0.8 lagging power factor (p.f.) from an ac source. When an additional load is added in parallel to the appliance, the source p.f. improves to 0.96 lagging. The real power consumed by the additional load is 450 kW. Find (a) the reactive power of the additional load, (b) the p.f. of the additional load, and (c) total rms current drawn from the source, after connecting the additional load, if the source voltage is 15625 V (rms). **[2+2+1]**

Solution: (a) −350 kVAR **(b)** 0.789 leading **(c)** 100 A