2013-14
(Reg.)

(3 Hours) [**Total Marks : 80**

N. B. : (1) Question No. **1** is **compulsory**.
   (2) Attempt any **three** questions from **remaining** questions.
   (3) **Assume** suitable **data** if **necessary**.

1. (a) Define relative, absolute and robust stability of the system.   20
   (b) What is gain and phase margin ? Explain how to find gain and phase margin by using polar plot.
   (c) Differentiate open loop and closed loop systems.
   (d) What is damping ratio ? Show the location of roots in s-plane for different values of damping ratio.

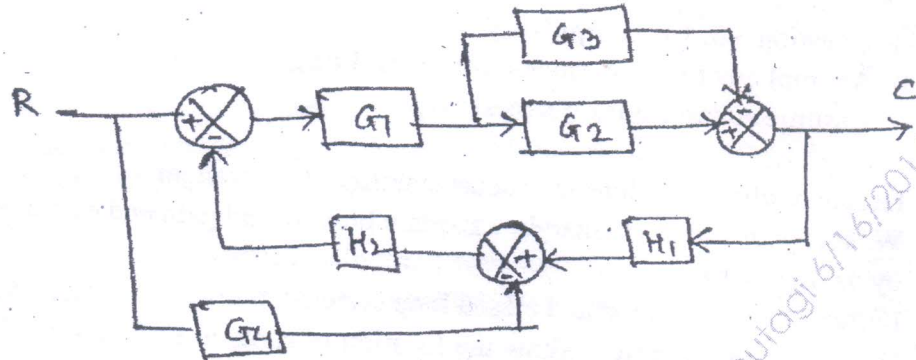2. (a) Derive the transfer function of electromechanical system shown in **figure** :-   10
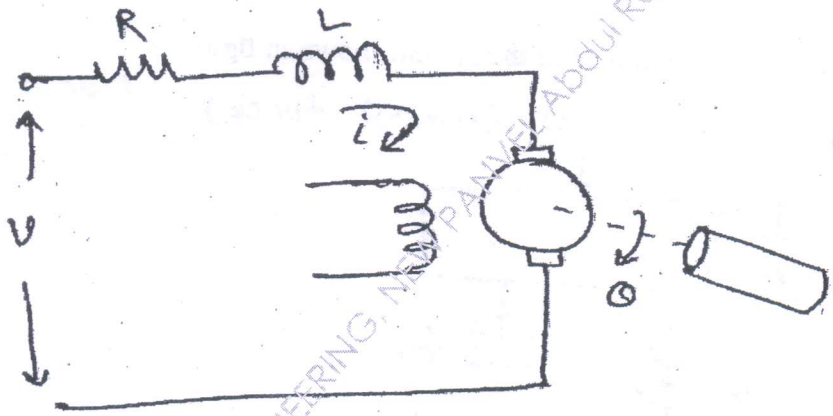
   (b) Find the transfer function of the electrical network shown in **figure** :-   10

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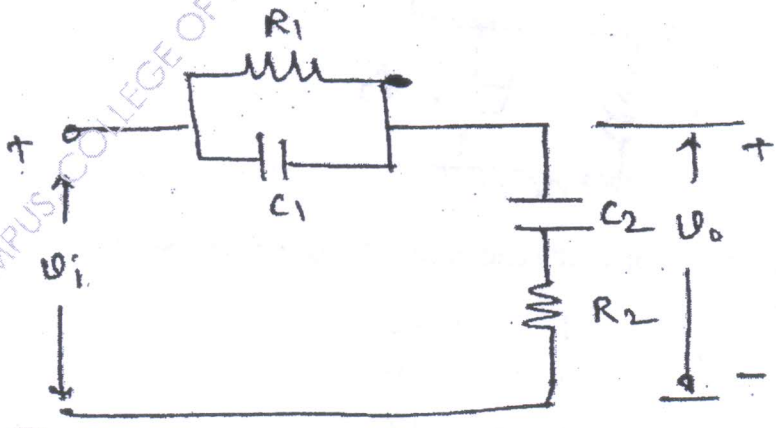
3. (a) Find the closed loop transfer function of the system whose block diagram is   10
given in **figure** :-

   (b) State and prove properties of state transition matrix.   5
   (c) What is optimal control ? Why optimal control is needed ?   5

4. (a) Construct a state model of the system shown in **figure** :-   10
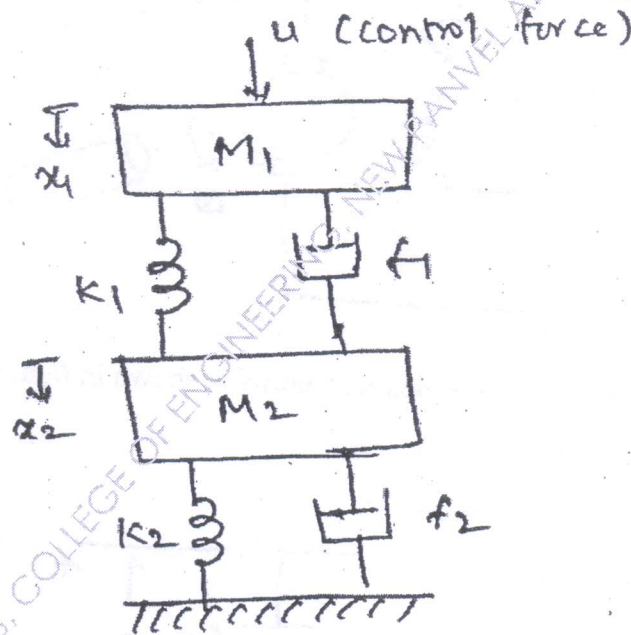
   (b) Predict the controllability and observability for the system :-   10

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 2 & 0 \end{bmatrix} x$$

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5. (a) Construct the root locus for the system having following open loop transfer   10
   function :-

$$G(s)H(s)=\frac{K}{(s+3)(s+5)(s^2+2s+2)}$$

(b) Construct the bode plot for the following transfer function :-   10

$$G(s)\cdot H(s)=\frac{10(s+10)}{s(s+2)(s+5)}$$

6. (a) What is adaptive control ? Explain one method of adaptive control.   7
   (b) Explain how the stability of the system can be analysed using Nyquist criterion.   7
   (c) Explain the time domain specifications.   6

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Con. 13856-14.

(3 Hours)   **[Total Marks : 80**

Q1. Is compulsory

Solve any **3** out of remaining

Q1. A   Explain functions of following Pins of microprocessor 8085.   (5 marks)

a) ALE   b) SOD/SID   c) TRAP   d) HOLD   f) $\overline{INTA}$

Q1. B   Explain Control Word of 8254 Timer. Write control word for Counter 0, Mode-2, R/W LSB, BCD counter.   (5 marks)

Q1. C.   Write features of 80286 microprocessor.   (5 marks)

Q1. D.   What are advantages of memory segmentation of 8086.   (5 marks)

Q2. A.   Draw and Explain Architecture of 8085 Microprocessor.   (10 marks)

Q2. B.   Explain Minimum mode of 8086 microprocessor. Draw timing diagram for write operation in minimum mode of 8086 and explain it.   (10 marks)

Q3. A.   Draw and explain interfacing of 8086 with 8255 I/O mapped I/O mode. (10 marks)

Q3. B   Write a Program to generate 1 KHz frequency square wave using 8254, if clock frequency of 8086 is 1 M Hz.   (10 marks)

Q4. A.   Draw and explain interfacing of DAC 0808 with 8086 using 8255. Write a program to generate square wave.   (10 marks)

Q4. B.   Draw and interface diagram of 8086 microprocessor and 8087 NDP, also explain various interface signals and co-processor working with host processor.   (10 marks)

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Q5. A. Design 8086 microprocessor based system using minimum mode with following specifications:-

     i.   8086 microprocessor working at 8 MHz

     ii.   32 KB EPROM using 16 K devices

     iii.   32 KB SRAM using 16 K devices

Clearly show memory map with address ranges. Draw a neat Schematic.   (10 marks)

Q5. B. Explain interrupt structure of 8086.   (10 marks)

Q6. A   Write a Program for 8086 microprocessor to exchange memory block of 10 bytes of

     location 30000 and 40000   (10 marks)

Q6. B. Draw and explain an architecture of Pentium processor.   (10 marks)

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(3 Hours) [Total Marks M.sc. : 80]

N.B. : (1) Question No. 1 is **compulsory**.
    (2) Attempt any **three** from remaining **five** questions.
    (3) Assume **suitable data** if **required** justify the **same**.

1. (a) Determine power and energy for the following signals.   20

    (i) $x(t) = 3 \cos 5\, \Omega_0 t$.

    (ii) $x[n] = \left(\dfrac{1}{4}\right)^n u[n]$

  (b) State and prove the following properties of fourier transform :
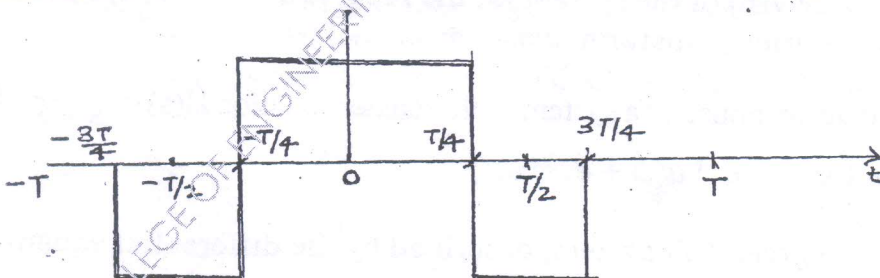   (i) Time shifting property   (ii) Convolution property.

  (c) Compare linear convolution and circular convolution.
  (d) Define and Explain :
    (i) Auto correlation
    (ii) Cross correlation
    (iii) Circular convolution.
  (e) $x[n] = u[n] - u[n - 5]$.
    Sketch even and odd parts of $x[n]$.

2. (a) Determine Fourier Series representation of the following signal :—   10

  (b) For a continuous time signal $x(t) = 8 \cos 200\, \pi t$.   10
    Find : (1) Minimum sampling rate.
        (2) If $f_s = 400$ Hz, what is discrete time signal ?
        (3) If $f_s = 150$ Hz, what is the discrete time signal ?
        (4) Comment on result obtained in 2 and 3 with proper justification.

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3. (a) Determine the inverse z transform of the funciton using Residue method : 10

$$X(z) = \frac{3 - 2z^{-1} + z^{-2}}{1 - 3z^{-1} + 2z^{-2}}$$

(b) Two LTI systems in cascade have impulse response $h_1[n]$ and $h_2[n]$ 10

$$h_1[n] = (0.9)^n \, u[n] - 0.5 \, (0.9)^{n-1} \, u[n-1]$$
$$h_2[n] = (0.5)^n \, u[n] - (0.5)^{n-1} \, u[n-1]$$

find the equivalent response $h[n]$ of the system.

4. (a) A causal LTI system is descrited $y[n] = \frac{3}{4} y[n-1] - \frac{1}{8} y[n-2] + x[n]$.   10

     Where $y[n]$ response of the system and $x[n]$ is excitation to the system.
       (i) Determine impulse response of the system.
       (ii) Determine step response of the system.
       (iii) Plot pole-zero pattern and state whether system is stable.

   (b) (i) Determine the z transform and the ROC of the discrete time signal.   5
       $x[n] = \{\ 2,\ 10,\ \underset{\uparrow}{1},\ 2,\ 5,\ 7,\ 2\ \}$

      (ii) Determine the inverse z-transform for the function :   5

$$X[z] = \frac{z^2 + z}{z^2 - 2z + 1} \quad ROC\,|z| > 1$$

5. (a) The impulse response of an LTI system $h[n] = \{1, 2, 1, -1\}$. Find the 10
response $y[n]$ of the system for the input $x[n] = \{1, 2, 3, 1\}$ using Discrete
time Fourier Transform.

   (b) Find the response of a system with transfer function $H(s) = \frac{1}{s+5}$ $R_e(s) > -5$ 10

     Input $x(t) = e^{-t} u(t) + e^{-2t} u(t)$.

6. (a) For the given LTI system, described by the differential equation :   10

$$\frac{dy^2(t)}{dt^2} + \frac{3dy(t)}{dt} + 2y(t) = x(t)$$

     Calculate output $y(t)$ if input $x(t) = e^{-3t} u(t)$ is applied to the system.

   (b) Find the autocorrelation, power and power spectral density of the signal   10
     $x(t) = 3 \cos t + 4 \cos 3t$.

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(3 Hours)   [Total Marks : 100

N. B. : (1) Question **No. 1** is **compulsory**.

(2) Attempt any **three** out of remaining **five**.

(3) Assume suitable data, whenever **necessary** and **justify** the same.

(4) **Figures** to the **right** indicates marks.

1. Attempt any **four** out of **five** :–

   (a) Identify the type of polarization of the Electromagnetic wave with the   5
following Electric fields and justify the same

    (i) $\vec{E} = \sin(\omega t - \beta z)\,\mathbf{a_x} + \sin(\omega t - \beta z + \dfrac{\pi}{2})\,\mathbf{a_y}$

    (ii) $\vec{E} = [E_1\cos(\omega t)\,\mathbf{a_x} - E_2\sin(\omega t)\mathbf{a_y}]e^{-j\beta z}$

   (b) With regards to the ionosphere discuss the following   5
    (i) E Layer
    (ii) Sporadic E Layer

   (c) Derive the boundary condition for electric and magnetic fields   5

   (d) With the help of a neat schematic, Explain the working of an electromagnetic   5
pump.

   (e) What do you mean by depth of penetration?   5

2. (a) State and Explain Faraday's Law in both the integral and differential form?   3+2
Explain the shortcomings of each of the form?

   (b) Four 40 nC charges are located at A(1,0,0), B(-1,0,0), C(O,1,0) and   5
D(0,-1,0). Determine the total force on the charge at A

   (c) The coefficient matrix for two elements as shown below are given by   5
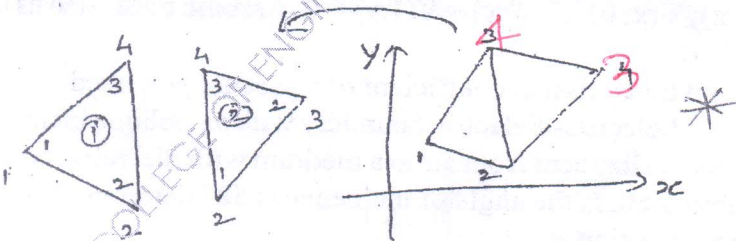
$$C^{(1)} = \begin{bmatrix} 1.2357 & -0.7786 & -0.4571 \\ -0.7786 & 0.6929 & 0.0857 \\ -0.4571 & 0.0857 & 0.3714 \end{bmatrix} \text{ and }$$

$$C^{(2)} = \begin{bmatrix} 0.5571 & -0.4571 & -0.1 \\ -0.4571 & 0.8238 & -0.3667 \\ -0.1 & -0.3667 & 0.4667 \end{bmatrix}$$
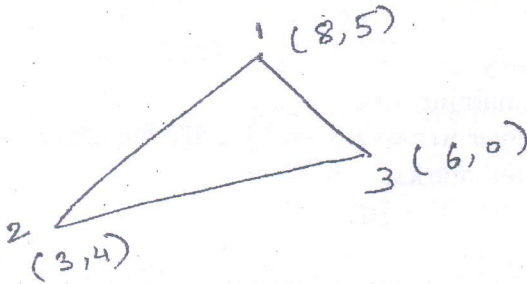
Determine the global coefficient matrix

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(d) Determine the shape functions a_1, a_2, a_3 for the following element   5

3. (a) State and explain Maxwell's equation in free space in integral and differential form   8+2
.Hence explain the difference between conduction and displncement current.

(b) A media has the following properties $\mu_r = 8$, $\varepsilon_r = 2$, $\sigma = 10^{-4}$ mho/m at 2 Ghz.
Determine   10
    (i) attenuation constant
    (ii) attenuation constant in dB
    (iii) phase constant
    (iv) propagation constant
    (v) wavelength
    (vi) phase velocity
    (vii) intrinsic impedance viii)refractive index
    (ix) loss tangent
    (x) is the media behaving like a conductor or dielectric

4. (a) Derive Wave equation in free space   5
(b) State the Poynting theorem. Write its final expression hence explain the   5
mennino of each term.
(c) Solve Laplace's Equation $\nabla^2 V = 0$; $0 \le x \le 1$; $0 \le y \le 1$ 10
With $V(x,1) = 45x(1-x)$; $V(x, 0) = V(0,y) = V(1,y) = 0$. Assume mesh size as 0.5

5. (a) Obtain the reflection and transmission coefficient of a parallel polarized   10
wave incident between a dielectric-dielectric boundary with an oblique incidence
(b) An electromagnetic wave is incident from air to a medium with dielectric constant   5
5 and relative permeability 80. If the angle of incidence is 58° determine the
angle of reflection and refraction.
(c) What polarization is transmitted in ground wave propagation and why? Hence state   4+1
typically till what distance is ground wave propagation effective

6. (a) Explain Super refraction and tropospheric fading   6+4
(b) What is virtual height of a layer? Why is it called so? Is it more or less than the actual   5
height of the layer
(c) What is ionosphere? Which layers are present during day and night time?   2+1+1+1
Where does maximum attenuation of an electromagnetic wave take place
inside the ionosphere? Hence define critical frequency.

(3 Hours) [Total Marks : 80

N.B. : (1) Question **No. 1** is **Compulsory.**
(2) Solve any **three** questions from remaining **five** questions.
(3) **Figures** to the right indicate **full marks.**
(4) Assume suitable data if necessary and mention the same in answer sheet.

1. Solve any **five** 20
   (a) Compare ideal and practical Op Amp.
   (b) Consider a BJT has parameters $f_T = 500$ MHz at Ic = 1 mA, $\beta = 100$ and $C\mu = 0.3$ pF. Calculate bandwidth f_β and capacitance $C\pi$ of a BJT.
   (c) What is cross-over disortion in power Amplifier. How it is overcome?
   (d) Which type of biasing technique is used to bias Integrated Circuit and why?
   (e) Find output voltage of differential amplifier if its differential gain Ad = 100, common mode gain Ac = 0.1 and input voltage are $V_1 = 2 + 0.55$ sinωt and $V_2 = 0.5 - 0.005$ sinωt.
   (f) Explain line regulation and load regulation of voltage regulator. Draw load and line regulation characteristics of ideal and practical voltage regulator.

2. (a) For the circuit shown in Fig 2a, the parameters are $R_s = 0.1$ kΩ, $R_1 = 20$kΩ, $R_2 = 2.2$ 10 kΩ, $R_E = 0.1$ KΩ, Cc = 47 μf, and Vcc = 10V. The transistor parameters are : $V_{BE(ON)} = 0.7$V, $\beta = 200$, and VA = ∞.
   (i) Derive expression for lower cut-off frequency (or time constant) due to coupling capacitor Cc,
   (ii) Determine lower cut off frequency and midband voltage gain.

Fig 2a
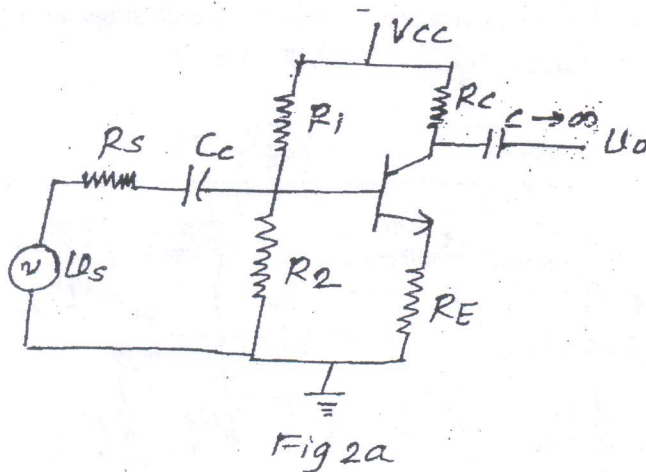
2. (b) For the circuit shown Fig.2b, the transistor parameters are : Kn = 1mA/V^2, V$_{TN}$ = 0.8V,   **10**
λ = 0, Cgs = 2pF, and cgd = 0.2pF. Determine
    (i)   Miller capacitance
    (ii)   The upper 3dB (high cut-off) frequency
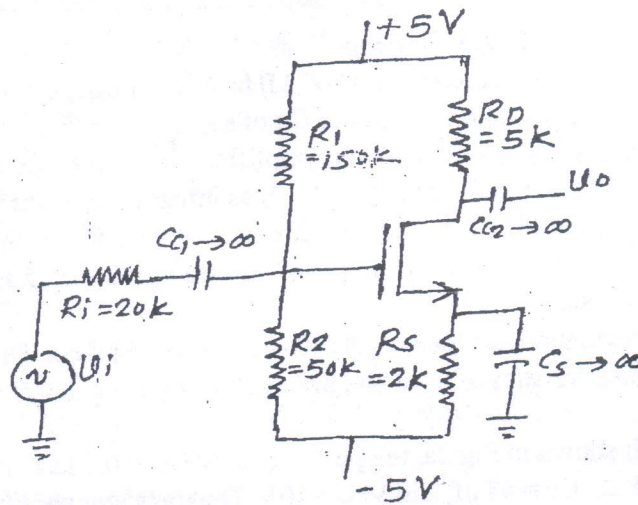   (iii)   The mid band voltage gain

Fig.2b

3. (a) For the circuit shown in Fig.3a, find overall midband voltage gain and capacitors Cc$_1$ and   **10**
Cc$_2$ such that the 3dB frequencies associated with each stage are equal. Assume BJT
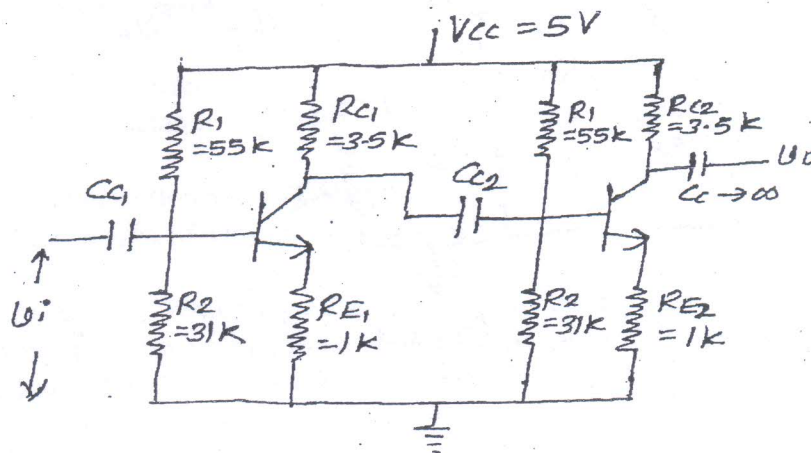have parameters : V$_{BE(ON)}$ = 0.7 V, β = 200, and VA = ∞.

Fig.3a

3. (b) For the differential amplifier shown in Fig 3b, derive expression for differential voltage   **10** gain, common-mode voltage gain and CMRR.
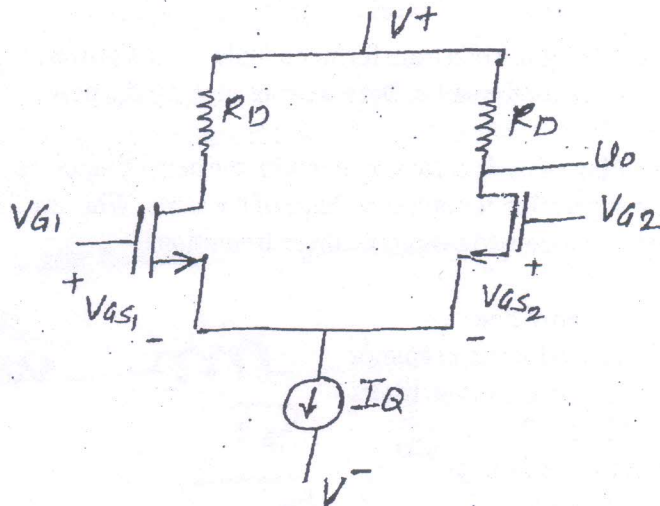

Fig 3b

4. (a) The transistor parameters for the circuit shown in Fig 4a are $\beta = 100$, $V_{BE(ON)} = 0.7V$,   **10** and $VA = \infty$.
    (i)   Determine R_E such that $I_E = 150\ \mu A$.
    (ii)   Find Ad, Acm and CMRR for one sided output at υ_{02}.
    (iii)   Determine the differential and common-mode input resistances.
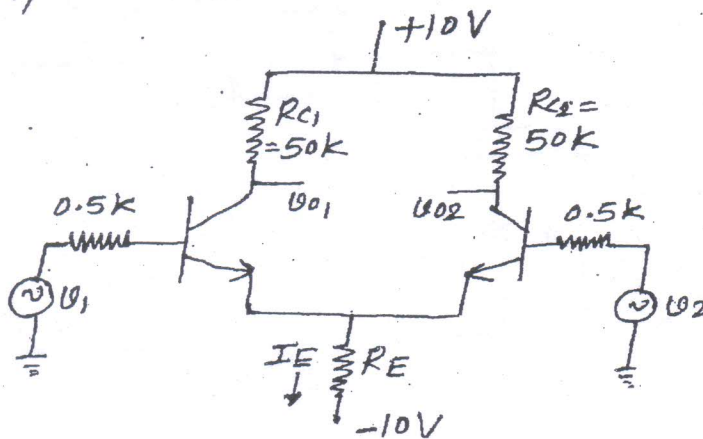

Fig 4a

4. (b) Explain the working of two transistor (BJT) current source with the help of necessary   **10**
   current relationships. Also explain the effect of finite output resistance on current source
   performance and the techniques to improve the same.

5. (a) Draw a circuit diagram of a transformer couple class A power amplifier. Also draw ac   **10**
   and dc load lines for the same. Derive expression for the power conversion efficiency.

5. (b) Explain working of basic differentiator with the help of input and output waveforms.   **10**
   Also derive expression for output voltage of the same. What are the limitations of basic
   differentiater and how to overcome these limitations.

6. Write short notes on amy **Four** :—   **20**
   - (a) Transistorized series regulator
   - (b) High pass and Low pass filters
   - (c) Power MOSFET
   - (d) Wilson Current source
   - (e) Darlington pair.

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