

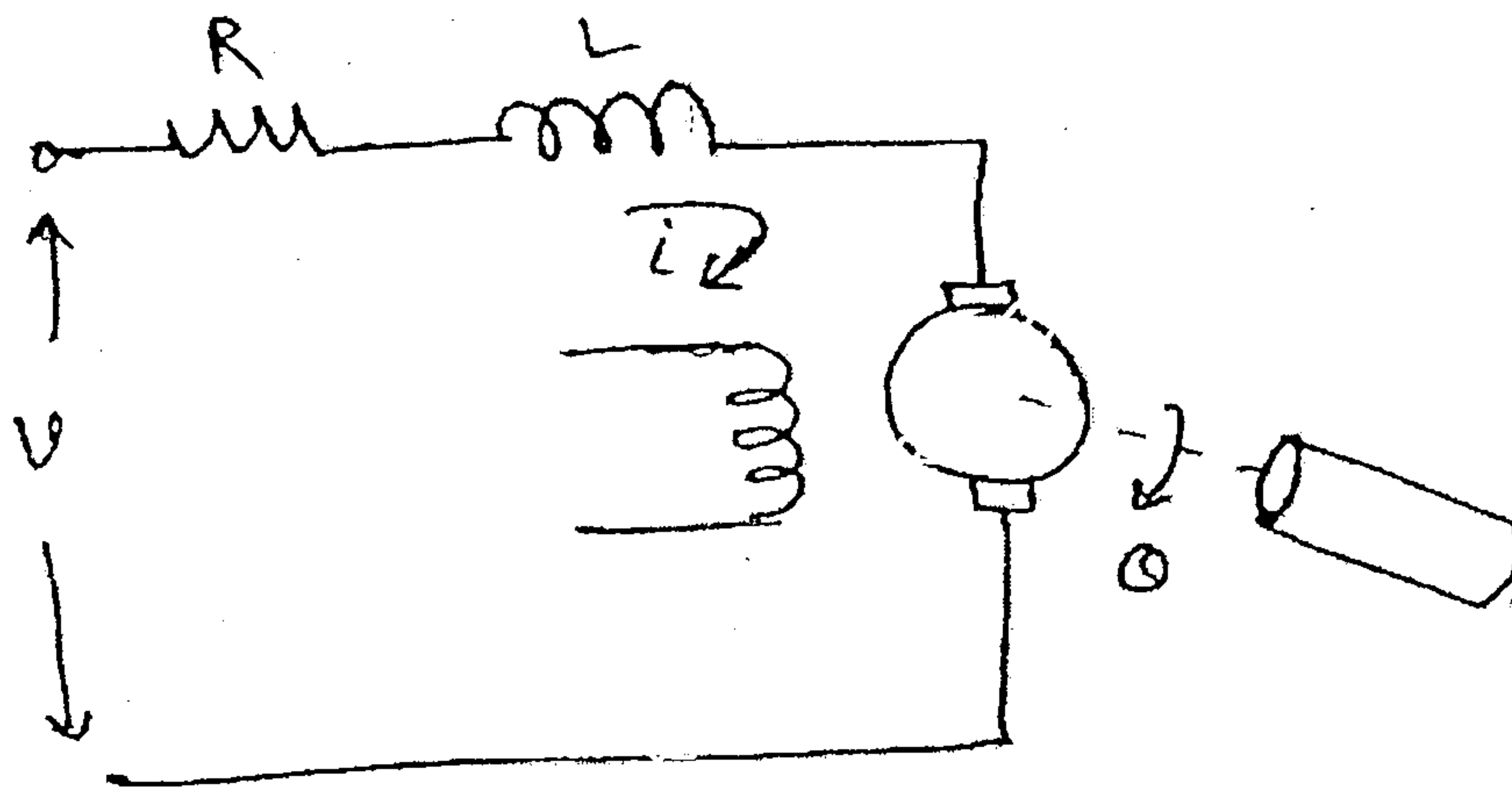
QP Code : NP-19880

(3 Hours)

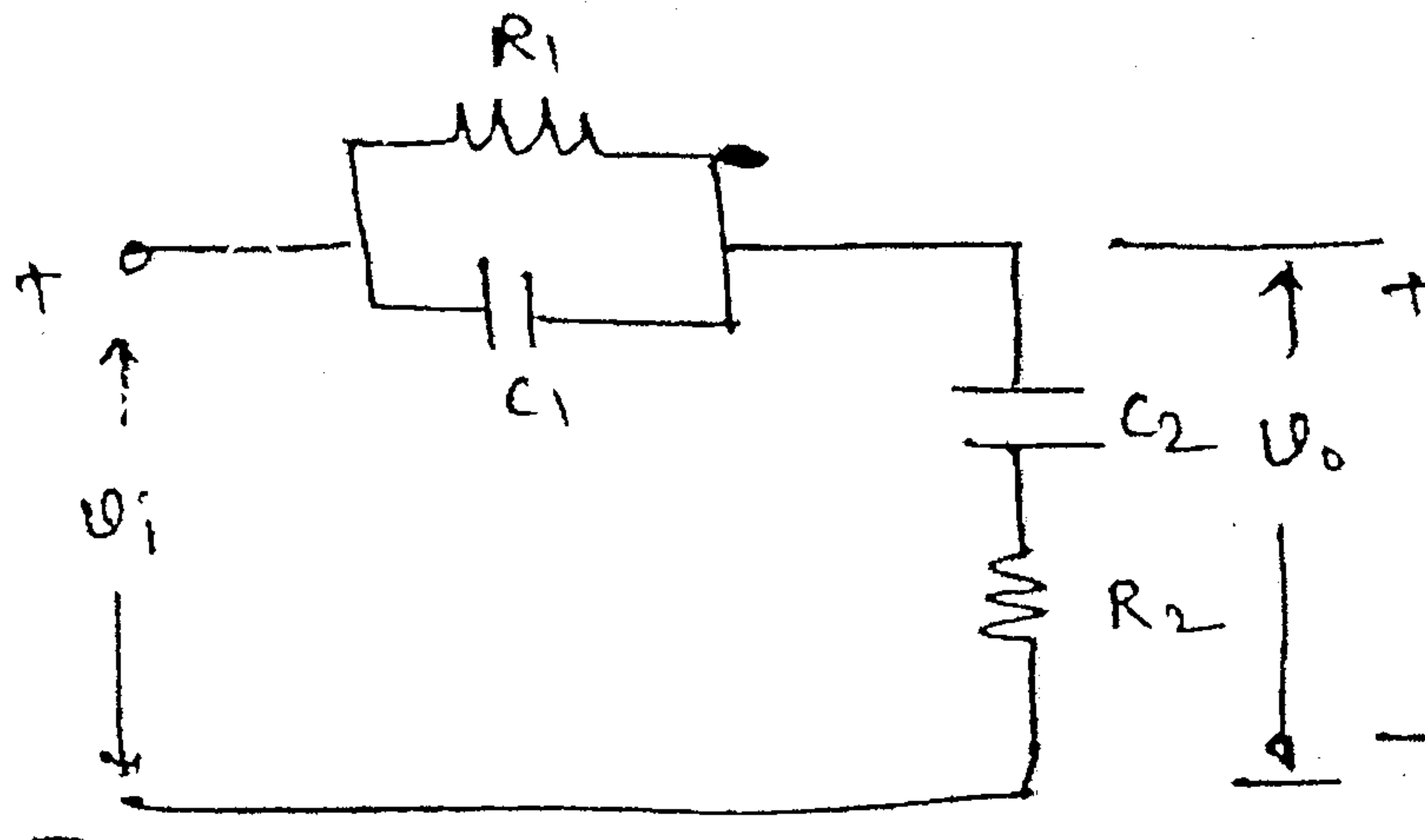
[ Total Marks : 80

- 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

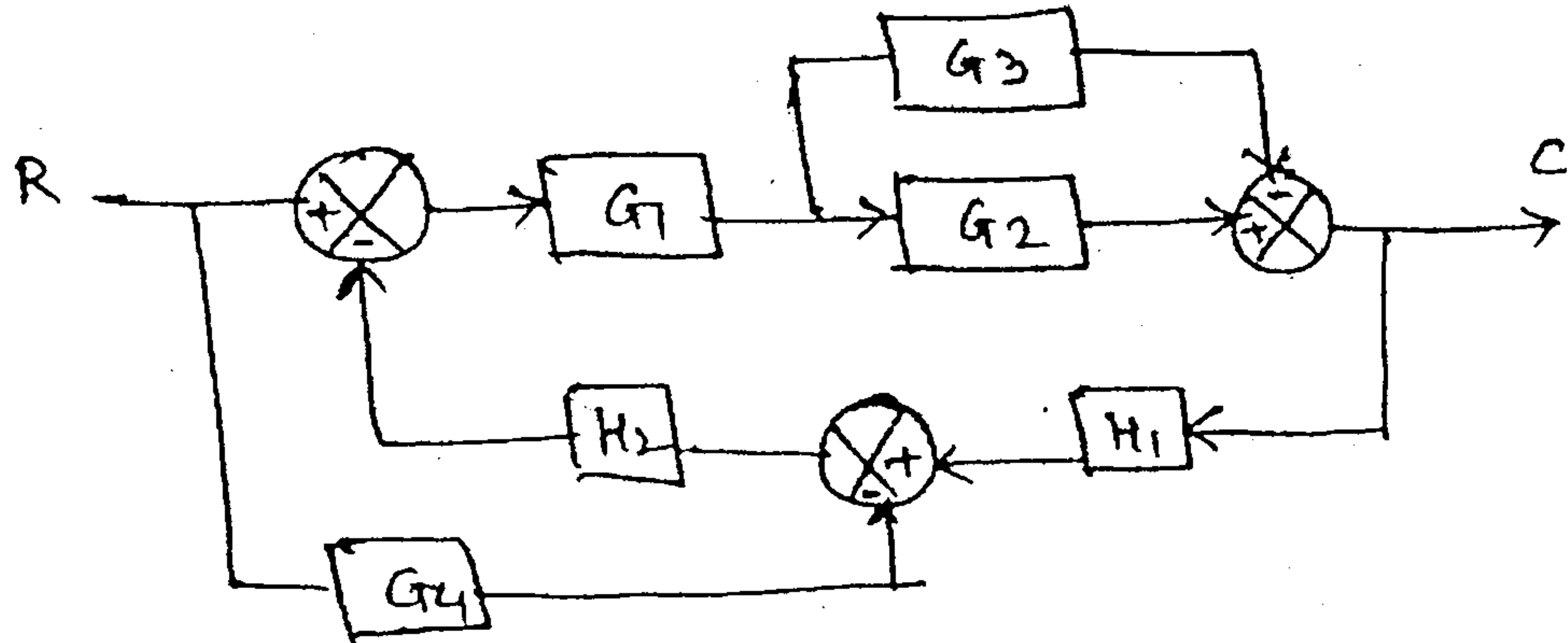


- (b) Find the transfer function of the electrical network shown in figure :- 10

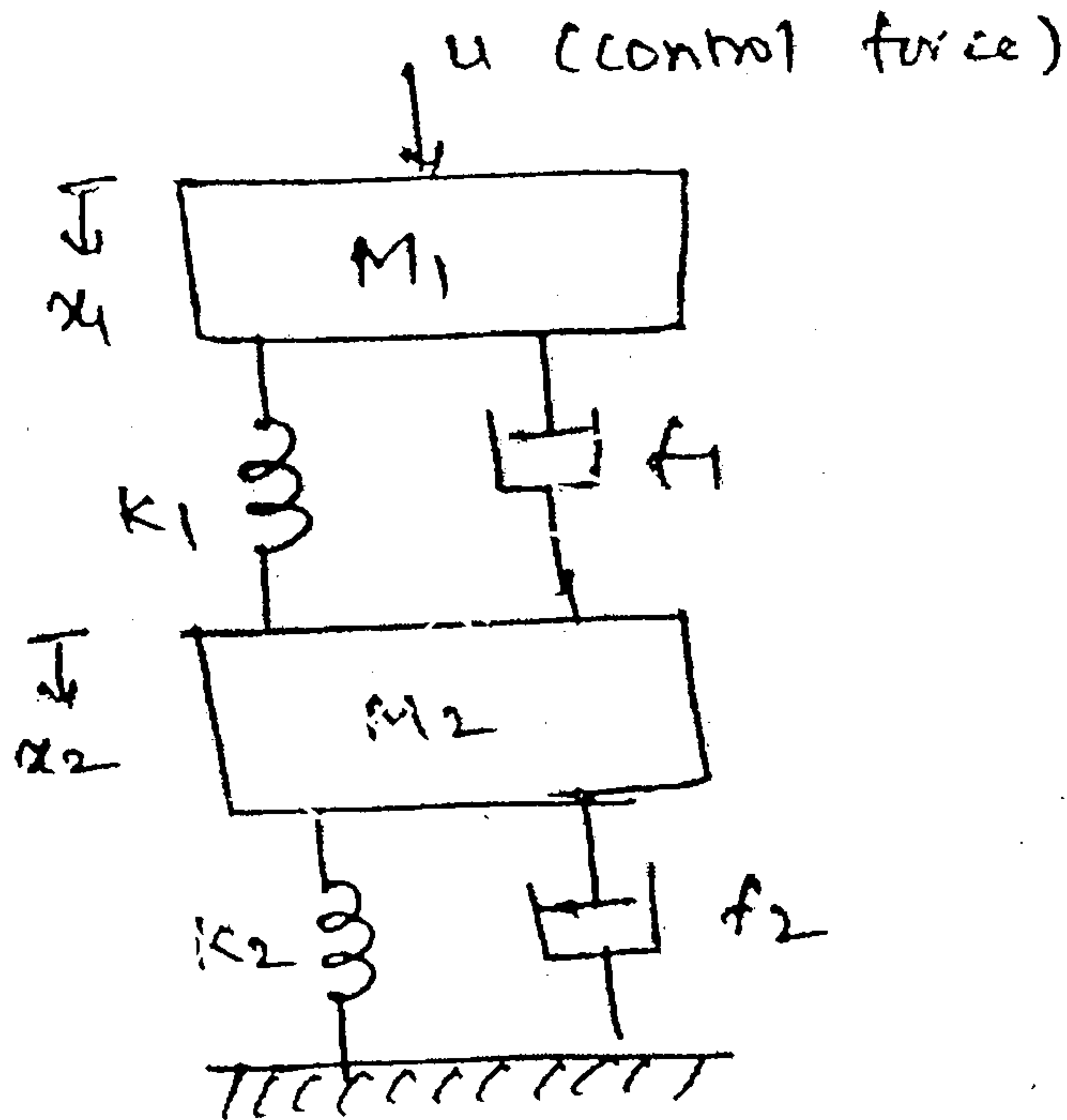


[ TURN OVER

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



- (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

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

$$y = [1 \ 2 \ 0]x$$

[ TURN OVER

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

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

- (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

(3 Hours)

[Total Marks : 80

Sub:- Microprocessors  
&  
peripherals.

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)

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)

S.E. ExTc sem II CBSQS M-2014

Sub:- AE -II

19/5/14

QP Code : NP-19691

(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

- Compare ideal and practical Op Amp.
- Consider a BJT has parameters  $f_T = 500$  MHz at  $I_C = 1$  mA,  $\beta = 100$  and  $C_\mu = 0.3$  pF. Calculate bandwidth  $f_\beta$  and capacitance  $C_\pi$  of a BJT.
- What is cross-over distortion in power Amplifier. How it is overcome?
- Which type of biasing technique is used to bias Integrated Circuit and why?
- Find output voltage of differential amplifier if its differential gain  $A_d = 100$ , common mode gain  $A_c = 0.1$  and input voltage are  $V_1 = 2 + 0.55 \sin \omega t$  and  $V_2 = 0.5 - 0.005 \sin \omega t$ .
- 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  $R_s = 0.1$  k $\Omega$ ,  $R_1 = 20$  k $\Omega$ ,  $R_2 = 2.2$  k $\Omega$ ,  $R_E = 0.1$  K $\Omega$ ,  $C_c = 47$   $\mu$ f, and  $V_{CC} = 10$ V. The transistor parameters are :  $V_{BE(ON)} = 0.7$ V,  $\beta = 200$ , and  $V_A = \infty$ .

10

- Derive expression for lower cut-off frequency (or time constant) due to coupling capacitor  $C_c$ ,
- Determine lower cut off frequency and midband voltage gain.

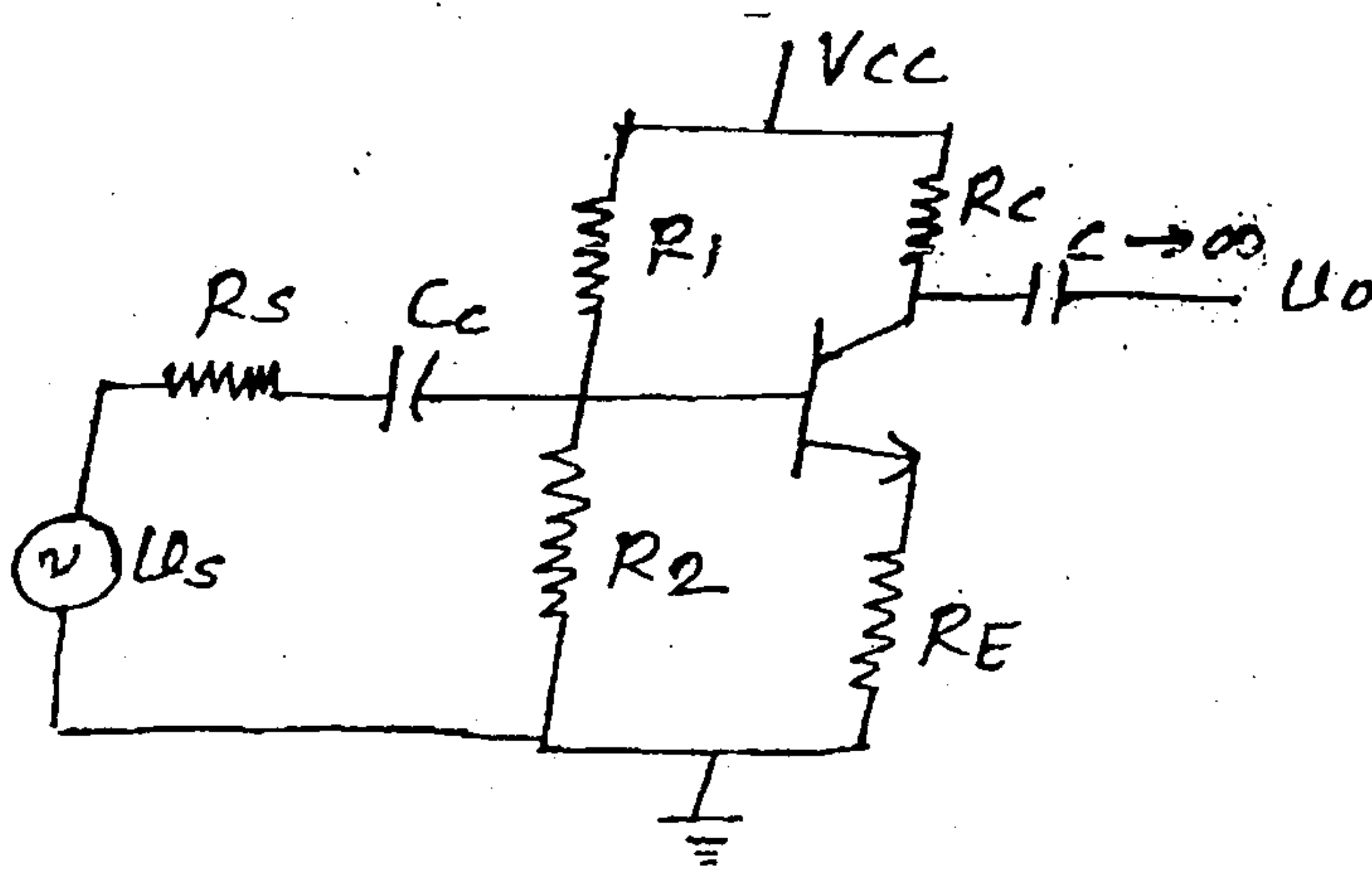


Fig 2a

2. (b) For the circuit shown Fig.2b, the transistor parameters are :  $K_n = 1\text{mA/V}^2$ ,  $V_{TN} = 0.8\text{V}$ ,  $\lambda = 0$ ,  $C_{gs} = 2\text{pF}$ , and  $c_{gd} = 0.2\text{pF}$ . Determine
- Miller capacitance
  - The upper 3dB (high cut-off) frequency
  - The mid band voltage gain

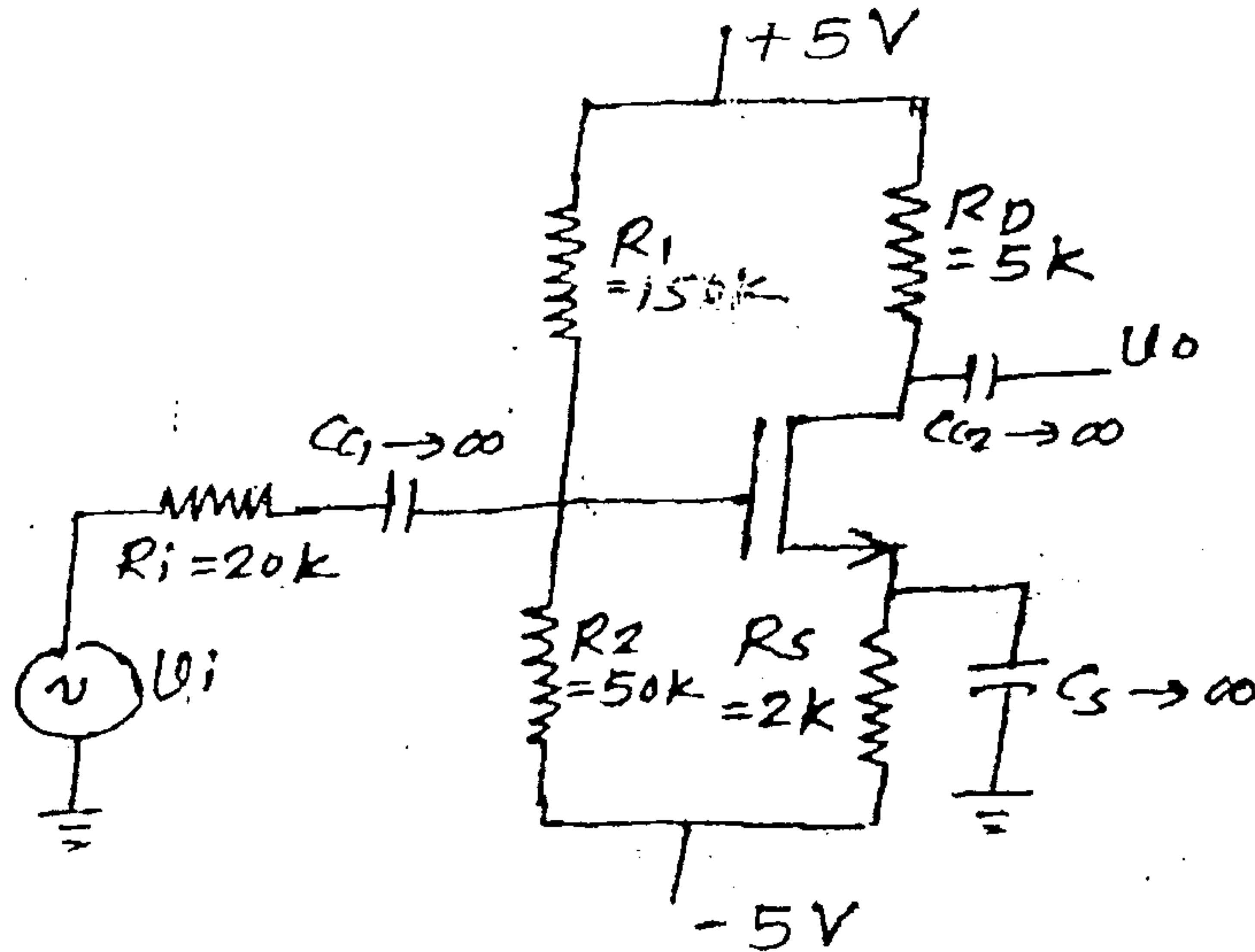


Fig.2b

3. (a) For the circuit shown in Fig.3a, find overall midband voltage gain and capacitors  $C_{c1}$  and  $C_{c2}$  such that the 3dB frequencies associated with each stage are equal. Assume BJT have parameters :  $V_{BE(ON)} = 0.7\text{V}$ ,  $\beta = 200$ , and  $V_A = \infty$ .

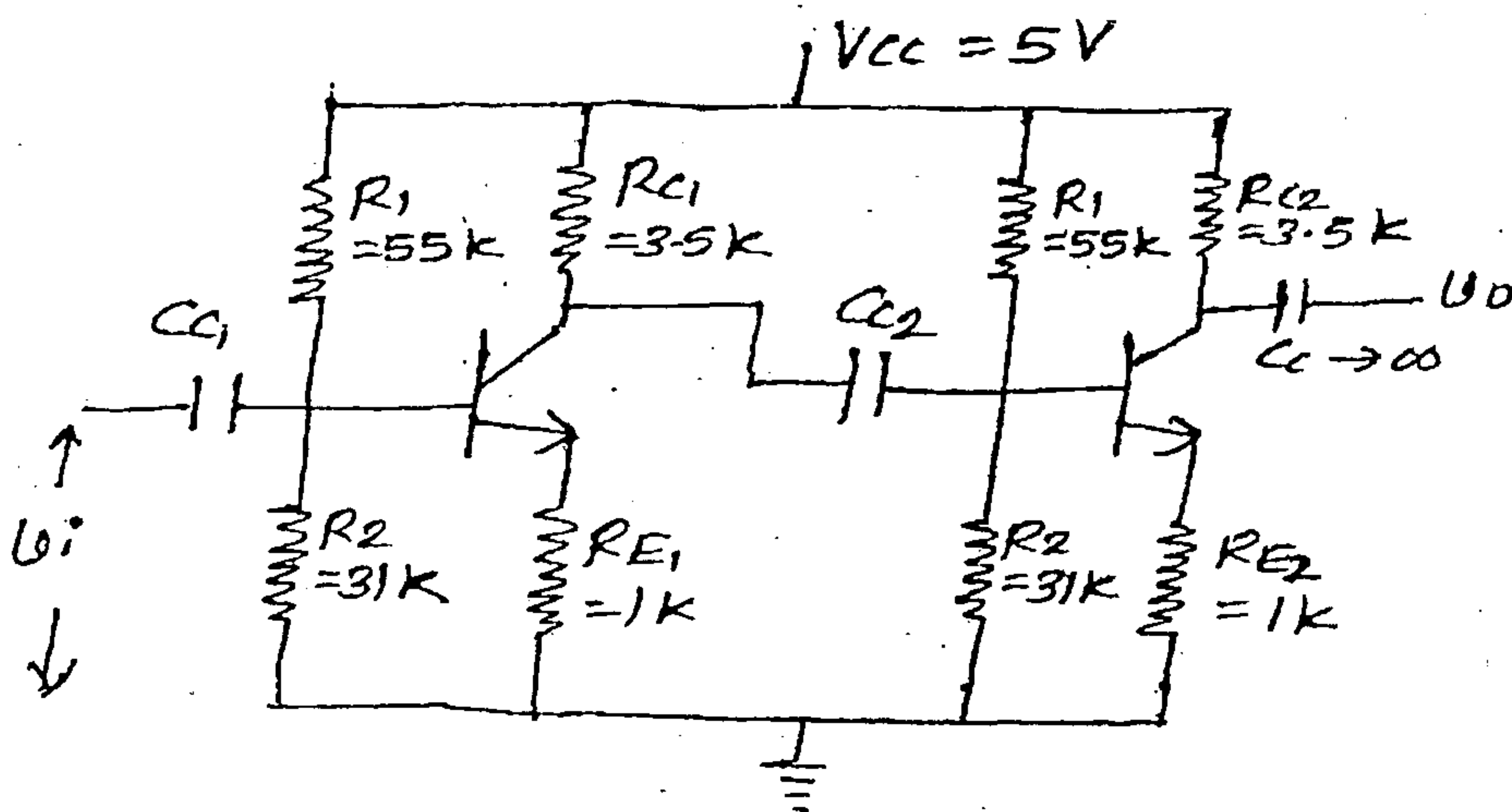


Fig.3a

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

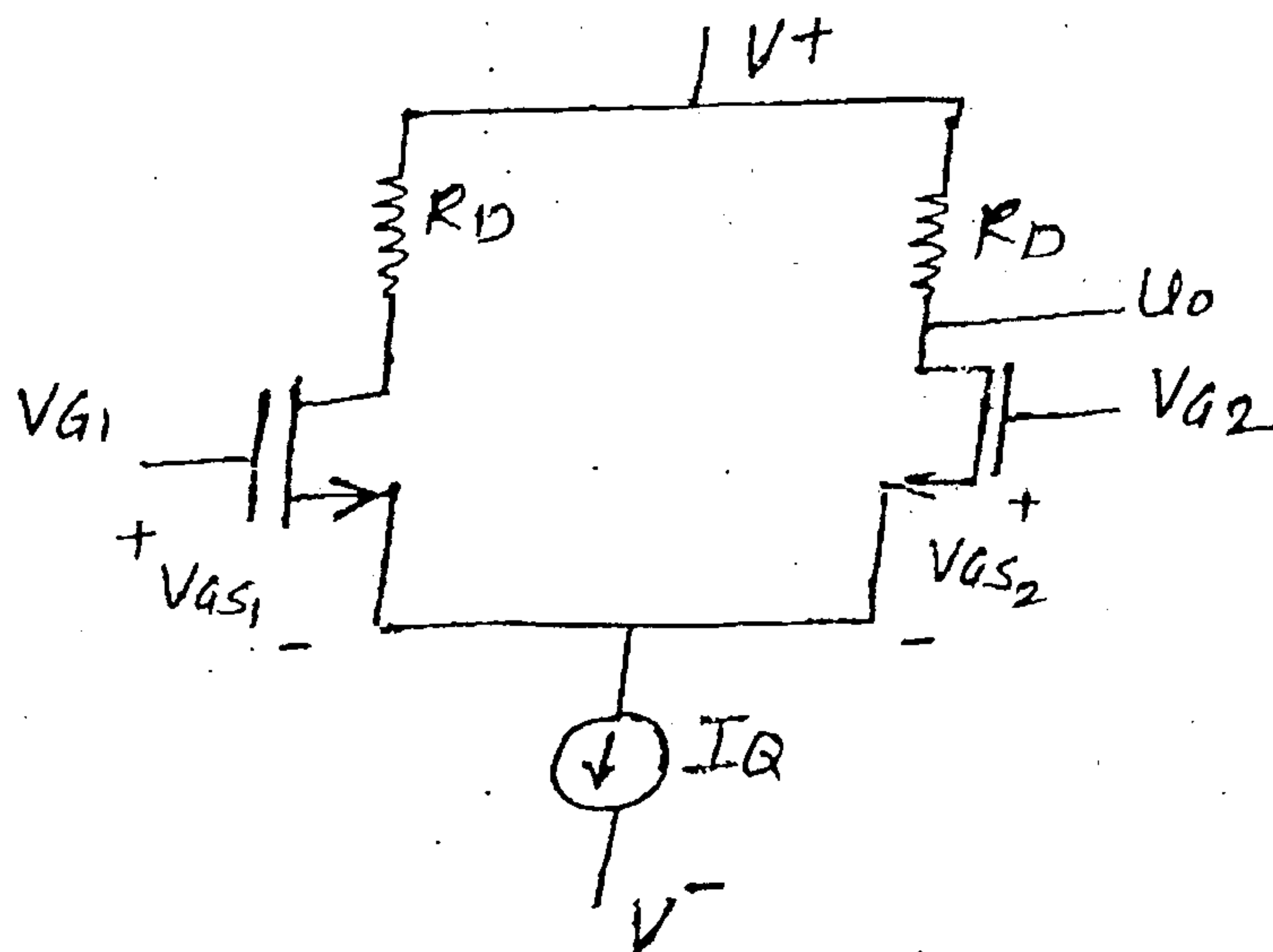


Fig 3b

4. (a) The transistor parameters for the circuit shown in Fig 4a are  $\beta = 100$ ,  $V_{BE(ON)} = 0.7V$ , and  $V_A = \infty$ . 10
- Determine  $R_E$  such that  $I_E = 150 \mu A$ .
  - Find  $A_d$ ,  $A_{cm}$  and CMRR for one sided output at  $u_{o2}$ .
  - Determine the differential and common-mode input resistances.

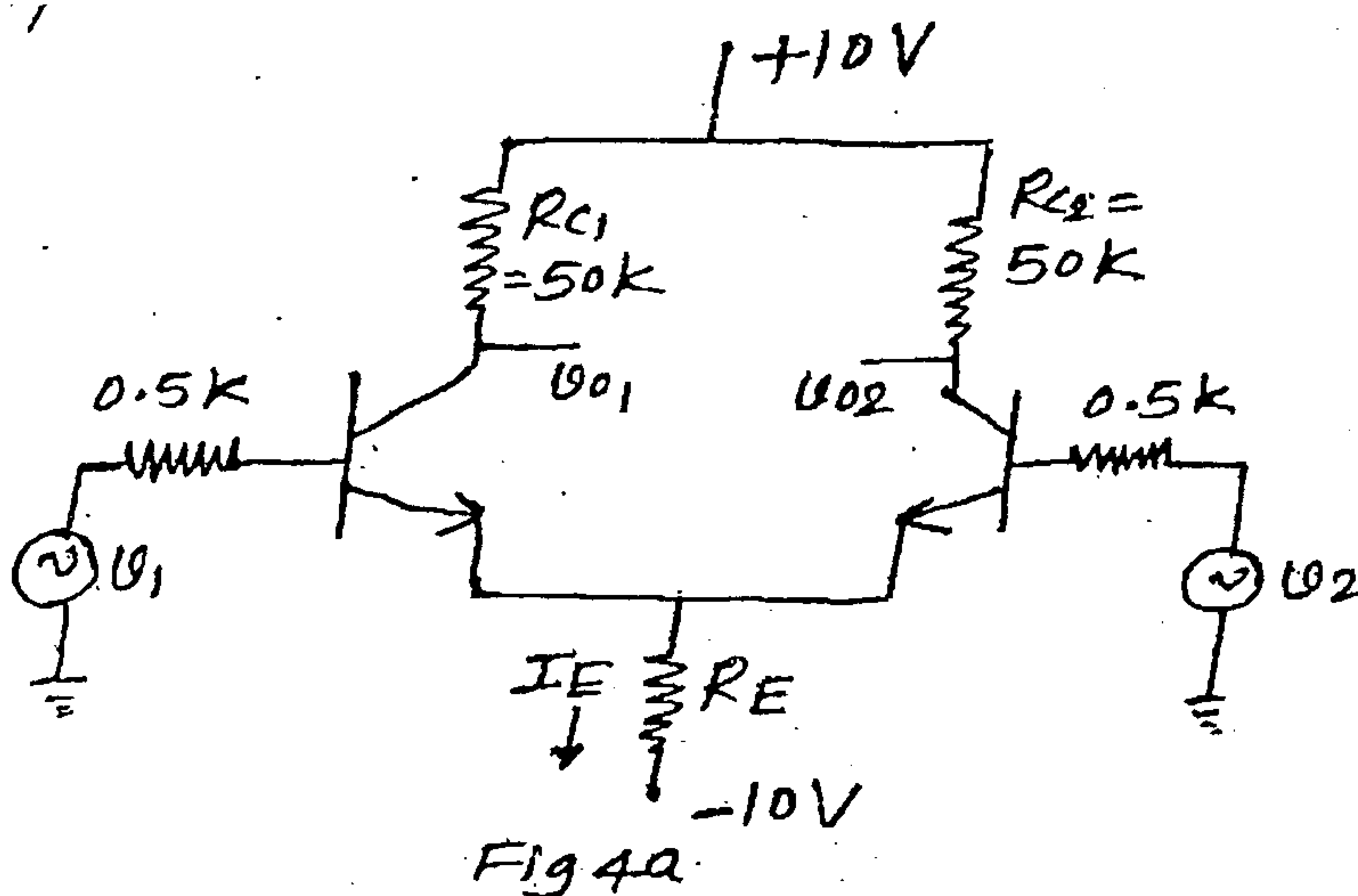


Fig 4a



4. (b) Explain the working of two transistor (BJT) current source with the help of necessary current relationships. Also explain the effect of finite output resistance on current source performance and the techniques to improve the same. 10
5. (a) Draw a circuit diagram of a transformer couple class A power amplifier. Also draw ac and dc load lines for the same. Derive expression for the power conversion efficiency. 10
5. (b) Explain working of basic differentiator with the help of input and output waveforms. Also derive expression for output voltage of the same. What are the limitations of basic differentiator and how to overcome these limitations. 10
6. Write short notes on any **Four** :— 20
- (a) Transistorized series regulator
  - (b) High pass and Low pass filters
  - (c) Power MOSFET
  - (d) Wilson Current source
  - (e) Darlington pair.
-

Wave theory & propagation. (EXTC),  
S.E. Sem - IV (CBCS) June 2014.

QP Code : NP-19806

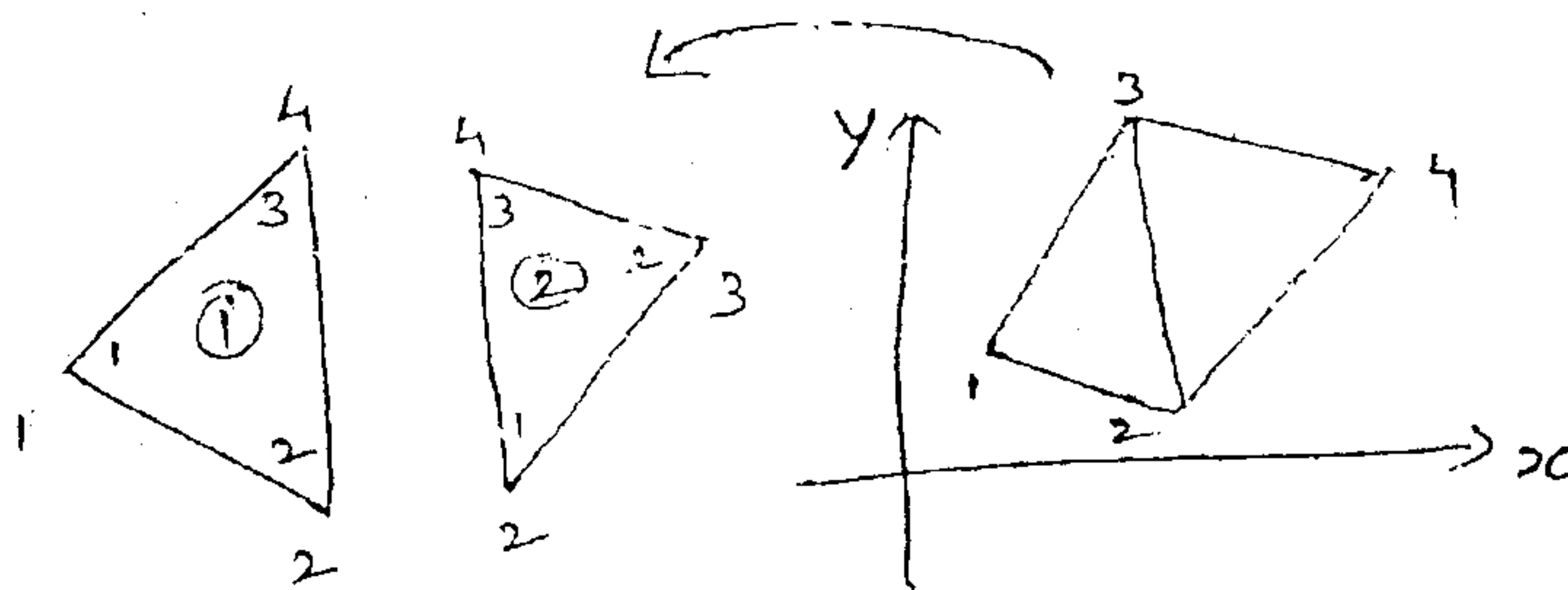
(3 Hours)

[ 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 following Electric fields and justify the same 5
- (i)  $\vec{E} = \sin(\omega t - \beta z) \mathbf{a}_x + \sin(\omega t - \beta z + \frac{\pi}{2}) \mathbf{a}_y$
- (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 pump. 5
- (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(0,1,0) and D(0,-1,0). Determine the total force on the charge at A 5
- (c) The coefficient matrix for two elements as shown below are given by 5



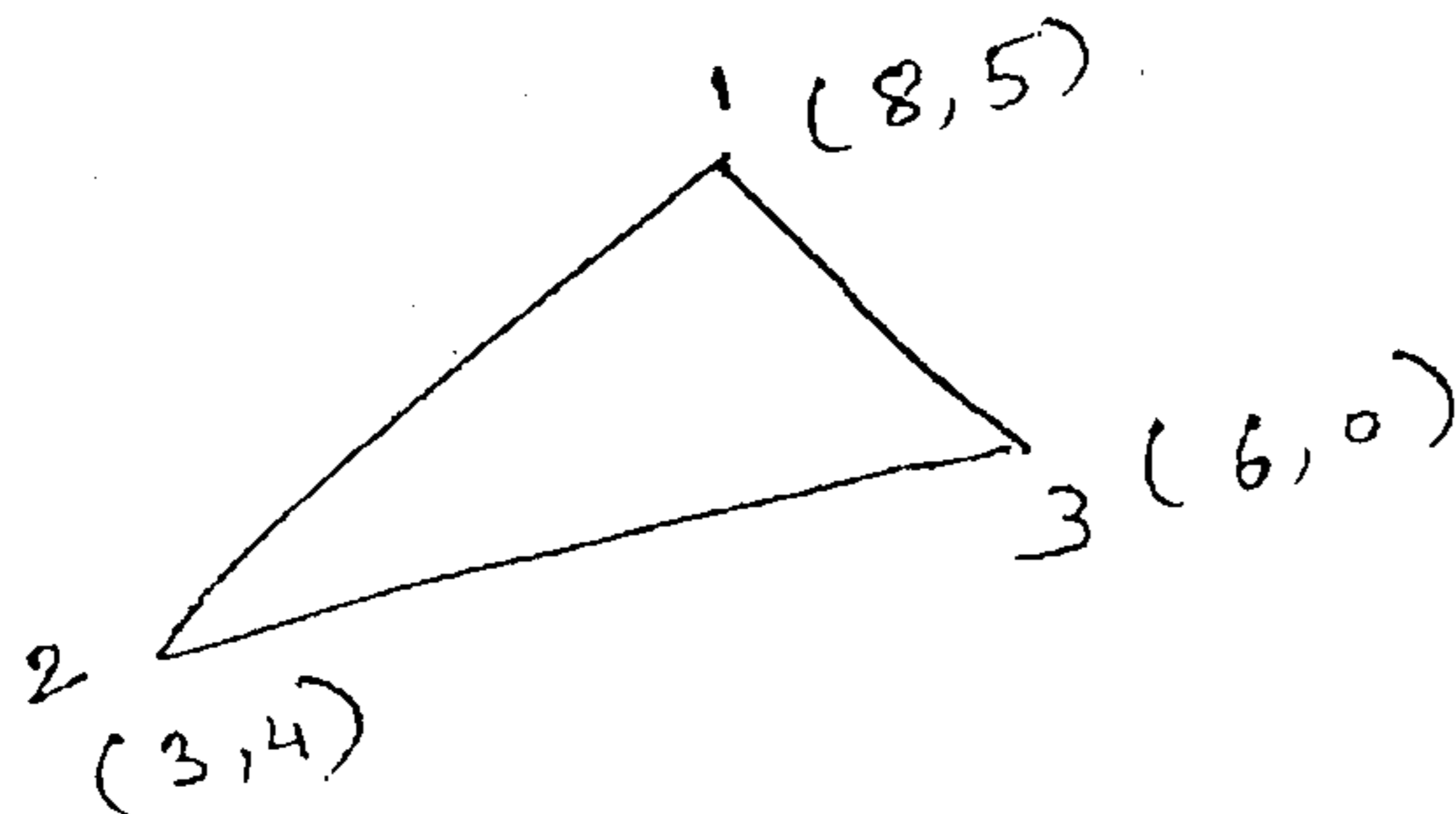
$$C^{(1)} = \begin{bmatrix} 1.2357 & -0.7786 & -0.4571 \\ -0.7786 & 0.6929 & 0.0857 \\ -0.4571 & 0.0857 & 0.3714 \end{bmatrix} \text{ and}$$

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

Determine the global coefficient matrix

- (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. Hence explain the difference between conduction and displacement current. 8+2
- (b) A media has the following properties  $\mu_r = 8, \epsilon_r = 2, \sigma = 10^{-4}$  mho/m at 2 GHz. Determine
- (i) attenuation constant 10
- (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 meaning of each term. 5
- (c) Solve Laplace's Equation  $\nabla^2 V = 0; 0 \leq x \leq 1; 0 \leq y \leq 1$  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 wave incident between a dielectric-dielectric boundary with an oblique incidence 10
- (b) An electromagnetic wave is incident from air to a medium with dielectric constant 5 and relative permeability 80. If the angle of incidence is  $58^\circ$  determine the angle of reflection and refraction. 5
- (c) What polarization is transmitted in ground wave propagation and why? Hence state typically till what distance is ground wave propagation effective 4+1
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 height of the layer 5
- (c) What is ionosphere? Which layers are present during day and night time? Where does maximum attenuation of an electromagnetic wave take place inside the ionosphere? Hence define critical frequency. 2+1+1+1

SE EXTC Sem-4 10/06/2014  
Signal and Systems.

QP Code : NP-19845

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

(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

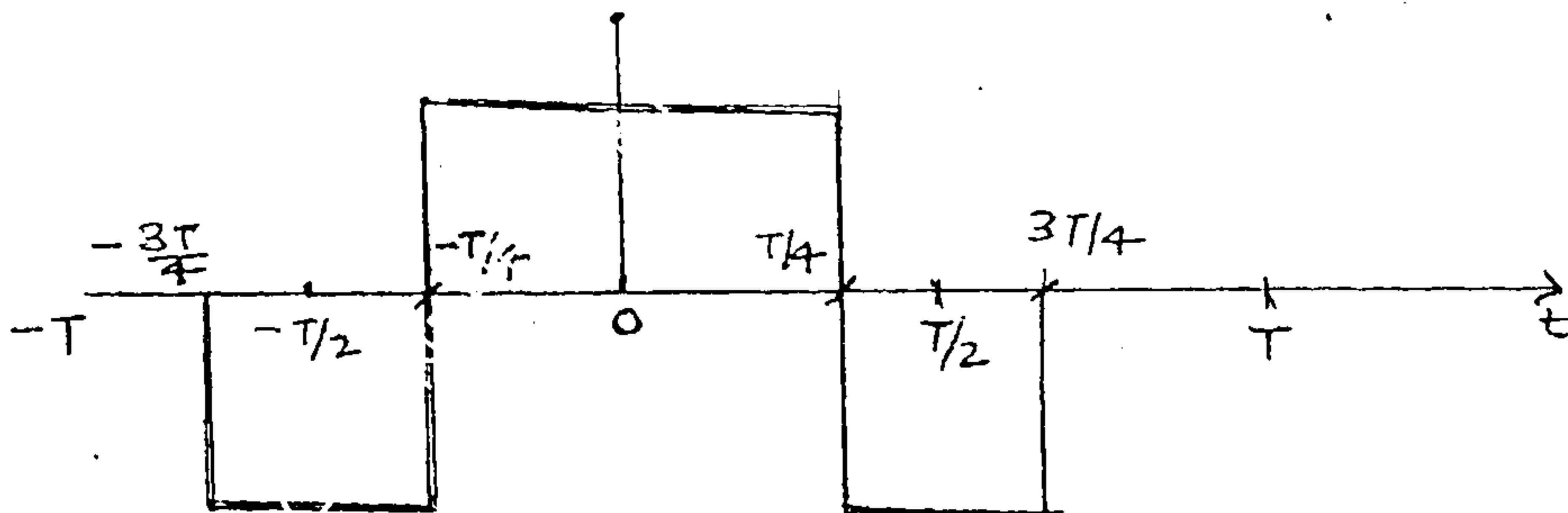
(ii) Cross correlation

(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 function 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 described  $y[n] = \frac{3}{4} y[n-1] - \frac{1}{8} y[n-2] + x[n]$ . 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

$$x[n] = \{ 2, 10, 1, 2, 5, 7, 2 \}$$

↑

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

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

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

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

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

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

$$x(t) = 3 \cos t + 4 \cos 3t$$

SE - ETRX & EATC

Sem - IV - AM - IV (CBCS)

Dt: - 23/05/14

QP Code : NP-19713

(3 Hours)

[ Total Marks : 80

- N.B.: (1) Questions No. 1 is compulsory.  
(2) Solve any **three** from the **remaining**.

1. (a) Prove that Eigen values of a hermitian matrix are real. 5

(b) Evaluate  $\oint_c \frac{e^{kz}}{z} dz$  over the circle  $|z|=1$  and  $k$  is real. Hence prove 5

$$\text{that } \int_0^\pi e^{k \cos \theta} \cos(k \sin \theta) d\theta = \pi.$$

(c) Find the extremal of  $\int_{x_2}^{x_1} (16y^2 - (y'')^2 + x^2) dx$  5

(d) Find a vector orthogonal to both  $u = (-6, 4, 2)$  and  $v = (3, 1, 5)$ . 5

2. (a) Find the curve  $y = f(x)$  for which  $\int_{x_1}^{x_2} y \sqrt{1+(y')^2} dx$  is minimum subject to the 6

$$\text{constraint } \int_{x_1}^{x_2} \sqrt{1+(y')^2} dx = \ell.$$

(b) Find eigen values and eigen vectors of the matrix  $A = \begin{bmatrix} -2 & 5 & 4 \\ 5 & 7 & 5 \\ 4 & 5 & -2 \end{bmatrix}$  6

(c) Obtain Taylor's series and two distinct Laurent's series expansion of 8

$$f(z) = \frac{z^2 - 1}{z^2 + 5z + 6} \text{ about } z = 0, \text{ indicating region of covergence.}$$

3. (a) State Cayley-Hamilton Theroern, hence deduce that  $A^8 = 625I$ , where 6

$$A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$$

(b) Using calculus of Residues, prove that  $\int_0^{2\pi} e^{\cos \theta} \cos(\sin \theta - n\theta) d\theta = \frac{2\pi}{n!}$ . 6

(c) Find the plane curve of fixed perimeter and maximum area. 8

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4. (a) State Cauchy-Schwartz inequality and hence show that 6

$$\left( x^2 + y^2 + z^2 \right)^{1/2} \geq \frac{1}{13} ( 3x + 4y + 12z ), \quad x, y, z \text{ are positive.}$$

- (b) Reduce the quadratic form  $Q = x^2 + y^2 - 2z^2 - 4xy - 2yz + 10xz$  to Canonical form using congruent transformation. 6

- (c) (i) If  $A = \begin{bmatrix} \pi/2 & 3\pi/2 \\ \pi & \pi \end{bmatrix}$ , find  $\sin A$ . 4

- (ii) Show that the matrix  $A = \begin{bmatrix} 5 & -6 & -6 \\ -1 & 4 & 2 \\ 3 & -6 & -4 \end{bmatrix}$  is Derogatory. 4

5. (a) Using Rayleigh - Ritz method, find an appropriate solution for the extremal of the 6

$$\text{functional } I[y(x)] = \int_0^1 \left[ xy + \frac{1}{2}(y')^2 \right] dx \text{ subject to } y(0) = y(1) = 0.$$

- (b) Find an orthonormal basis of the following subspace of  $\mathbb{R}^3$ ,  $S = \{ [1, 2, 0] [0, 3, 1] \}$ . 6

- (c) Is the matrix  $A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$  diagonalizable. If so find diagonal form and transforming matrix. 8

6. (a) Find  $f(3)$ ,  $f'(1+i)$ ,  $f''(1-i)$ , if  $f(a) = \oint_c \frac{3z^2 + 11z + 7}{z-a} dz$ ,  $c: |z|=2$ . 6

- (b) Evaluate  $\int_0^\infty \frac{x^3 \sin x}{(x^2 + a^2)^2} dx$  using contour integration. 6

- (c) Find the singular value decomposition of the matrix  $A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \\ 1 & -1 \end{bmatrix}$ . 8