SE (ETTC) SEM IV (CBGS) Dec 2014

Control System

Q.P. Code : **12595**

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

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

1. (a) Compare open loop and closed loop systems with suitable examples. **5**

(b) Draw the step response for an underdamped second order system with damping ratio 0.2, 1, 1.2 respectively. **5**

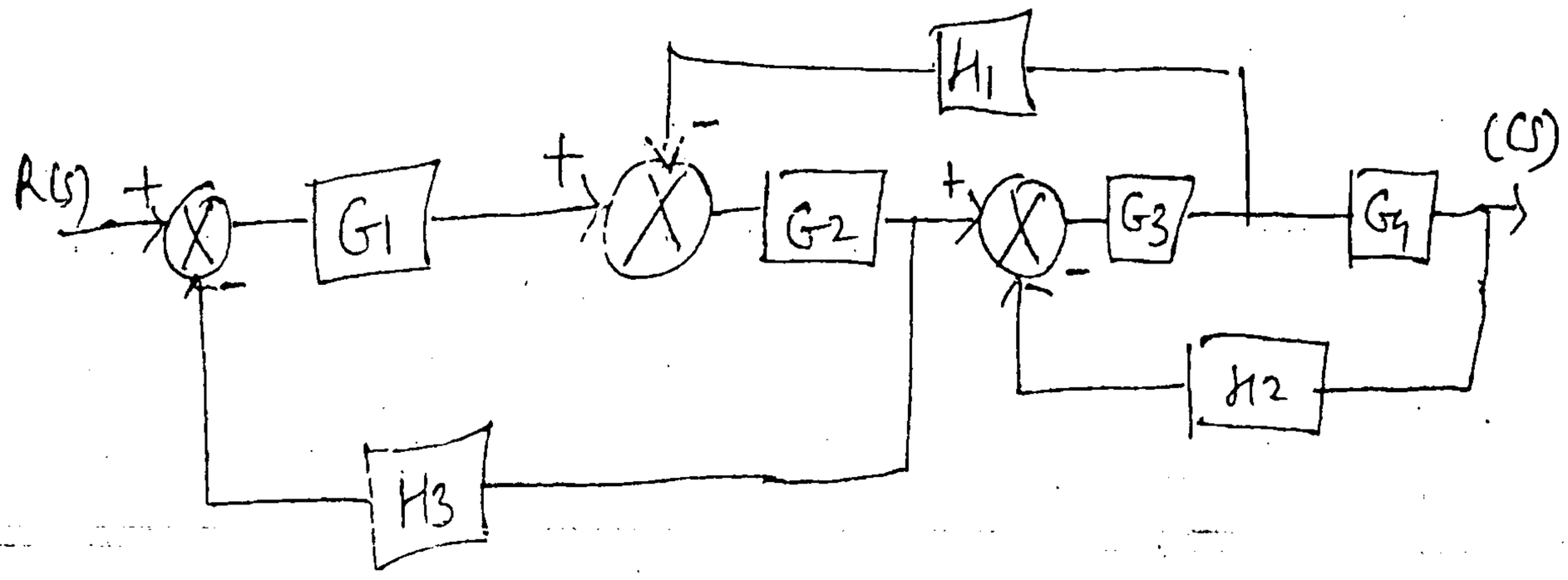
(c) The transfer function of a system is given by - **5**

$$T(s)=\frac{k(s+6)}{s(s+2)(s+5)\left(s^2+7s+1^2\right)}$$

Determine (i) poles (ii) zeros (iii) Characteristic equation

(d) Define Hurwitz stability Crieteria with its advantages and disadvantages. Give suitable example. **5**

2. (a) Determine transfer function C(S) / RCS) of the system shown in fig. **10**



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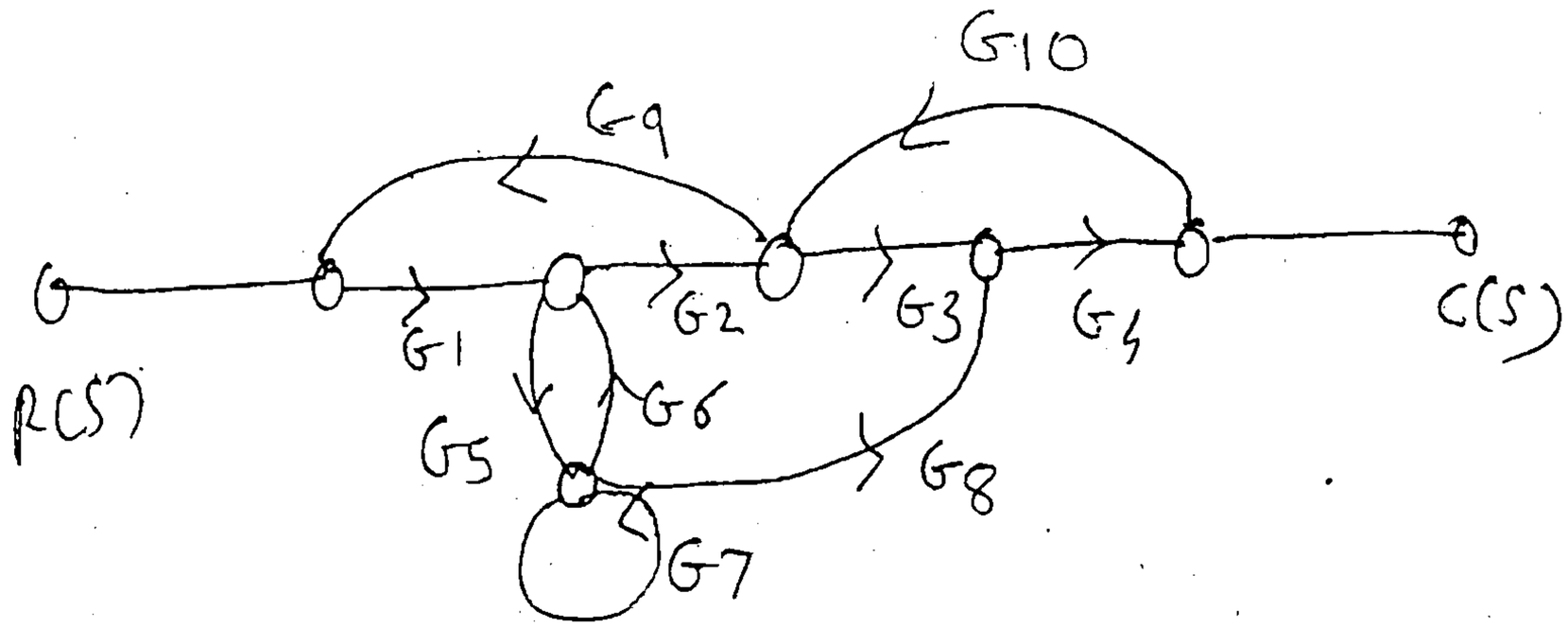
(b) using Mason's gain formula, find C(S)/RCS) of SFG shown in fig. **10**

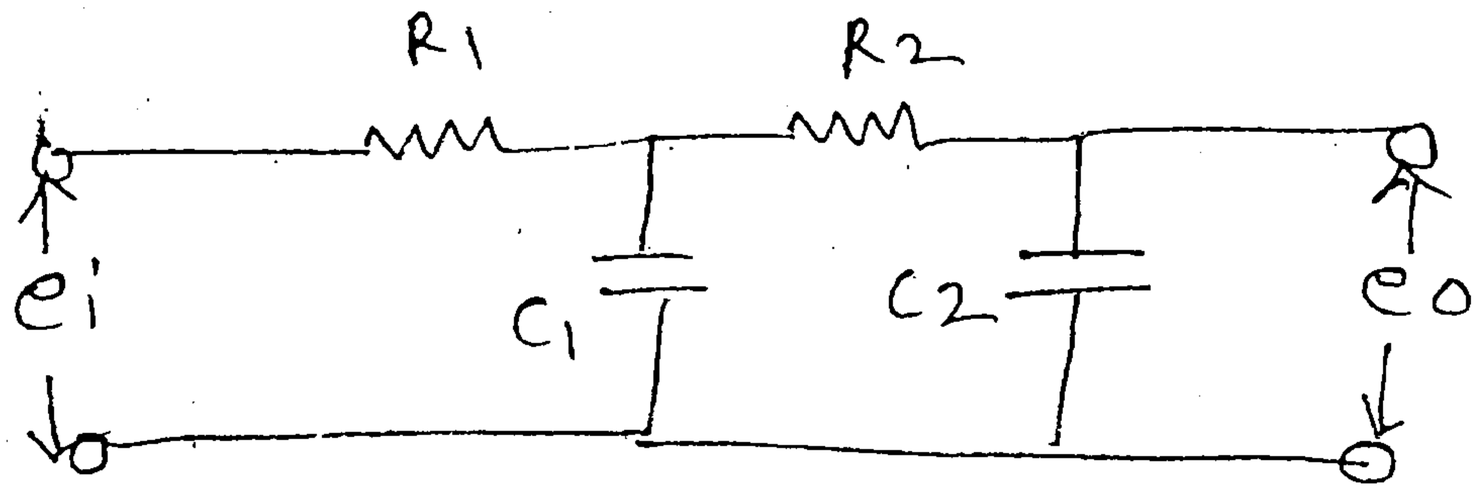


3. (a) Show th epole zero location and the unit step response of the following second order control system - **10**

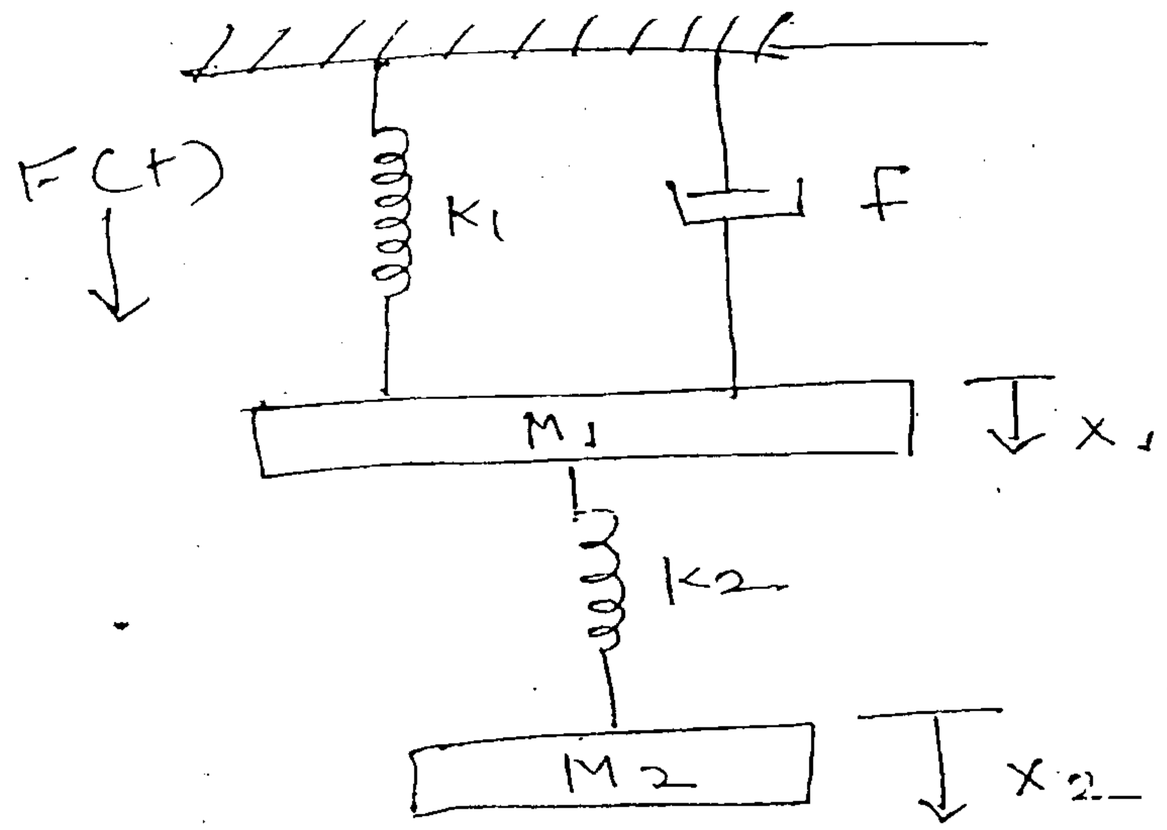
(1) Underdamped
(2) Overdampsed
(3) Critically damped
(4) Undamped

(b) For the Network shown in fig obtain - **10**

(i) Transfer function
(ii) State variable model



4. (a) Write the differential equation for the mechanical system shown in fig and explain force voltage analgy. **10**



(b) The open loop transfer function of a unity feedback system is given by **10**

$$G(S)=\frac{k(s+9)}{s\left(s^2+4s+11\right)}$$

Sketch the Root locus of the system.

5. (a) Sketch the polar plot for the open loop transfer function given by - **10**

$$G(s)\frac{1}{s^2(1+s)(1+2s)}$$

(b) A unity feedback system has **10**

$$G(s)\frac{40(s+2)}{s(s+1)(s+5)}$$

Determine (i) Type of system
(ii) All error coefficients
(iii) Error for ramp I/P with magnitude 3.

6. (a) Sketch the bode plot for the following Transfer function. **10**

$$G(s)=\frac{75(1+0.25)}{s\left(s^2+16s+100\right)}$$

(b) What is Adaptive control ? Explain any one of adaptive control methods. **5**

(c) Explain controllability and observability. **5**

SE-SEM IV (CBGS) EXTC Signals & Systems

QP Code :12561

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

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions **out of** the remaining **five** questions.
(3) Assume suitable **data** wherever **necessary**.

1. (a) Determine the fundamental period of the following signals :— **20**

(i) $x(t) = \cos\frac{\pi}{3}t + \sin\frac{\pi}{4}t$

(ii) $x[n] = \cos^2\frac{\pi}{8}n$

(b) State and prove Time Shifting and Time Scaling property of continuous time Fourier Transform.

(c) For the following system, determine whether it is. (i) memory less, (ii) causal, (iii) linear, (iv) time-invariant $y[n] = x[n^2]$

(d) Find out even and odd component of the following two signals :
(i) $x(t) = t^3 + 3t$
(ii) $x[n] = \cos n + \sin n + \cos(n) \sin(n)$

(e) Determine whether the signals are power or energy signals. Calculate energy / power accordingly :
(i) $x(t) = 0{\cdot}9\, e^{-3t} u(t)$
(ii) $x[n] = u[n]$

2. (a) Find the inverse Laplace Transform of $\frac{s-2}{s(s+1)^3}$ **5**

(b) Let $x(t) = 1 \ldots\ldots 0 \le t \le 2T$ and ; $h(t) = e^{-at} \ldots. 0 \le t \le T$. Compute y(t) using graphical convolution approach. **10**

(c) State and discuss the properties of the region of convergence for Z Transform. **5**

3. (a) An LTI system is characterized by the system function : **10**

$$H(z) = \frac{z}{\left(z-\frac{1}{4}\right)\left(z+\frac{1}{4}\right)\left(z-\frac{1}{2}\right)}$$

Write down possible ROCs. For different possible ROCs, determine causality and stability and impulse response of the system.

(b) Calculate Z transform of the following signals : **10**

(i) $x[n] = n\left(-\frac{1}{4}\right)^n u[n] * \left(-\frac{1}{6}\right)^{-n} u[-n]$

(ii) $x[n] = u[n-6] - u[n-10]$

[TURN OVER

4. (a) For the periodic signal $x(t) = e^{-t}$ with a fundamental period $T_0 = 1$ second. Find the exponential form of Fourier Series. Also plot the Fourier spectrum (Magnitude and phase spectrum) **10**

(b) Consider a continuous time LTI system described by $\frac{dy(t)}{dt} + 2y(t) = x(t)$. Using the Fourier transform, find out output to each of the following input signals. **10**

(i) $x(t) = e^{-t}u(t)$ (ii) $x(t) = u(t)$

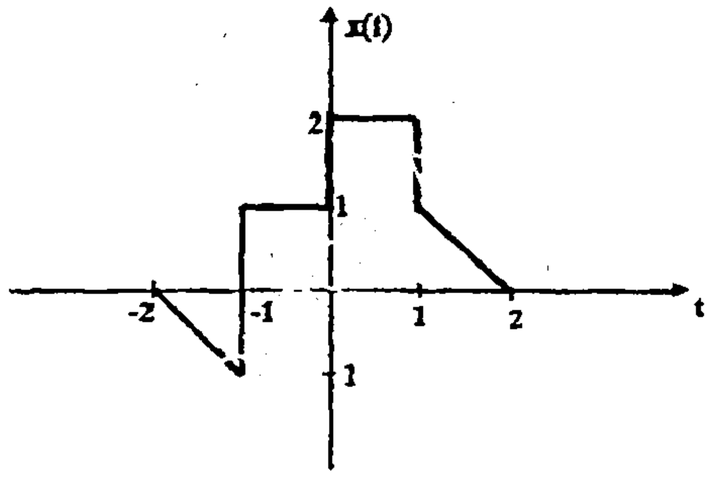
5. (a) Convolve $x[n] = \left(\frac{1}{3}\right)^n u[n]$ with $h[n] = \left(\frac{1}{2}\right)^n u[n]$ using convolution sum formula and verify your answer using z transform. **10**

(b) Explain Gibb's phenomenon. Also explain conditions necessary for the convergence of Fourier Series. **5**

(c) A system is described by the following difference equation. Find out its transfer function H(z). **5**

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

6. (a) For the signal x(t) depicted in the figure given below, sketch the signals : **10**



(i) x (–t)
(ii) x (t + 6)
(iii) x (3t)
(iv) x (t / 2)

(b) For the periodic signal x[n] given below, find out Fourier Series coefficient : **10**

$$x[n] = 1 + \sin\left(\frac{2\pi}{N}\right)n + 3\cos\left[\frac{2\pi}{N}\right]n + \cos\left(\frac{4\pi}{N}n + \frac{\pi}{2}\right)$$

S.E. EXTC IV (CBGS) 9/12/14.
Wave theory & Prop.

QP Code : 12521

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

N.B. : (1) Question No **1** is **compulsory**
(2) Attempt any **three** out of remaining five.
(3) Assume suitable **data** wherever **necessary** and **justify** the **same.**
(4) **Figures** to the right indicate **full** marks.

1. Attempt any four out of the **five** :–
   (a) Write integral from of Ampere's Law and interprete the same. **5**
   (b) Define Intrinsic Impedance. Calcualte its value for free space. **5**
   (c) Give and explain various steps involved in finding characteristic impedance for microstrip line using finite difference Method. **5**
   (d) What do you mean by Depth of pentration. **5**
   (e) What is "loss Tangent". Explain how it classifies lossless dietlectrics, lossy Dielectric and good conductor. **5**

2. (a) Derive Maxwell's equation in point form and integral form. **10**
   (b) Compare FDM, FEM & MOM. **5**
   (c) Compare scalar and vector potential. **5**

3. (a) In certain Medium $\bar{E} = \left[10e^{-0.05x}\sin\left(2\times10^{8}t-2x\right)\right]\bar{a}_z v/m$ Find : **10**
      (a) Propagation constant.
      (b) Wavelength
      (c) Speed of wave
      (d) Skin Depth.
   (b) Derive wave equation for good dielectric medium. **5**
   (c) Give Boundary conditions for Electric and magnetic field for itnerface between good conductor and dielectric. **5**

4. (a) Use method of moment to find the capacitance of parallel plate capacitor of figure 1. Take a = 1 meter; b = 1 meter; d = 1 meter and $\varepsilon_r = 1$. **10**

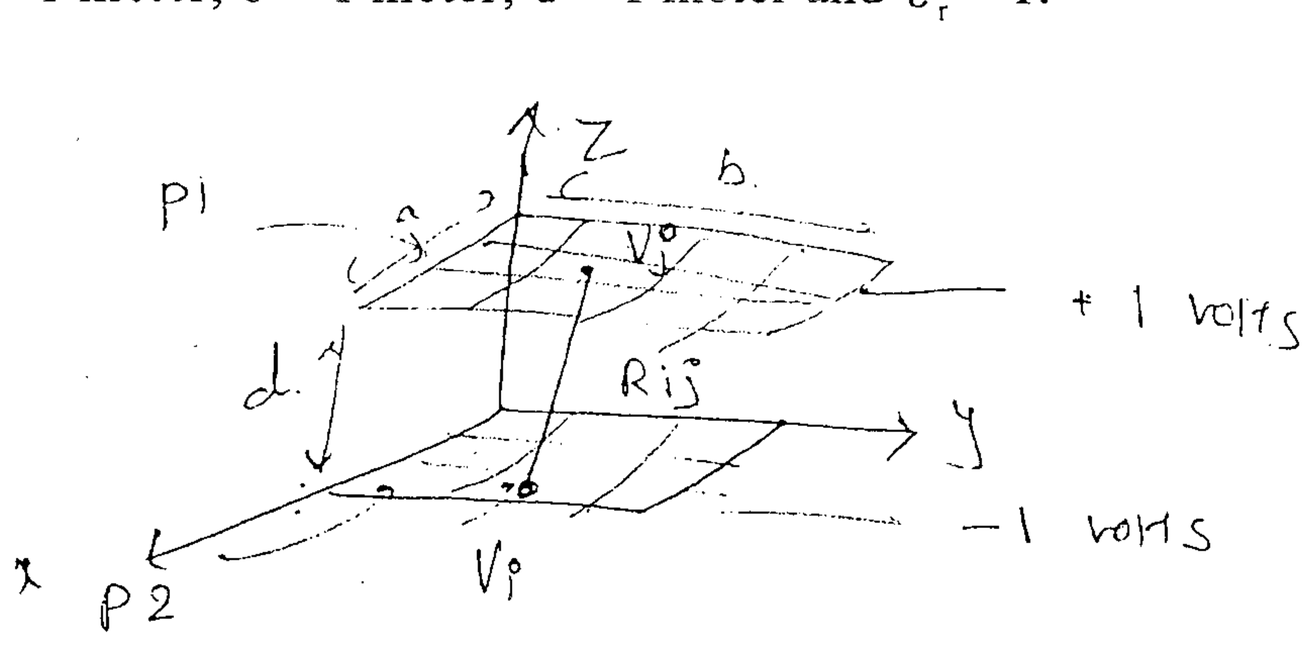


Figure - 1

(b) Derive an expression for magnetic field intensity due to finite long straight element. 10

5. (a) What do you mean by Fading ? How it can be minimized ? 5
(b) Write a short note on Ionospheric Propagation. 5
(c) Explain Super Refraction and Tropospheric Fading. 10

6. (a) Prove that static electric field is irrotational and static magnetic field is solenoidal. 10
(b) Explain Reflection of Uniform Plane wave at Oblique Incidence. 10

B.E. Extc Sem IV
µp & Peripherals
3/12/14

QP Code :12485

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

- **Question number 1 is compulsory**
- **Solve any four out of remaining**

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

Q1 B. Explain Control Word of 8254 Timer. Write control word for Counter 1, Mode-3, R/W MSB, binary counter.(5 marks)

Q1 C. Write features of 80386 microprocessor. (5 marks)

Q1. D. Explain features of coprocessor 8087. (5 marks)

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

Q2 B. Explain modes of PPI 8255. (10 marks)

Q3. A. Draw and explain interfacing of 8086 in maximum mode with 8259 in cascade mode.(10 marks)

Q3 B Explain maximum mode of 8086 microprocessor. Draw timing diagram for write Operation in maximum mode of 8086 and explain it. (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. 16 KB EPROM using 8 K devices
iii. 16 KB SRAM using 8 K devices

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

Q5. B. Which are the different types of interrupt supported by 8086? Explain interrupt vector table of 8086. (10 marks)

Q6. A Write a Program for 8086 microprocessor to exchange memory block of 10 bytes from location 30000 to 40000 (10 marks)

Q6. B. Draw and explain an architecture of 80286 processor. (10 marks)

GN-Con.:9629-14.

B.E EXTC Sem IV (CBGS) (R.T.).

AE-II

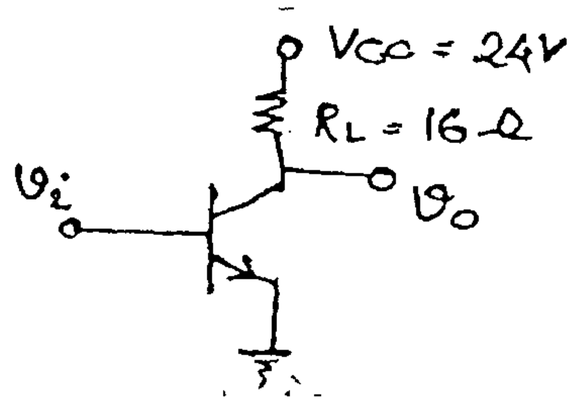
21/11/14.

QP Code : 12422

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

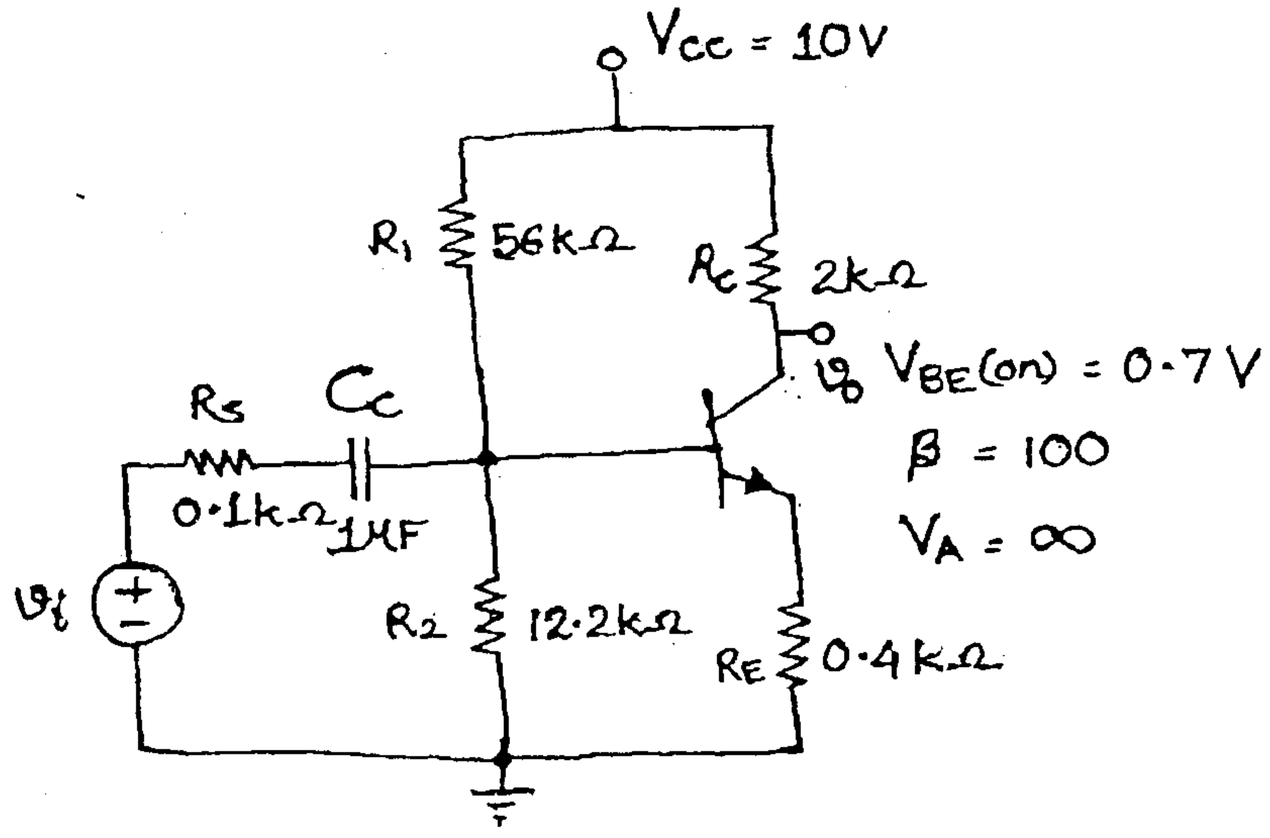
N.B. : (1) Question No. **1** is **compulsory.**
(2) Solve any **three** questions from the remaining **five.**
(3) **Figures** to the right indicate **full** marks.
(3) **Assume** suitable data if required and mention the same in the answersheet.

1. Solve any **five** :— **20**
   (a) Draw the high frequency hybrid -pi equivalent circuit of a BJT and define the various components in the model.
   (b) Define differential and common mode gain, and differential and common mode input impedance of differential amplifiers.
   (c) Draw the circuit diagram and derive the relationship between the output current and reference current for Wilson current source.
   (d) Compare power BJTs and power MOSFETS. Determine the required power rating of a power BJT for the circuit given below.



   (e) List the characteristics of an ideal op-amp and compare with the practical ones.
   (f) With the help of a neat circuit diagram explain the working of transistorized series regulator.

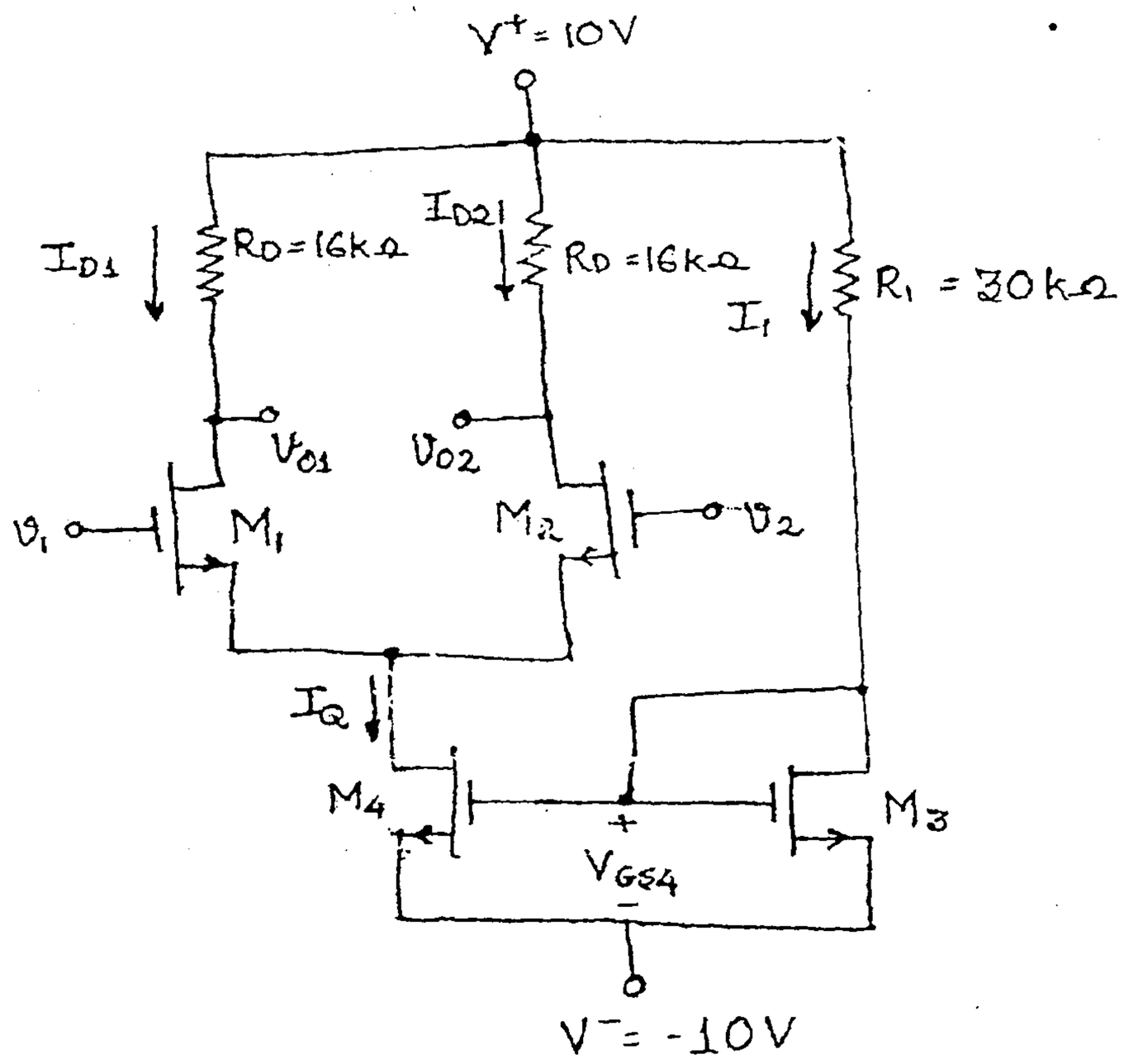
2. (a) Determine the corner frequency and maximum gain of a bipolar common-emitter circuit with an input coupling capacitor. **10**



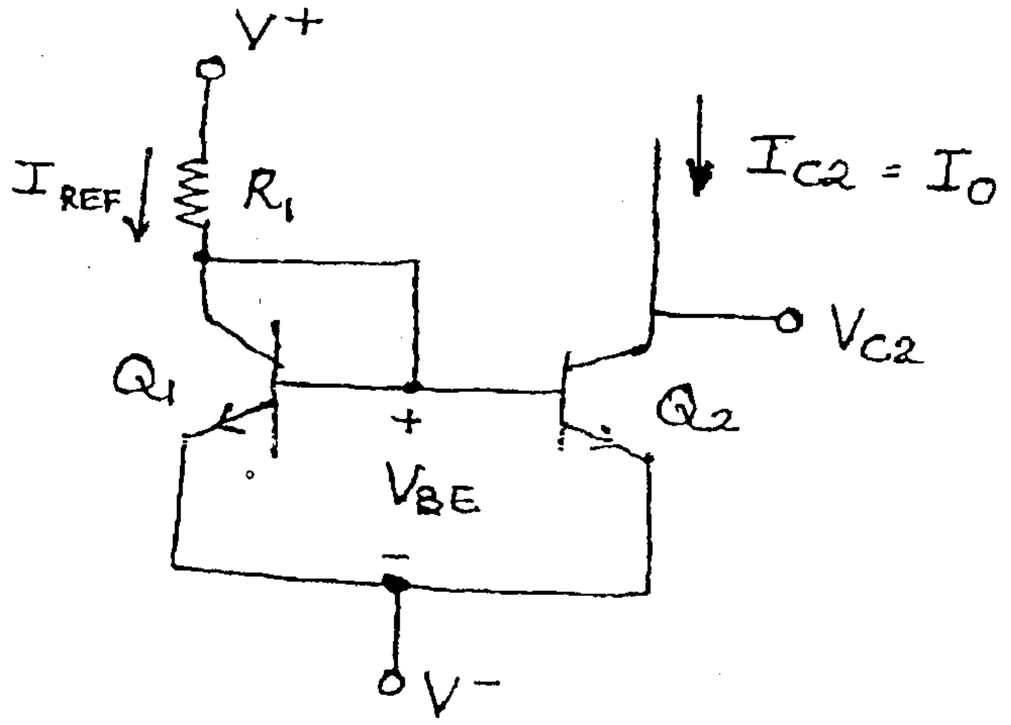
(b) Determine the unity-gain bandwidth of N-channel MOSFET with parameters K_n=0.25 mA/V², V_{TN} = 1V, λ =0, Cgd = 0.04pF, Cgs = 0.2 pF, V_{GS}= 3V. If a 10 kΩ load is connected to the output between drain and source determine the Miller capacitance and cut off frequency. 10

3. (a) Draw the small signal equivalent circuit of the bipolar differential amplifier. Determine its output voltage in the general form for one sided output $V_o = A_d V_d + A_{cm} V_{cm}$, and hence the expressions for differential mode gain and common mode gain. 10

(b) For the MOSFET differential amplifier, the transistor parameters are $K_{n1} = K_{n2}$= 0.1 mA/V², $K_{n3} = K_{n4}$ = 0.3 mA/V², V_{TN}= 1V for all transistors, λ=0 for M_1, M_2 and M_3 and λ = 0.01 V^{-1} for M_4. Determine the bias current I_Q, output resistance of current source, differential-mode voltage gain, common-mode voltage gain and CMRR for the differential amplifier. 10



4. (a) Determine I_{REF} and Io for the two transistor current source. The circuit parameters are V^+ =10V, V^- =0V, R_1 = 15 kΩ and transistor parameters are $V_{BE}(on)$ = 0.7V, β=75, and $V_A = \infty$. 4



(b) Draw a neat diagram of a Widlar current source. Derive the relationship between the reference and bias currents. 8

(c) Draw the circuit diagram and small signal equivalent circuit for a Darlington pair configuration. Derive the expression for its input resistance and overall current gain. 8

5. (a) Define slew rate. With the help of waveforms shown how slew rate affects the output response of an operational amplifier to a rectangular input voltage pulse. If the bias current of an op-amp is 19 μA and its internal frequency compensation capacitor has a value of 30 pF determine its slew rate. 8

(b) Draw the circuit diagram for a summing amplifier and determine the expression of output voltage v_0 in terms of the input voltages v_1, v_2 and v_3, and the resistances used in the circuit. If it is desired to have $v_0 = -(3v_1+4v_2+2v_3)$ find suitable values of these resistances. 8

(c) With the help of VI characteristics of a Zener diode explain the working of a Zener shunt regulator. 4

6. (a) With the help of a neat diagram, dc and ac load lines explain the working of a transformer coupled class A amplifier. What is the effect of the transformer coupling on the power conversion efficiency of the class A amplifier. 8

(b) List the different techniques for biasing the class-AB power amplifier and explain any one them. 8

(c) Differentiate between two transistor and three transistor current sources. 4

GN-Con.:6864-14.

S.E. ETRX & EXTC Sem IV (CBGS)
App. Maths – IV

27/11/14.

QP Code 12440

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

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

1. (a) Find the value of μ which satisfy the equation. $A^{100} x = \mu X$. where **5**

$$A = \begin{bmatrix} 2 & 1 & -1 \\ 0 & -2 & -2 \\ 1 & 1 & 0 \end{bmatrix}$$

(b) Evaluate $\int_0^{1+i} (x^2 + iy)\, dz$ along **5**

$y = x$ and $y = x^2$.

(c) Find the extermal of the function. **5**

$$\int_{x_1}^{x_2} \left[y^2 - y'^2 - 2y \cosh x \right] dx$$

(d) Verify Cauchy–Schwartz inequality for the vectors. **5**
$u = (-4, 2, 1)$ & $v = (8, -4, -2)$

2. (a) Determine the function that gives the shortest distance between two given points. **6**
(b) Find eigen values and eigen vectors of— **6**

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 3 & 4 \end{bmatrix}$$

(c) Obtain Taylor's and two distinct Laurent's series expansion of $f(z) = \dfrac{z-1}{z^2 - 2z - 3}$ **8**

about $z = 0$ indicating the region of convergence.

3. (a) Verify Caley. Hamilen theorem for 6

$$A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$ hence find A^{-2}.

(b) Evaluate by using Residue theorem. 6

$$\int_0^{2\pi} \frac{d\theta}{(2+\cos\theta)^2}$$

(c) Solve the boundary value problem. 8

$$I = \int_0^1 \left(2xy - y^2 - y^{1^2} \right) dx$$

given y (0) = y (1) = 0 by Rayleigh–Ritz method.

4. (a) Reduce the following Quadrate form 6

$$Q = 3x_1^2 + 5x_2^2 + 3x_3^2 - 2x_1x_2 - 2x_2x_3 + 2x_3x_1$$

into cunmical form. Hence find its rank, index and signature.

(b) Show that the matrix $A = \begin{bmatrix} 7 & 4 & -1 \\ 4 & 7 & -1 \\ -4 & -4 & 4 \end{bmatrix}$ is derogatory. 6

(c) (i) Show that the set $W = \{(1, x) \mid x \in R\}$ is a subspace of R^2 under operations 4
$[1, x] + [1, y] = [1, x + y]$; $k\,[1, x] = [1, kx]$; k is any scalar.

(ii) Is the set $W = \{ [a, i, 1] \mid a \in R \}$ a subspace of R^3 under the usual addition 4
and scalar multiplication ?

5. (a) Find the plane curve of fixed Perimeter and maximum area. 6

(b) Construct an orthonormal basis of R^2 by applying Gram schmidt orthogonalization 6
to S = { [3, 1], [2, 2] }

(c) Show that the matrix $A = \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$ is diagonable. Also find diagonal form 8

and diagonalising matrix.

6. (a) Evaluate $\int_{-\infty}^{\infty} \frac{\cos 3x}{(x^2+1)(x^2+4)}\,dx$ using Cauchy Residue Theorem. **6**

(b) If $\phi(\alpha) = \oint_c \frac{ze^z}{z-\alpha}\,dz$ where c is $|z - 2i| = 3$ **6**

find $\phi(1), \phi'(2), \phi(3), \phi'(4)$

(c) Show that the set V of positive real numbers with operations. **8**

Addition : $x + y = xy$

Scalar multiplication : $kx = x^k$.

is a vector space

where x, y are any two real numbers and k is any scalar.
