SE (SEM IV) CCBSGS)
EXTC
CONTROL SYSTEMS
Dt . 12/06/15

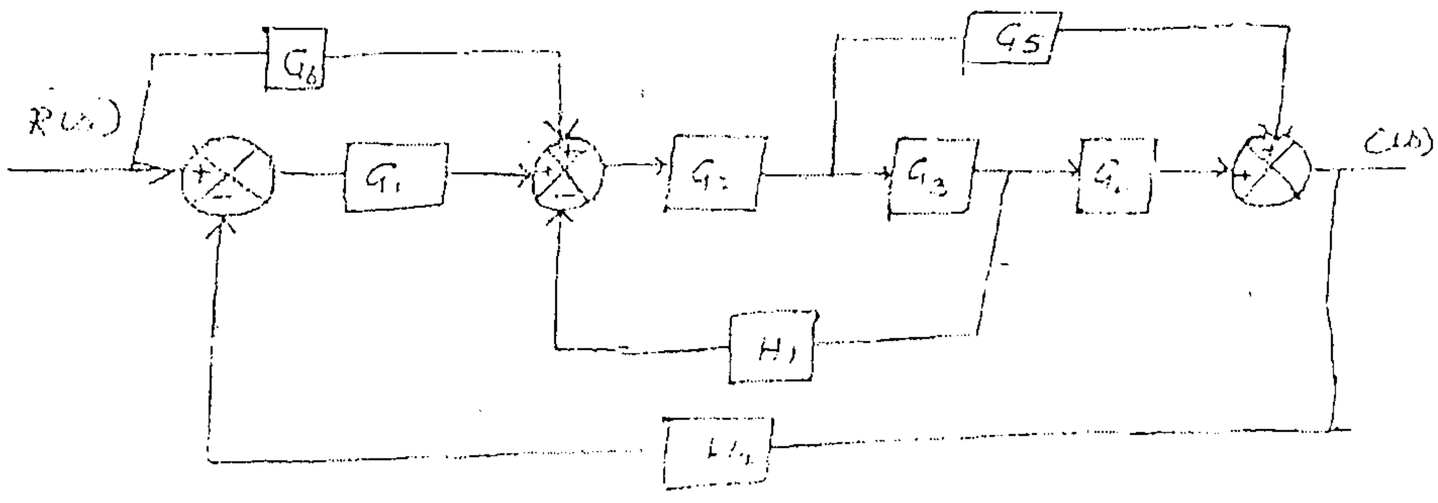
Q.P. Code : 3624

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

N. B.: (1) Question No. 1 is compulsory.
(2) Attempt any three questions from remaining five questions.
(3) Assume suitable data if necessary.
(4) Figures to the right indicate full marks.

1. Attempt the following 20
(a) Differentiate open-loop and closed-loop systems.
(b) Explain Mason's gain formula
(c) What is optimal control? What the advantages and disadvantages of optimal control.
(d) Define gain and phase margin. Explain how to find gain margin and phase margins using polar plot.

2. (a) Find the transfer function of the block diagram shown in figure by using block diagram reduction method 10

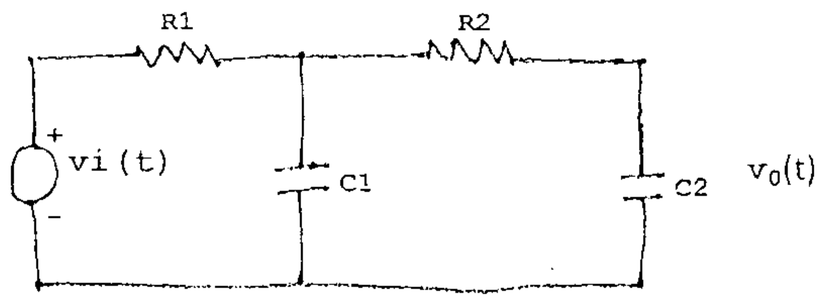


(b) Construct the root locus having following open loop transfer function. 10

$$G(s)H(s) = \frac{K(s+4)}{(s+0.5)^2(s+2)}$$

Find range of K for the system to be stable.

3. (a) Find the transfer function of the electrical network shown in figure. Also obtain the state space model. 10



(b) Check whether the system is stable or not 05

$$s^6 + 3s^5 + 2s^4 + 9s^3 + 5s^2 + 12s + 20 = 0$$

(c) State and prove properties of state transition matrix. 05

[TURN OVER

4. (a) The open-loop transfer function of a control system is 10

$$G(s)H(s) = \frac{0.5s+1}{s(1+0.1s)(1+0.2s)}$$

Determine approximate values of gain and phase margins.

(b) For the system described by the following state equation, determine the step response of the system 10

$$\dot{x} = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix} x + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u; \qquad y = \begin{bmatrix} 0 & 1 \end{bmatrix} u$$

5. (a) Determine the controllability and observability properties of the following system 10

$$\dot{x} = \begin{bmatrix} 1 & 1 & 0 \\ 0 & -2 & 1 \\ 0 & 0 & -1 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \\ -2 \end{bmatrix} u; \qquad y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} x$$

(b) Write a short note on stability analysis using Nyquist criterior. 05

(c) Write a short note on adaptive control. 05

6. (a) Explain the correlation between time and frequency domain specifications. 08

(b) Derive the equation for solution of homogeneous system. 07

(c) Explain different time domain specifications. 05

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S.E. Sem IV (CBGS) (EXTC). 27/5/15.

Microprocessor & peripherals.

QP Code : 3615

Time: 3 Hours **Max. Marks: 80**

Note: **Question number 1 is compulsory.**
Solve any THREE out of remaining.
Assume suitable data if necessary.

Q.1 Attempt any **FOUR**

(A) Explain flag register used in 8085 processor. **(5)**

(B) Explain what is the need and advantages of memory segmentation in 8086 Microprocessor. **(5)**

(C) Explain addressing modes of 8086 Microprocessor. **(5)**

(D) Write a program to blink bit 4 of port C using BSR mode of 8255. **(5)**

(E) Write features of 80486 Microprocessor. **(5)**

Q. 2 (A) Design an 8086 based system with the following specifications. **(20)**

(1) 8086 working at 6 MHz at minimum mode.

(2) 32 KB EPROM using 16 KB devices.

(3) 64 KB RAM using 32 KB devices.

(4) 2, 8-bit i/p & 2, 8-bit o/p ports in Memory mapped I/O.

Design system with absolute decoding. Clearly show memory address map and I/O address map. Draw a neat schematic for chip selection logic.

Q.3 (A) Draw & Explain Interrupt structure of 8086 Microprocessor with its IVT. **(10)**

(B) Draw & Explain interfacing of DAC 0808 with 8086 Microprocessor using 8255. Write a program to generate square wave. **(10)**

Q.4 (A) Explain interfacing of 8087 co-processor with 8086 Microprocessor. **(10)**

(B) Draw timing diagrams of memory read & memory write machine cycles for maximum mode of 8086 Microprocessor. **(10)**

Q.5 (A) Explain MODE 0 and MODE 1 of 8254 Timer/Counter peripheral IC with the help of timing diagram. **(10)**

(B) Explain different modes of operation of 8257 DMA controller. **(10)**

Q.6 (A) Write a program for 8086 Microprocessor to multiply two 32-bit numbers (12345678 X 87654321). **(10)**

(B) Write a program for 8086 Microprocessor to find out smallest number in an array of 10 numbers. **(10)**

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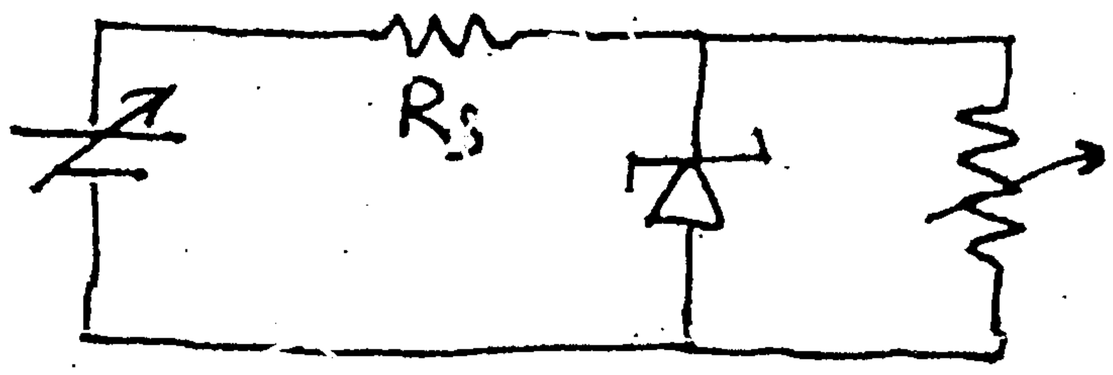
S.E. (EXTC) – IV (CBSGS) 15/5/201
A.E – II

Q.P. Code : 3610

(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 mentain the same in answer sheet.

1. (a) Define the CMRR of Differential Amplifier ? Why constant current source biasing is preferred for Differential Amplifier. **20**
(b) What is the major limitations of class B power amplifier and how to overcome the same ?
(c) Draw high frequency hybrid pi equivalent circuit of a BJT and define various components in the model.
(d) Draw the circuit diagram of widlar current source and derive the relationship between output current and referrence current.
(e) A zener voltage regulator as shown below has Vz = 6.2 V. The input voltage varies from 10V to 15V and load current is 50 mA. To hold output voltage constant under all conditions what should be the range of series resistance (Rsmin and Rsmax)
(Izmin = 10 mA , Pz max = 2W)



(f) Draw subtractor using OPAMP and also derive expression for its output voltage

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2. (a) For the circuit shown in **Fig.2a** The transistor parameters are $V_{BE(ON)}$ = 0.7V , β = 100 , $C\pi$ = 2 pf , $C\mu$ = 0.2 pF. Find lower cut off frequency, higher cut off frequency and bandwidth of circuit. **10**

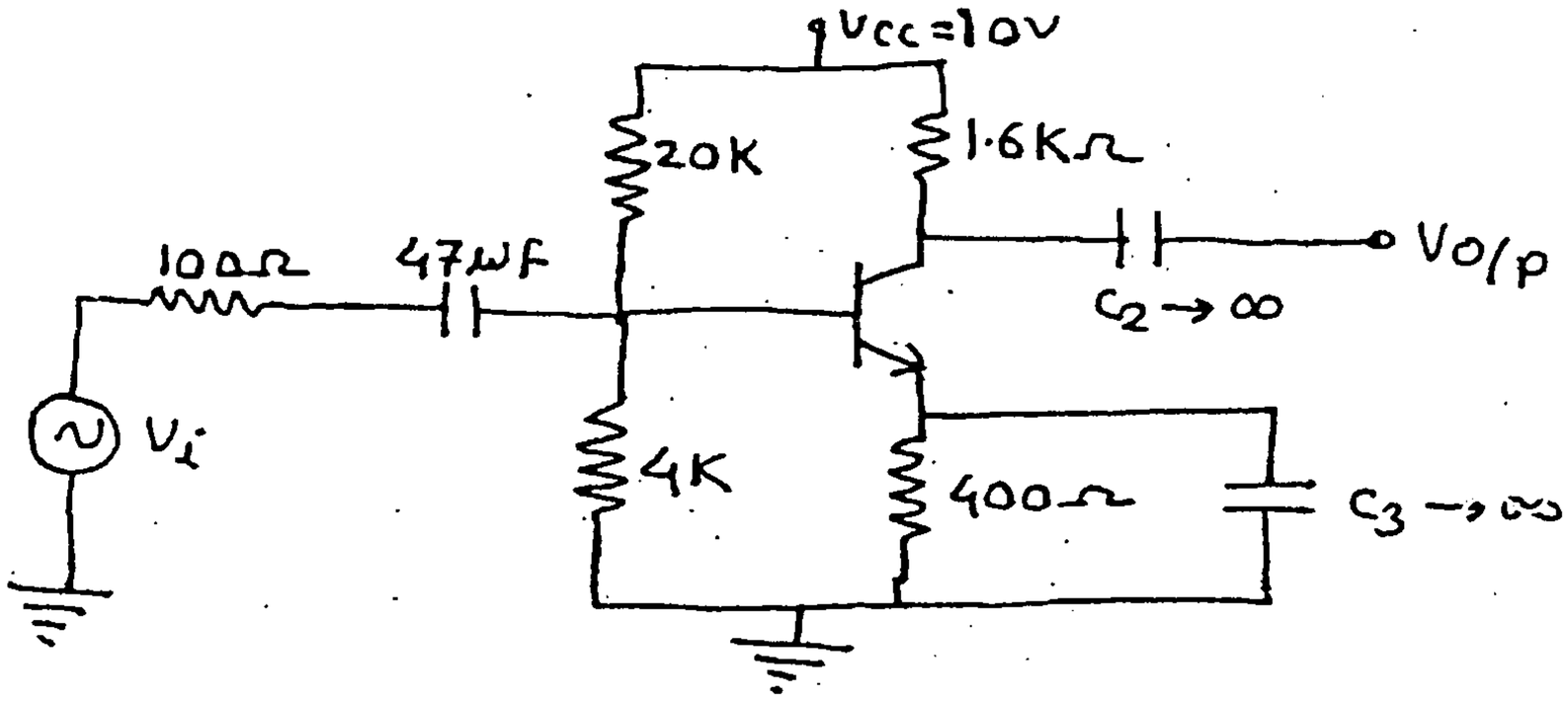


Fig.2a

(b) Draw the circuit diagram of MOSFET based differential amplifier and derive the expression for differential gain, common mode gain and CMRR. **10**

3. (a) For the circuit shown in **Fig.3a** Transistors parameters are Kn = 1m A/V² ,Vtn = 0.7V , Cgs = 2 pF , Cgd = 0.2 pF λ = 0. Find the miller capacitance, mid band voltage gain and upper cut off frequency. **10**

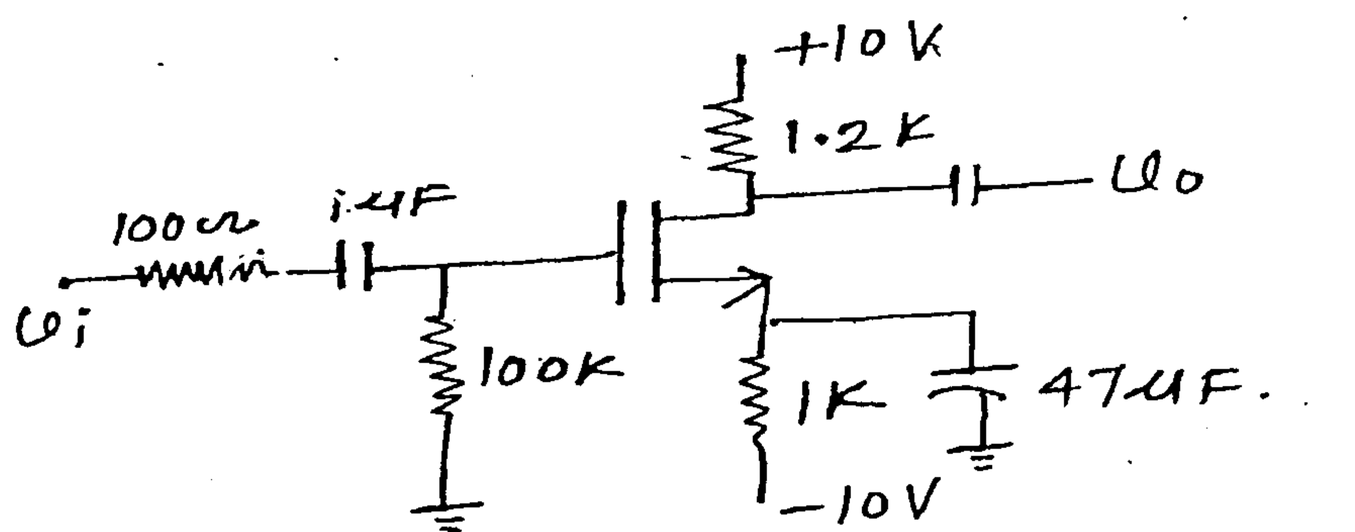


Fig.3a

(b) What are the ideal characteristics of OPAMP and also explain effect of high frequency on OPAMP gain and phase. **5**

[TURN OVER

(c) Draw the circuit of V_{BE} multiplier biased class AB amplifier and explain the working and advantages of V_{BE} multiplier biased class AB amplifier. 5

4. (a) Determine overall input resistance and output resistance of the circuit as shown in **Fig 4a.** For both transiters β =120. 10

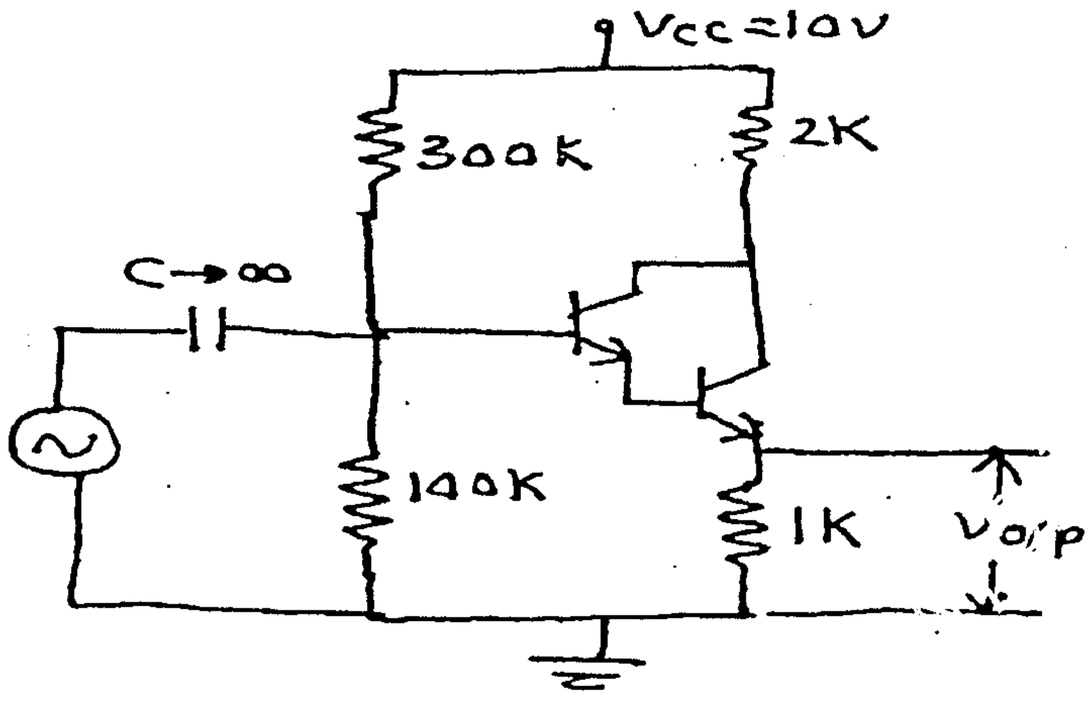


Fig 4a

(b) For the circuit shown in **Fig 4b** transistor parameters are $\beta = 100$, $V_{BE(ON)} = 0.7$ V, VA = ∞. The constant source has a finite output resistance of 100 K. 10

Find : (a) Differential and common mode input resistance.

(b) Find Ad , Ac, and CMRR of the circuit.

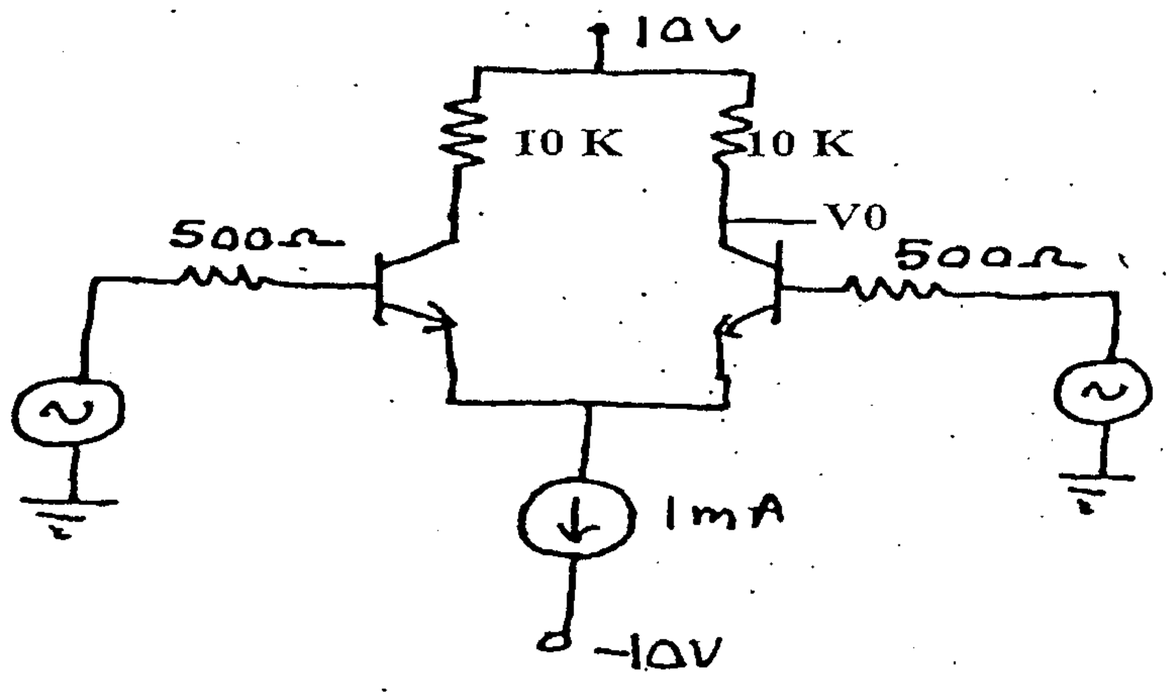


Fig 4b

5. (a) Draw the circuits of OPAMP based differentiator circuit and derive the expression for output voltage. What are the limitations of ideal differentiator circuit and how to overcome the limitations ? **10**

(b) In the MOSFET cascode current source shown in the **Fig.5b** all transistors are identical with parameters. **10**

$V_{TN} = 1V$, $Kn = 80\ \mu A/V^2$ and $\lambda = 0$.

Let $I_{REF} = 20\ \mu A$. The circuit is biased at $V^+ = 5V$ and $V^- = -5V$ determine

(i) V_{GS} of each transistors.

(ii) The lowest possible voltage value of V_{D4}.

(iii) Output resistance Ro.

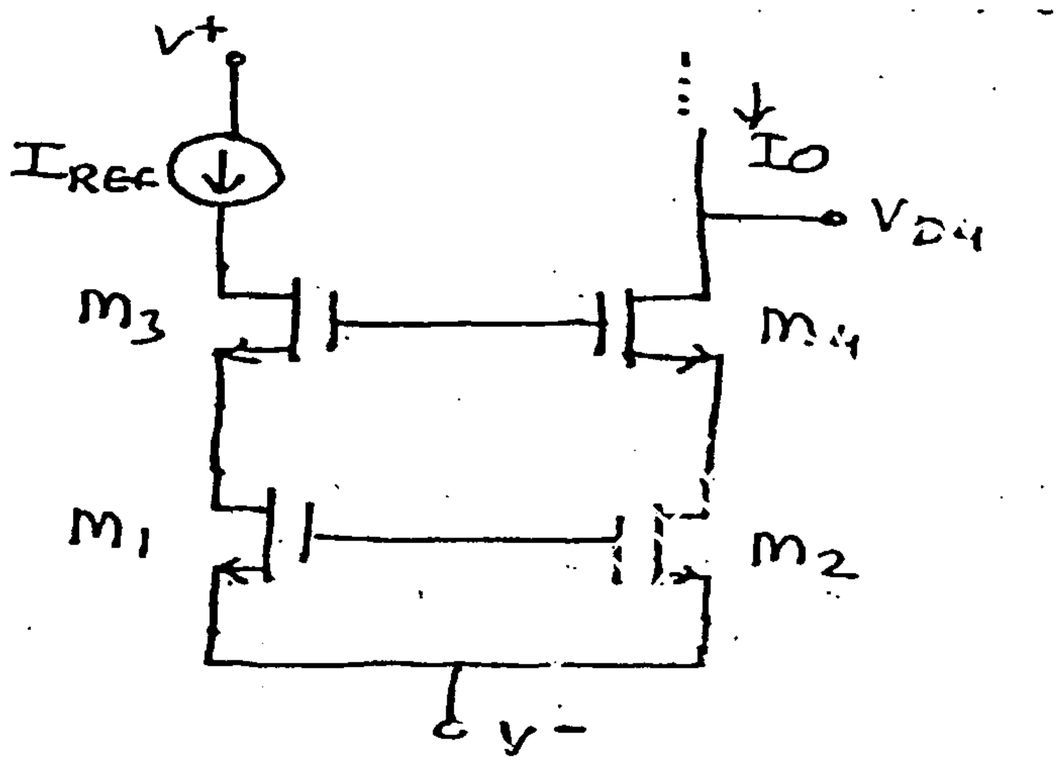


Fig.5b

6. Write short note on (Any **three**) :- **20**

(a) Series voltage regulator

(b) Class AB power amplifier

(c) Active filters

(d) Power MOSFET.

S.E. (sem. IV) – CBGS – EXTC 02/06/2015

Wave Theory & Propagation

Q.P. Code : 3618

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

N.B.: (1) Questions No. **1** is compulsory.
(2) From remaining **five** questions solve any **three.**
(3) Use suitable data, whenever **required.**

1. (a) Give significance of boundary conditions for electric field. **20**
(b) Can you use CRO to measure the ratio of charge & mass of electron?
(c) Give behaviour of wave for normal incidence in dielectric media.
(d) Why do we need numerical techinques to solve field problems.

2. (a) Explain plane earth reflection on horizontally polarized & vertically polarized wave. **10**

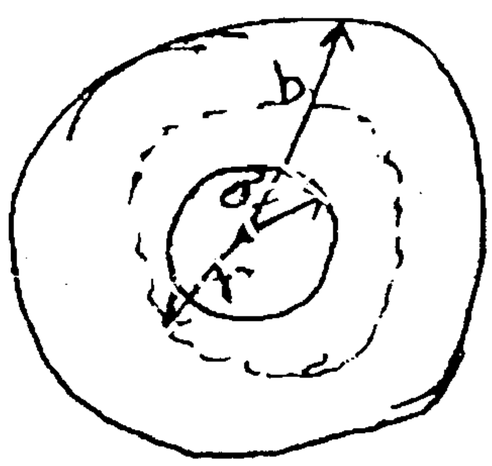
(b) Derive relation between MUF & Skip distance. **10**

3. (a) In non-magnetic medium **10**

$$\bar{E} = 4\sin\left[2\pi \times 10^7 t - 0.8x\right]\bar{a}_z \text{ V/meter. Find}$$

(i) ε_r ;η
(ii) The time average power carried by the wave.
(iii) The total power crossing 100 cm^2 of plane $2x + y = 5$

(b) Determine potential at 2.8cm from the center of co axial cable as shown in figure 1 by using FEM. There is no free charge between inner & outer sheaths of coaxial cable. **10**



a = 1.5 cm.
b = 4.4 cm
r = 2.8 cm

Figure 1

4. (a) Explain parallel & perpendicular polarization of wave. **8**

(b) A uniform plane wave in air with $\bar{E} = 8\cos\left[\omega t - 4x.3z\right]\bar{a}_y$ volt / meter is incident on dielectric slab [$z \geq 0$] with $\mu r = 1$, $\varepsilon_r = 2.5$, $\sigma = 0$ **6**
Find
(i) Polarization of wave.
(ii) The Angle of incidence

(c) Explain Ray path & critical frequency. **6**

5. (a) What is the advantage of using a traingular mesh in the FEM 5

(b) Give the solution of wave equation for free space. 5

(c) Solve Laplace's equation $\overline{V}^2 V = 0$ 10
$0 \leq x \leq 1$; $0 \leq y \leq 1$ with
$V(x, 1) = 45\, x\, (1 - x)$;
$V(x, 0) = V(0, y) = V(1, y) = 0$
Assume mesh size as 0.5

6. (a) Write maxwell's equation in a) point form b) integral form 10
Explain the significance of each equation.

(b) State poynting theorem. What is poynting vector? 5

(c) What is a magnetic dipole? How does a magnetic dipole differ from electric dipole. 5

SE (Sem IV) CBSGS EXTC | signals & systems |

8 ~~May~~ 2015
08 June 2015

Q.P. Code : **3621**

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

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

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

(i) $x(t) = 14 + 40\cos(60\pi t)$ (ii) $x[n] = \cos^2\left[\frac{\pi}{4}n\right]$

(b) Compare the nature of ROC of Z transform and Laplace transform.

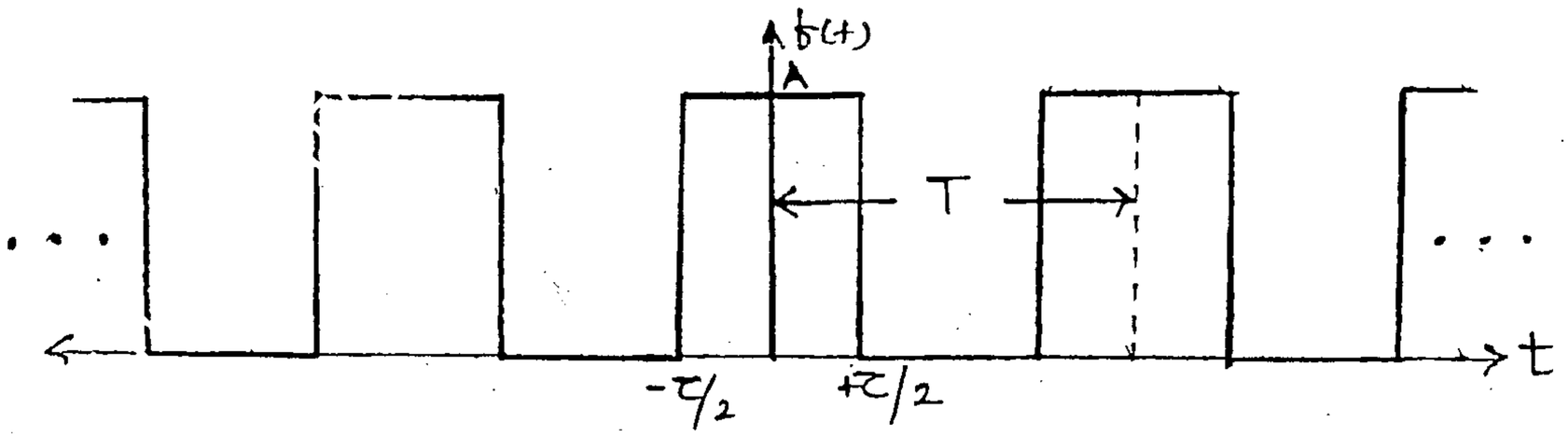
(c) For the given system, determine whether it is,
(i) memory less (ii) causal
(iii) linear (iv) time-invariant
$y[n]=x[-n]$

(d) Find out even and odd component of the following two signals.

(1) $x(t) = \cos^2\frac{\pi t}{2}$ (2) $x(t) = \begin{cases} t \ldots\ldots & 0 \le t \le 1 \\ 2-t \ldots\ldots & 1 < t \le 2 \end{cases}$

(e) Determine whether the signals are power or energy signals. Calculate energy/ power accordingly.
(i) $x(t)= Ae^{-\alpha t}u(t)$ .....$\alpha>0$ ii) $x[n]=u[n]$

2. (a) Expand the periodic gate function as shown in the figure by the exponential Fourier Series. Also plot the Fourier spectrum (Magnitude and phase spectrum). **10**



(b) Find the inverse Laplace Transform of the following. **10**

(i) $X(S) = \frac{s-3}{s^2+4s+13}$

(ii) $X(S) = \frac{5s^2-15s-11}{(s+1)(s-2)^3}$

3. (a) Obtain inverse Laplace transform of the function 10

$$X(s) = \frac{3S + 7}{s^2 - 2s - 3}$$

Write down and sketch possible ROCs. Find out inverse Laplace for all the possible ROCs.

(b) Using the z transform method, solve the difference equation 10

$y[n] - 4y[n-1] + 4y[n-2] = x[n] - x[n-1]$

When $y(-1) = y(-2) = 0$

4. (a) Explain Gibbs phenomenon. Also explain conditions necessary for the convergence of Fourier Series. 5

(b) Find out Fourier Transform of $f(t) = 10\,\delta(t-2)$. Sketch its amplitude and phase spectrum. 5

(c) Perform convolution of

(i) $2u(t)$ with $u(t)$ 2

(ii) $e^{-2t}\,u(t)$ with $e^{-5t}\,u(t)$ 4

(iii) $tu(t)$ with $e^{-5t}\,u(t)$ 4

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 Fourier transform. 10

(b) A system is described by the following difference equation. 10

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

Determine the following

(i) The system Transfer function H(z)

(ii) Impulse response ofthe system h[n]

(iii) Step response of the system s[n]

6. (a) A discrete time signal is given by $x[n] = \{1,1,1,1,2\}$ (↑ at 2). Sketch the following signals. 10

(a) x[n] (b) x[n–2] (c) x[n]•u[n–l]

(d) x[3–n] (e) x[n–l]•δ[n–l]

(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. (ETRX/EXTC) Sem IV CBGS
AM IV
21st May 2015

QP Code : 3488

(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) Figures to right indicate full marks.

Q1. (a) Evaluate $\int_c |z|\,dz$, where c is the left half of unit circle $|z|=1$ from $z=-i$ *to* $z=i$ 5

(b) If λ is an Eigen value of the matrix A with corresponding Eigen vector X, prove that λ^n is an Eigen value of A^n with corresponding Eigen vector X. 5

(c) Find the extremal of $\int_{x_1}^{x_2} \frac{\sqrt{1+y'^2}}{x}dx$ 5

(d) Find the unit vector orthogonal to both $[1,1,0]$ & $[0,1,1]$ 5

Q2. (a) Find the curve on which the functional $\int_0^1 \left[y'^2+12xy\right]dx$ with $y(0)=0$ & $y(1)=1$ can be Extremised. 6

(b) Find the Eigen values and Eigen vectors for the matrix $\begin{bmatrix}2&2&1\\1&3&1\\1&2&2\end{bmatrix}$ 6

(c) Obtain two distinct Laurent's series expansions of $f(z)=\frac{2z-3}{z^2-4z+3}$ in powers of $(z-4)$ indicating the region of convergence in each case 8

Q3. (a) If $A=\begin{bmatrix}2&1\\1&2\end{bmatrix}$, find A^{50} 6

(b) Evaluate $\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)}\,dz$, where c is the circle $|z|=3$ 6

(c) Using Rayleigh-Ritz method, find an approximate solution for the extremal of the functional $I(y)=\int_0^1 \left(y'^2-2y-2xy\right)dx$ subject to $y(0)=2,\ y(1)=1$. 8

Q4. (a) Find the vector orthogonal to both $[-6,4,2]$ & $[3,1,5]$ 6

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

(c) Reduce the matrix of the quadratic form $6x_1^2+3x_2^2+3x_3^2-4x_1x_2+4x_1x_3-2x_2x_3$ to canonical form through congruent transformation and find its rank, signature, and value class. 8

Q5. (a) Find the extremal of $\int_{x_0}^{x_1}\left(2xy-y''^2\right)dx$ 6

(b) Show that the set $W=\{[x,y,z] \mid y=x+z\}$ is a subspace of $\mathbf{R^n}$ under the usual addition and scalar multiplication. 6

(c) Show that the following matrix $A=\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ is diagonalisable. Also find the diagonal form and a diagonalising matrix. 8

Q6. (a) If $f(a)=\int_c \frac{3z^2+7z+1}{z-a}\,dz$, where c is a circle $|z|=2$, find the values of i) $f(-3)$, ii) $f(i)$, iii) $f'(1-i)$ 6

(b) Evaluate $\int_0^{2\pi}\frac{d\theta}{13+5\sin\theta}$ 6

(c) Verify Cayley-Hamilton theorem for the matrix A and hence find A^{-1} and A^4.

Where $A=\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ 8
