SE/SEM-IV(CBSGS)/ETRX, INST/Applied Mathematics IV/Nov-1
& EXTC

Q. P. Code : 545800

Duration: 3 Hours (Revised Course) Total Marks: 80

N.B. : 1) Q.1. is compulsory.

2) Attempt any three from the remaining.

Q.1. a) If $f(x)$ is an algebraic polynomial in x and λ is an eigen value and X is the corresponding eigen vector of a square matrix A then $f(\lambda)$ is an eigen value and X is the corresponding eigenvector of $f(A)$. (5)

b) Find the extremal of $\int_{x_0}^{x_1}(x+y')y'dx$ (5)

c) Express $(6,11,6)$ as linear combination of $v_1=(2,1,4), v_2=(1,-1,3), v_3=(3,2,5)$. (5)

d) Evaluate $\int_C \frac{z}{(z-1)^2(z-2)}dz$, where C is the circle |z-2|=0.5 (5)

Q.2. a) Find the curve $y=f(x)$ for which $\int_0^{\pi}(y'^2-y^2)dx$ is extremum if $\int_0^{\pi} ydx=1$. (6)

b) Evaluate $\int_0^{2\pi}\frac{\cos 3\theta}{5+4\cos\theta}d\theta$ (6)

c) Find the singular value decomposition of $\begin{bmatrix}2 & 3\\ 0 & 2\end{bmatrix}$ (8)

Q.3. a) Verify Cayley Hamilton theorem for $A=\begin{bmatrix}3 & 10 & 5\\ -2 & -3 & -4\\ 3 & 5 & 7\end{bmatrix}$ and hence, find the matrix represented by $A^6-6A^5+9A^4+4A^3-12A^2+2A-I$. (6)

b) Construct an orthonormal basis of R^3 using Gram Schmidt process to S={(3,0,4),(-1,0,7),(2,9,11)} (6)

c) Find all possible Laurent's expansions of $\frac{z}{(z-1)(z-2)}$ about $z=-2$ indicating the region of convergence. (8)

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Q.4. a) Reduce the quadratic form $2x^2 - 2y^2 + 2z^2 - 2xy - 8yz + 6zx$ to canonical form and hence, find its rank, index and signature and value class. (6)

b) If $\phi(\alpha) = \int_C \frac{4z^2 + z + 5}{z - \alpha} dz$, where C is the contour of the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$, find the values of $\phi(3.5), \phi(i), \phi'(-1), \phi''(-i)$ (6)

c) Using Rayleigh–Ritz method , solve the boundary value problem $I = \int_0^1 (y'^2 - y^2 - 2xy)dx;$ $0 \le x \le 1$, given $y(0) = y(1) = 0$. (8)

Q.5. a)Find the extremal of the function $\int_0^{\pi/2} (2xy + y^2 - y'^2)dx$; with $y(0) = 0, y(\pi/2) = 0$ (6)

b) Find the orthogonal matrix P that diagonalises $A = \begin{bmatrix} 4 & 2 & 2 \\ 2 & 4 & 2 \\ 2 & 2 & 4 \end{bmatrix}$ (6)

c) Using Cauchy's Residue theorem, evaluate $\oint_C \frac{z^2 + 3}{z^2 - 1} dz$ where C is the circle (i)$|z - 1| = 1$ (ii) $|z + 1| = 1$. (8)

Q.6. a) Find the sum of the residues at singular points of $f(z) = \frac{z}{(z-1)^2(z^2-1)}$ (6)

b) If $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$, prove that $A^{50} - 5A^{49} = \begin{bmatrix} 4 & -4 \\ -2 & 2 \end{bmatrix}$ (6)

c) (i) Check whether W={(x,y,z)|y=x+z, x,y,z are in R} is a subspace of R^3 with usual addition and usual multiplication. (4)

(ii) Find the unit vector in R^3 orthogonal to both u=(1,0,1) and v=(0,1,1). (4)

S.E. / SEM IV (CBSGS) / EXTC / NOV '16.

ANALOG ELECTRONICS II

QP CODE : 545704

(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
(4) Assume suitable data if required and mention the same in the answer sheet.

1. Solve any five:- 20

(a) Compare series and shunt voltage regulators
(b) Differentiate between two transistor(BJT) and three transistor (BJT) current sources
(c) What is cross-over distortion? How it is overcome.
(d) Derive expression for the output voltage of differentiator.
(e) BJT has parameters f_T=200MHz at I_C=1.5mA, β=200,C_μ=0.2pF. Calculate bandwidth f_β and capacitance C_π of BJT.
(f) Draw and explain in brief frequency response of Common Emitter Amplifier.

2. (a) In the common-base circuit shown in Fig 2a, the transistor parameters are: β=100, V_{BE}(on)=0.7V, V_A=∞, Cπ=10pF and Cμ=1pF. (i) Determine the higher cut off frequencies corresponding to the input and output portions of the equivalent circuit. (ii) Calculate the small signal mid band voltage gain. 10

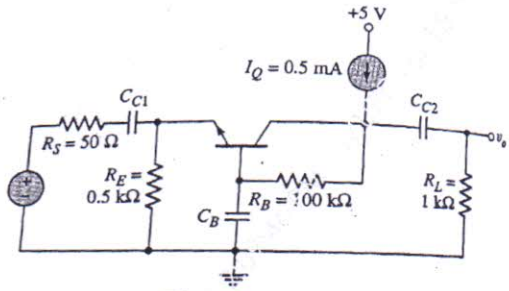

Fig 2a

2. (b) For the circuit in Fig 2b, the transistor parameters are: Kn=1mA/V^2, V_{TN}=0.8V, Cgs=2pF and Cgd=0.2pF. Determine: (i) the Miller Capacitance (ii) the higher cut-off frequency (iii) the mid band voltage gain 10

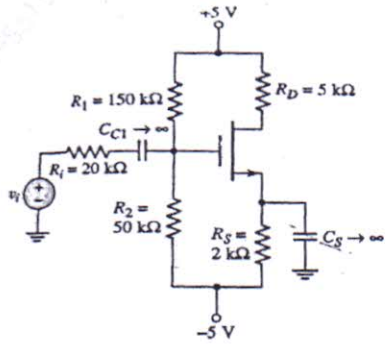

Fig. 2b

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3. (a) Draw circuit diagram of two stage Common Emitter Amplifier (CE-CE) and derive expression for overall voltage gain, current gain, input resistance and output resistance using hybrid-π equivalent circuit. 10

3. (b) The transistor parameters for the circuit shown in Fig 3b are: β =100, $V_{BE}(on)$=0.7V, and V_A=∞. (i) Determine R_E such that I_E=150μA. (ii) Find differential gain Ad, Common Mode gain Ac for one sided output at Vo_2. 10

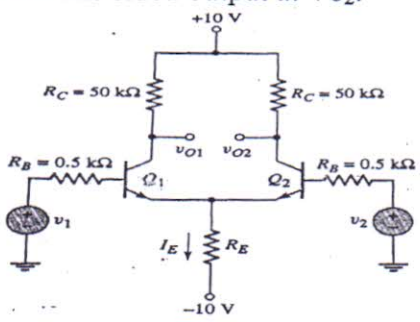

Fig 3b

4. (a) Explain working of first order low pass filter with help of circuit diagram and also derive expression for its voltage gain and cut-off frequency. 10

4. (b) Explain working of transformer coupled Class-A power Amplifier and derive expression for its efficiency. 10

5. (a) Draw circuit diagram of subtractor using OpAmp and derive expression for its output voltage. 10

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

6. Write short notes on any four 20
   (a) Darlington Configuration
   (b) Transistorized series regulator
   (c) Widlar Current sources
   (d) Cascode Amplifier
   (e) Class AB Power Amplifier

EXTC | Sem-IV(CBSGS) | Microprocessors & Peripherals. | Nov. 16.

Q.P. Code : 545901

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

N.B. : (1) Q 1 is compulsory. Solve any 3 questions out of remaining

1. (a) Write features of 80486. **4**
   (b) Differentiate between minimum and maximum modes of 8086. **4**
   (c) Describe pin diagram of 8085 microprocessor. **4**
   (d) Sketch read and write bus cycle of 8086 with example. **4**
   (e) Explain in brief about programmable peripheral interface 8255. **4**

2. (a) Describe the various addressing modes supported by 8086 with examples. **10**
   (b) Explain with suitable examples the following instructions of 8086. **10**
   i) CBW ii) TEST iii) LAHF iv) XLAT v) LEA

3. (a) Write an assembly language program of 8086 to find out factorial of number N and also draw Flowchart. **10**
   (b) Discuss the functions of general purpose registers of 8086. Explain the function of each register and instruction support for these functions. **10**

4. (a) Describe the function of following pins in 8086 Microprocessor. **10**
   1) NMI 2) READY 3) ALE 4) QS0 and QS1 5) S0, S1, S2
   (b) Explain pin diagram of ADC 0808/0809 and method of interfacing to 8086 microprocessors. **10**

5. Design 8086 microprocessor based system using minimum mode with the following specifications. **20**
   (i) 8086 microprocessors working at 10 MHz
   (ii) 32Kb EPROM using 8 k Devices
   (iii) 32 Kb SRAM using 8 k devices
   Clearly show memory map with address range. Draw the neat schematic.

6. (a) Explain direct memory access (DMA) controller 8257 and its method of interfacing with 8086 microprocessor with a suitable example. **10**
   (b) Describe in brief and compare architecture of 80286 and 803 86 microprocessors. **10**

S.E/EXTC/SEM IV (CBSGS) NOV/DEC'16

WAVE THEORY & PROPAGATION

QP CODE : 546003

(3 Hours) (Total Marks : 80)

NOTE :

1. Question No.**1**. is **compulsory**. Attempt any **four** out of **five** in it.
2. Attempt any **three** out of remaining **five**.
3. Assume suitable data, wherever **necessary** and **justify** the same.
4. Figures to the right indicate marks.

1. **A)** Given the potential $V = 2x^2y - 5z$ (V) and a point P (-4, 3, 6), find **(2+2+1)**
   a) Electric field intensity at P
   b) Electric flux density at P
   c) Volume charge density at P

   B) State the Maxwell's equations for good dielectric in integral and point form. Also state their significance. **(5)**

   C) Explain Super refraction. **(5)**

   D) With the help of neat schematic diagram, explain the working of an Electromagnetic Pump. **(5)**

   E) Compare MOM, FEM and FDM. **(5)**

2. **A)** Two extensive homogeneous isotropic dielectrics meet on plane $z = 0$. **(5+5)**
   For $z > 0$, $\varepsilon_{r1} = 4$ and for $z < 0$, $\varepsilon_{r2} = 3$.
   A uniform electric field $\vec{E}_1 = 5\hat{a}_x - 2\hat{a}_y + 3\hat{a}_z$ (kV/m) exists for $z \geq 0$. Find,
   a) $\vec{E}_2$ for $z \leq 0$.
   b) The angles E_1 and E_2 make with the interface.

   B) State Poynting theorem. Write its final expression and explain the meaning of each term. **(5)**

   C) Obtain the reflection and transmission coefficient of a perpendicular polarized wave incident between a dielectric-dielectric boundary with an oblique incidence. **(5)**

3. **A)** Determine the potential at the free nodes in the potential system of Fig.1. using Finite Difference Method (Band Matrix Method). **(10)**

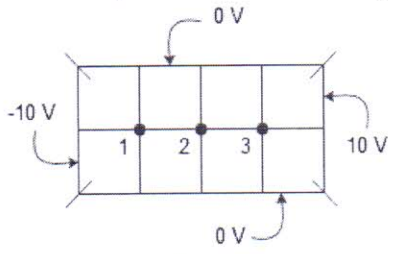

Fig.1.

B) Derive Helmholtz equations for electromagnetic fields in free space. **(5)**

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C) For the normal incidence, determine the amplitudes of reflected and transmitted $\vec{E}$ and $\vec{H}$ at interface of two regions at $z = 0$. Given: Incident $E_i = 1.5 \times 10^{-3}$ (V/m); $\varepsilon_{r1} = 8.5$; $\mu_{r1} = 1$; $\sigma_1 = 0$. Second region is free space. (5)

4. A) State and derive FRISS transmission equation. (10)

B) Calculate skin depth and wave velocity at 1.6 MHz in aluminum with the conductivity 38.2 mS/m and $\mu_r = 1$. (5)

C) What is ionosphere? Which layers are present during day and night time? Where maximum attenuation of electromagnetic waves takes place inside the ionosphere? (5)

5. A) Obtain an expression for MUF in terms of d, H and f_c. (5+5)
If a high frequency communication link is to be established between two points on the Earth 2000 km away, and the reflection region of ionosphere is at height of 200 km and has critical frequency of 5 MHz, then calculate the MUF for the given path.

B) The receiving antenna is located at 80 km from the transmitting antenna. The height of transmitting antenna is 100 m. Find the required height of receiving antenna. (5)

C) Explain the formation of inversion layer in troposphere. (5)

6. A) Consider a two element mesh as shown in Fig.2. Using FEM determine the potentials at free nodes. (10)

Node	(x, y)
1	(0.8, 1.8)
2	(1.4, 1.4)
3	(2.1, 2.1)
4	(1.2, 2.7)

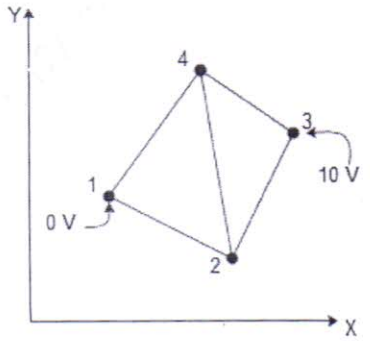

Fig.2.

B) Define critical frequency as a measure of ionospheric propagation and determine critical frequency for reflection at vertical incidence if the maximum value of electron density is 1.24×10^6 per CC. (2+3)

C) Explain formation of duct and condition for duct propagation. (5)

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S.E. / Sem IV (CBSGS) / EXTC NOV | DEC '16

Q. P. Code : 546102

SIGNALS & SYSTEMS.

N.B.:

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

Q 1] Answer the following **[20]**

a) Determine if the following system is memoryless, causal, linear, time invariant

$y(t) = t\,x(t)$

b) Explain in brief ROC (Region of Convergence) conditions of Laplace transform.

c) Explain Gibbs phenomenon. What is a Gibbs oscillation?

d) Explain relation between Fourier Transform and Laplace transform.

e) Determine if the given sequence is periodic or not. If periodic, find out fundamental period.

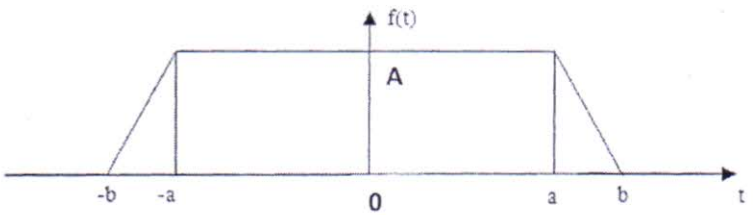
$$x[n] = \sin\left(\frac{6\pi}{7}n + 1\right)$$

Q 2] a) Find the response of the time invariant system with impulse response h[n]={1, 2, 1, -1} to an input signal x[n]= {1,2,3,1} using convolution as well as using Z transform. Verify your answers. **[10]**

b) Determine inverse Laplace Transform of **[10]**

$$X(s) = \frac{3s^2 + 8s + 23}{(s+3)(s^2 + 2S + 10)}$$

Q 3] a) Determine the Fourier Transform of the trapezoidal function shown in the figure below. **[10]**



b) Find the inverse Z transform of the following function **[10]**

$$X(z) = \frac{1}{1 - 0.8z^{-1} + 0.12z^{-2}}$$

for the following ROCs

a) $|z| > 0.6$

b) $|z| < 0.2$

c) $0.2 < |z| < 0.6$

TURN OVER

Q 4] a) Find out DTFT of the following **[10]**

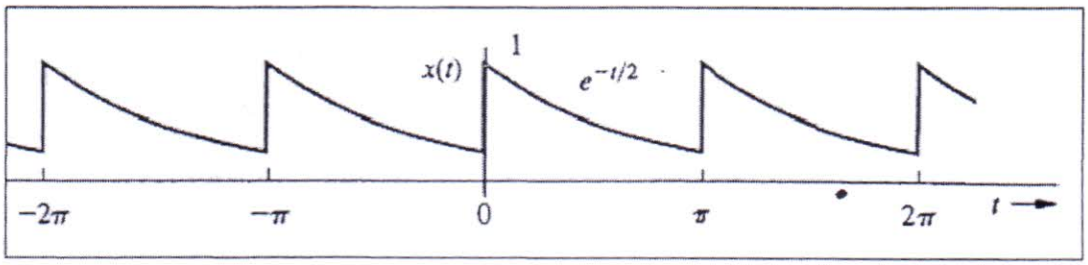
i) x[n]={1,-1,2,2}

ii) $x[n] = -a^n u[-n-1], where |a| < 1$

b) An LTI system is described by the following equation. Determine the transfer function and impulse response of the system. Sketch the poles & zeros of the z-plane. **[10]**

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

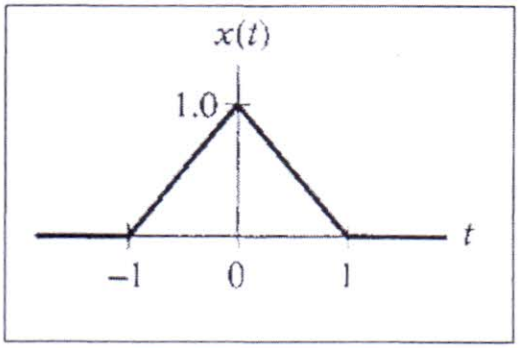
Q 5] a) Find Compact trigonometric Fourier Series for the signal x(t) shown in the following figure. Sketch the amplitude and phase spectra for x (t). **[10]**



b) The impulse response of a CT system is given below. Determine the unit step response of the system using convolution theorem of Laplace Transform. **[10]**

h(t)= u(t+2) + u(t-2)

Q 6] a) A CT signal has been shown below. Sketch the following signals **[10]**



i) x(t-4) ii) x(4-t) iii) x(-2t+2) iv) x(0.5t)

b) State and prove with appropriate mathematical derivation, 'convolution in time domain' property and 'time reversal' property of Z transform. Also comment on importance of these properties in the field of communication and signal processing. **[10**

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546102

S.E / Sem IV (CBSGS) / EXTC NOV/DEC 16

CONTROL SYSTEMS

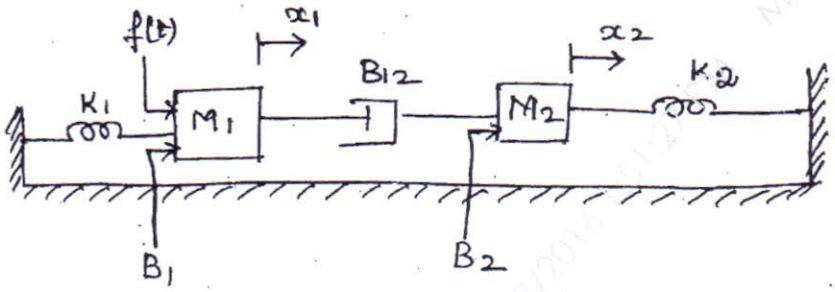
Q.P. Code : 546200

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

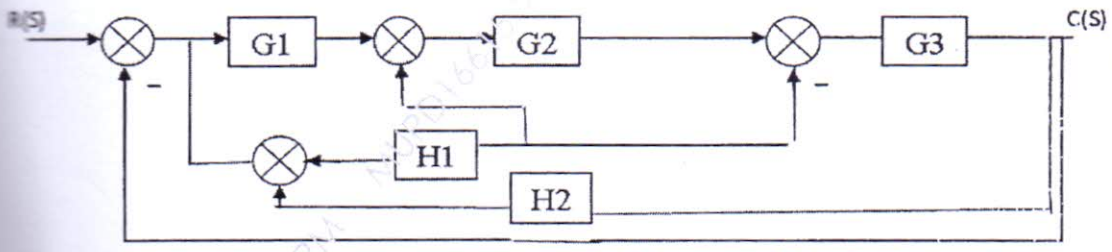
N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions from **remaining** questions.
(3) Assume suitable **data** if **necessary**.

1. (a) Differentiate between feed back and feed forward control system. 5
(b) What are the basic properties of signal flow graph? 5
(c) Compare Lead compensator and Lag compensator. 5
(d) Explain different performance index for optimal control problems. 5

2. (a) Obtain the transfer function of the Mechanical System : 10



(b) Using the block diagram reduction Technique find the transfer function of the given system: 10



3. (a) Obtain the state variable model of the Transfer function : 10

$$\frac{Y(s)}{U(s)} = \frac{3s+4}{s^2+5s+6}$$

(b) Explain controllability and observability analysis of LTI system. Using example. 10

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4. (a) Sketch the root locus for given system with unity feedback. **10**

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

(b) Use the Routh stability criterion to Determine the range of 'k' for stability of unity feed back system whose open Loop transfer function is **10**

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

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) Sketch the Bode plot for the following Transfer function :

$$G(s)=\frac{75(1+0.2s)}{s(s^2+16s+100)}$$

6. (a) Explain the frequency domain specifications. **7**
(b) Explain the concept of Neuro-Fuzzy adaptive control system. **6**
(c) Write short note on : Steady state errors in feed back control system and their types. **7**
