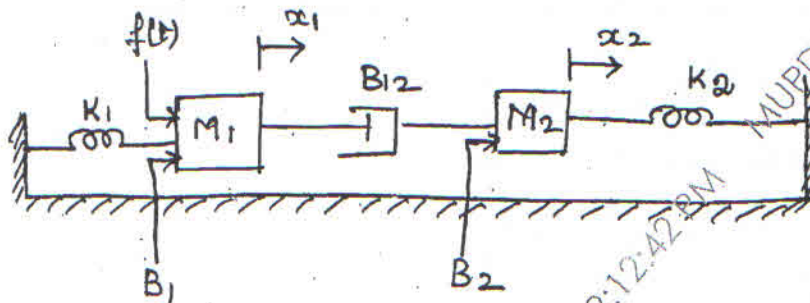


N.B. : (1) Question No. 1 is compulsory.

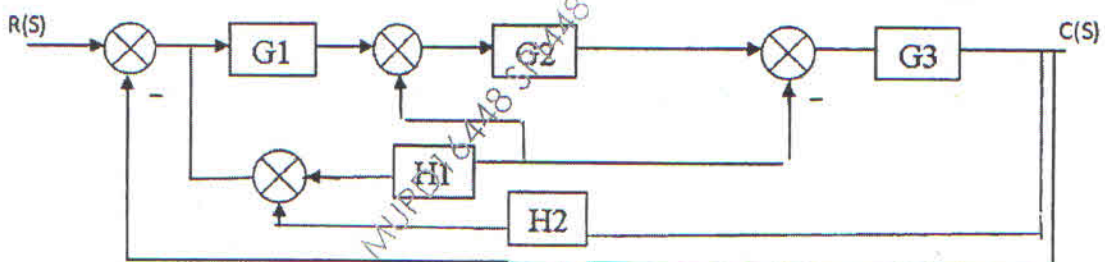
(2) Attempt any **three** questions from **remaining** questions.

(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

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

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.

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

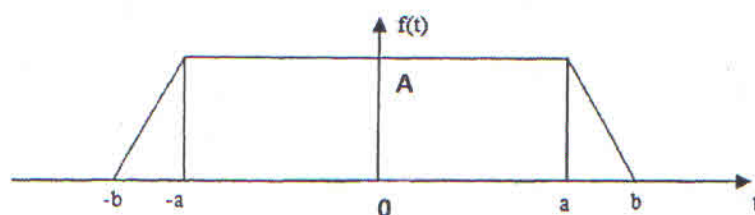
Q 2] a) Find the response of the time invariant system with impulse response  $h[n] = \{1, 2, 1, -1\}$  to an input signal  $x[n] = \{1, 2, 3, 1\}$  using convolution as well as using Z transform. Verify your answers. [10]

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  $|a| < 1$

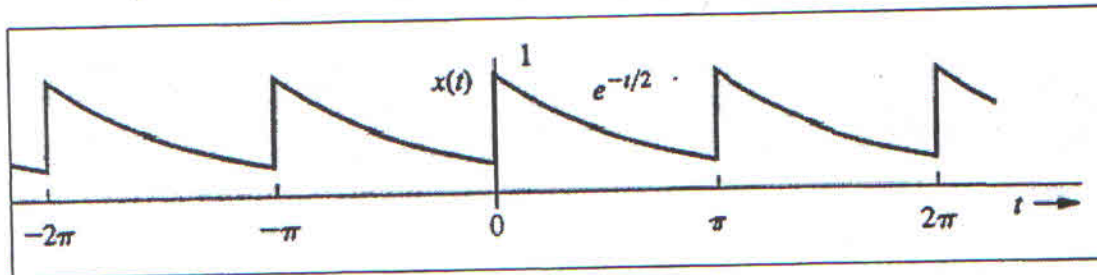
b) An LTI system is described by the following equation. Determine the transfer function and impulse response of the system. Sketch the poles & zeros of the z-plane.

[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]



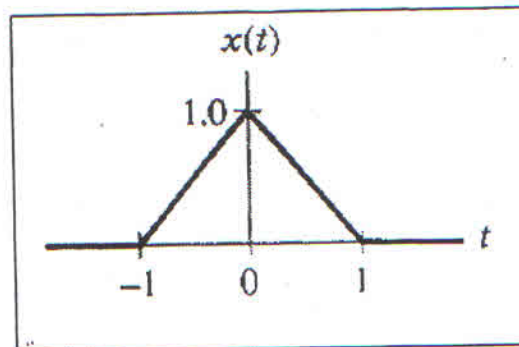
b) The impulse response of a CT system is given below. Determine the unit step response of the system using convolution theorem of Laplace Transform.

[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]

-----XXX-----XXX-----XXX-----



**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. (5)  
Also state their significance.
- 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  $z > 0$ ,  $\epsilon_{r1} = 4$  and for  $z < 0$ ,  $\epsilon_{r2} = 3$ .  
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. (10)  
using Finite Difference Method (Band Matrix Method).

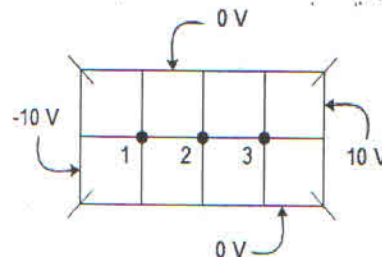


Fig.1.

- 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  $z = 0$ . (5)  
 Given: Incident  $E_i = 1.5 \times 10^{-3}$  (V/m);  $\epsilon_{r1} = 8.5$ ;  $\mu_{r1} = 1$ ;  $\sigma_1 = 0$ .  
 Second region is free space.
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? (5)  
 Where maximum attenuation of electromagnetic waves takes place inside the ionosphere?
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)

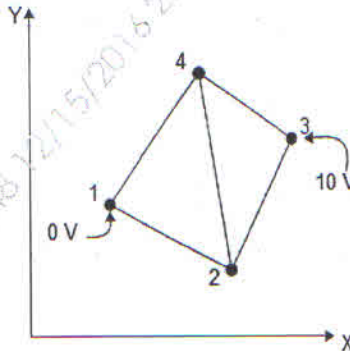


Fig.2.

- 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  $1.24 \times 10^6$  per CC. (2+3)  
 C) Explain formation of duct and condition for duct propagation. (5)

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**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 80386 microprocessors. 10