E./SEM V/Rev. 2012 (CBSGS)/ Electronics / MAY 2018

Electromagnetic Engineering

Q. P. Code: 37487

(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. Answer the following (any four): 20
   a) Let $\epsilon_r = 5, \mu_r = 4$ and $\sigma = 0$. If the displacement current density is $20\cos(1.5 \times 10^8 t - \beta x)\,\overrightarrow{a_y}$ μA/m². Find $\overrightarrow{D}$, and $\vec{E}$.
   b) For a wave propagating in z-direction, prove that $\vec{E} \cdot \vec{H}=0$ and $\vec{E} \times \vec{H}$ gives the direction of propagation.
   c) An electromagnetic wave propagating in a perfect dielectric is normally incident on a perfect dielectric. Derive the reflection and transmission coefficient for the reflected wave.
   d) Explain the concept of retarded potential.
   e) Explain ground wave propagation. State its applications.

2. a) What is polarization? Explain different types of polarization. 10
   b) Derive the reflection coefficient for a wave with oblique incidence having perpendicular polarization, reflected from a perfect dielectric. 10

3. a) State and prove Poynting theorem. Give interpretation of each power term. 10
   b) Explain in detail FDM method and state its advantages and drawbacks. 10

4. a) Derive the expression for the radiated power for a hertzian dipole. 10
   b) Define critical frequency, MUF and OWF. A high frequency radio link has to be established between two points on the earth 2500km away. If the reflection region of the ionosphere is at a height of 200km and has a critical frequency of 12MHz, calculate the MUF of the given path. 5
   c) Find the average and maximum radiation intensity, Uave and Umax respectively and the directivity, D if $U(\theta,\phi)=4\text{cosec}^2\theta$, $\pi/3 < \theta < \pi/2$, $0 < \phi < \pi$. 5

5. a) Derive boundary conditions for electric and magnetic fields at dielectric-dielectric boundary. 10
   b) What is line of sight propagation? Obtain an expression for the range of line of sight for space wave propagation in terms of antenna's transmitting and receiving heights. 5

6. Write short note on:
   a) Folded dipole antenna 5
   b) Poisson's and Laplace's equations 5
   c) Wave equations for time harmonic fields 5
   d) Interpretation of Maxwell's equations in integral form 5

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T. E. SEM: V (CBSGS)
EXTC (S.S.).

May 2018

Q.P. Code : 50772

(3 Hrs) **Total Marks: 80**

NOTE:
1) Question number 1 is compulsory.
2) Attempt any three questions from the remaining five questions.
3) Assume suitable data wherever necessary.

Q1 a Check whether the following systems are linear, time variant, causal or otherwise: **(5)**
i) $y(n) = x(n) + n^* x(n-1)$
ii) $y(t) = x(t) + 3x(t+4)$

b What is autocorrelation and cross correlation? How is it related to ESD and PSD? **(5)**

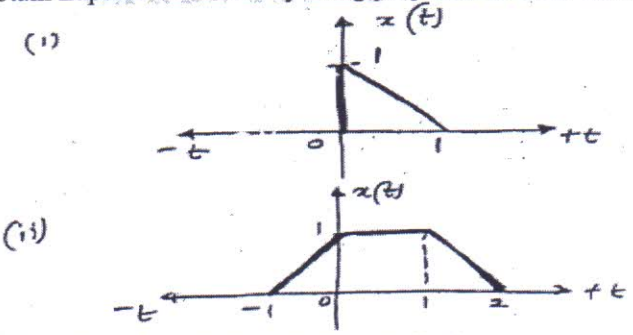
c Find the convolution of the sequences $x_1(n) = x_2(n) = \{1,1,1\}$ using convolution property of Fourier transform. **(5)**

d Verify periodicity of the following continuous time signals. If periodic, find the fundamental period. **(5)**
(i) $x(t) = 2\cos(t/4)$
(ii) $x(t) = e^{-j2\pi t/7}$

Q2 a Determine power or energy of the following continuous time signal: **(5)**

(i) $x(t) = e^{-2t}.u(t)$
(ii) $x(t) = 3\cos(5mt)$

b Obtain Laplace transform by using properties of Laplace transform only. **(10)**



c Explain Gibb's phenomenon. **(5)**

Q3 a Find the natural response of the system described by the equation **(10)**

$$\frac{d^2y(t)}{dt^2} + 6\frac{dy(t)}{dt} + 5y(t) = \frac{dx(t)}{dt} + 4x(t) \;;$$

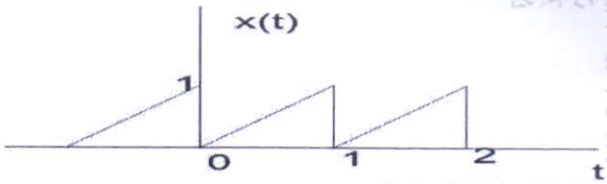
for $y(0) = 1$; $\left.\frac{dy(t)}{dt}\right| = -2$ at $t=0$

b Consider the analog signal x(t) = 5 cos50πt +2 sin200πt -2 cos100 πt. Determine the minimum sampling frequency and the sampled version of analog signal at this frequency. Sketch the waveform and show the sampling points. Comment on the result. **(10)**

Q4 a Convolve the following two signals in time domain and sketch the output: **(10)**

X (t) =2(t)*[u (t+2)-u (t-2)], h (t) =u (t) - u (t-4)

b Determine the exponential Fourier series of the given signal: **(10)**

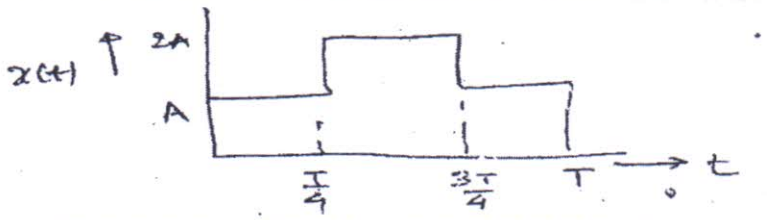


Q5 a Determine inverse Z transform for the following functions: **(10)**

$$X(z) = \frac{1+z^{-1}}{1-z^{-1}+0.5z^{-2}}$$

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

b Obtain Fourier transform by using properties of Fourier transform only. **(10)**



Q6 a) State Initial and Final value theorem of Z-transform and Laplace transform. **(5)**

b) Prove that Energy of a power signal is infinite and Power of an Energy signal is Zero. **(5)**

c) Determine h(n) for all possible ROC conditions. **(10)**

$$H(z) = \frac{z(z^2-3z+11)}{(z-\frac{1}{4})(z-4)(z+6)}$$

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E | Sem V | ETRX | CBSGS | May 2018

Digital Communication

Q. P. Code: 37491

(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. Answer the following (any four): 20
   a) State and explain central limit theorem.
   b) Show that the mean of the sum of random variables is the sum of the means of the random variables.
   c) Consider the five messages given by the probabilities ½, ¼, 1/8, 1/16, 1/16. Calculate average information and information rate if r=1messages per second.
   d) The binary data 1101101011 is applied to the input of a duo-binary system with a pre-coder. Draw the duo-binary encoder and construct the encoder output.
   e) For the binary sequence 1011001101 draw the following line codes: i) NRZ, ii)RZ, iii)AMI, iv)RB, v) bi-phase M.

2. a) A discrete memory less source has an alphabet of five symbols with their probabilities a shown below: 12

Symbol	S1	S2	S3	S4	S5
Probability	0.19	0.22	0.10	0.38	0.11

i) Construct Huffman code for each symbol and determine the following parameters:
Entropy, Average code word length, code efficiency and code redundancy.
ii) Determine the above parameters for Shannon-Fano code.

   b) Discuss the causes of ISI and ways to overcome it. Also state and explain the Nyquist condition for zero ISI. 8

3. a) The generator vectors for a convolutional encoder with code rate 1/3 are g1=111, g2=101 and g3=110. 10

i) Draw the encoder diagram and determine the code word for the input vector (11010)
ii) Draw trellis diagram and state diagram.

   b) A (7, 4) cyclic code is generated using the polynomial $g(x)=(1+x+x^3)$. Find the code word if the data word is i) 0011, ii) 0100(MSB) by long division method. Draw the encoder and generate the code word for the same data tracing the path through the encoder. 10

4. a) What is spread spectrum modulation? Explain FHSS giving appropriate diagrams 10
   b) With a neat diagram, explain the working of the Integrate and Dump receiver. Derive the expression for its probability of error. 10

5. a) Draw the signal constellation for 16-QASK and hence find its Euclidean distance. Compare it with the Euclidean distance of 16-QPSK. 10
   b) For the bit sequence 101010011010 draw the MSK waveform. 5
   c) If the direct sequence spread spectrum system has the following parameters: 5
      Data sequence bit duration, T_b=6.125ms,
      PN chip duration, Tc= 1.5μs,
      The probability of error is less than 10^{-5}; (E_b/N_0=10)
      Then calculate the Processing gain and Jamming Margin.

6. Write short notes on:
   a) Expression for PSD of NRZ data 5
   b) Eye pattern and its significance 5
   c) Significance of AWGN channel 5
   d) Desirable properties of line code 5

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