TE | EXTC | V CBSGS

RSA

2nd Half-12 mina-(b)-71

Con. 7580-12. **KR-4994**

(3 Hours) **[Total Marks : 100**

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

1. (a) State and prove Baye's Theorem. 5
(b) State Axiomatic definition of probability. 5
(c) If A and B are two events such that : P (A) = 0·3, P (B) = 0·4, P (A ∩ B) = 0·2. 5
Find :
(i) P (A ∪ B)
(ii) $P\left(\overline{A}/B\right)$
(iii) $P\left(\overline{A}/\overline{B}\right)$
(iv) $P\left(\overline{A} \cup \overline{B}\right)$
(d) Explain properties of a distribution function. 5

2. (a) The joint probability density function of a two-dimensional random variable (X, Y) is given by : 10

$$f(x,y) = k\,x\,y\,e^{-\left(x^2+y^2\right)} \; ; \; x \geq 0, \; y \geq 0$$

Find :
(i) The value of k
(ii) Marginal density function of X and Y
(iii) Conditional density function of Y given that X = x and the conditional density function of X given that Y = y.
(iv) Check for independence of X and Y.
(b) Explain Moment Generating Function of discrete random variable and continuous random variable in detail. 10

3. (a) If X and Y are two independent random variates with identical uniform distribution in (0, 1), find probability density function of (U, V) where U = X + Y and V = X − Y. Are U, V independent ? 10
(b) Find the characteristic function of Binomial Distribution and Poisson Distribution. 10

4. (a) Define Central Limit Theorem. 5
(b) Describe Sequence of random variables. 5
(c) Explain and prove Chebychev's Inequality. 10

5. (a) A random process is given by X (t) = sin (Wt + Y) where Y is uniformly distributed in (0, 2π). Verify whether { X (t) } is wide-sense stationary process. 10
(b) State and prove the properties of autocorrelation function and cross-correlation function. 10

[TURN OVER

6. (a) If a random process { X (t) } is given by X (t) = 10 cos (100 t + θ) where θ is uniformly distributed over $(-\pi, \pi)$, prove that { X (t) } is correlation ergodic. **10**

   (b) A WSS random process { X (t) } is applied to the input of an LTI system whose impulse response is $te^{-at}\, u(t)$ where a (> 0) is a real constant. **10**

7. (a) State and prove the Chapman-Kolmogorov equation. **10**

   (b) The transition matrix of a Markov Chain with three states 0, 1, 2 is given by : **10**

$$P = \begin{array}{c} \\ 0 \\ 1 \\ 2 \end{array} \begin{array}{c} \begin{array}{ccc} 0 & 1 & 2 \end{array} \\ \begin{bmatrix} 3/4 & 1/4 & 0 \\ 1/4 & 1/2 & 1/4 \\ 0 & 3/4 & 1/4 \end{bmatrix} \end{array}$$

and the initial state distribution is :

$$P(x_0 = i) = \frac{1}{3}, \quad i = 0, 1, 2.$$

Find :—

(i) $P[X_2 = 2]$

(ii) $p[X_3 = 1, X_2 = 2, X_1 = 1, X_0 = 2]$.

03/12/12

T.E. EXTC sem V (Rev) NID. 2012

Sub:- RFCD

Con. 9752-12. KR-5258

(2 Hours) [Total Marks : 50

N. B. : (1) Question No. 1 is **compulsory**.
(2) Solve any **four** questions from the **remaining** questions.
(3) Use of Smith charts is **permitted**.
(4) Assume **suitable** data if **needed**.

1. (a) A losslees Co-oxial cable has wavelength of electric and magnetic filed of λ = 20 cm of 960 MHz. Find the relative dielectric of insulation. 5
(b) A typical PCB substrate consists of Al_2O_3 with a relative dielectric constant of 10 and loss tangent of 0·0004 at 10 GHz. Find conductivity of substrate. 5
(c) For a parallel copper plate transmission line operated at 1 GHz, the following parameters are given – 5
W = 6 mm, d = 1 mm, ϵ_r = 2·25 and σ_{diel} = 0·125 ms/m. Find line parameters R, L, G and C per unit length.
(d). A lossless 50 Ω microstrip line is terminated into a load with admittance of 0·05 ms. What additional impeadance has to placed in parallel with load to assure impeadance of 50 Ω. 5

2. (a) A transmission line of characteristic impeadance of z_o = 50 Ω and length d = 0·15 λ is terminated into load impedance of Z_L = (25 – j 30) Ω. Find Γ_o, $z_{in}(d)$, and SWR. 10
(b) A lossless transmission line with z_o = 50 Ω is 10 cms long, f = 800 MHz, v_p = 0·77 C. If the input impeadance is z_{in} = j 60 Ω, find C_L. What length of a short circuited transmission line would be needed to replace Z_L. 10

3. (a) To suppress noise in a digital communication system a bandpass RF filter is required with a passband from 1 GHz to 2 GHz. The minimum attenuation of filter at 2·1 GHz and 1·8 GHz should be 30 dB. Assuming that a 0·5 dB ripple in passband can be tolerated, design a filter that would be using minimum number of components. 10
(b) Derive expressions for internal, external and loaded quality factors for standard series and parallel reserance. 10

4. (a) The intrinsic carrier concentration is typically recorded at room temperature. For GaAs at T = 300°k the effective densities of states are 10
$Nc = 4·7 \times 10^{17}/cm^3$
$Nv = 7·0 \times 10^{18}$. cm^3.
Assuming that bandgap energy of 1·42 eV remaines constant :
(i) Find intrinsic carries concentration at room temperature
(ii) Compute η_i at T = 400°k.
(b) Explain in brief the principle of operation of HEMT and RF FET along with their construction. 10

[TURN OVER

5. (a) Design a prototype law pass filter with Butterworth response that will provide attenuation of at least at frequency $f = 2 f_{3dB}$. Compute and plot the amplitude response for 0 to 5 GHz. **10**

   (b) Explain Ebers-Moll model of a large signal BJT. Also give details of transport representation. **10**

6. (a) Explain in brief the determination of AC parameters of bipolar transistors. **10**

   (b) Show that feedback capacitance C_{cb} can be expressed as **10**

$$C_{M1} = C_{cb}\left(1 - \frac{V_{ce}}{V_{be}}\right) \text{ on the input port}$$

$$C_{M2} = C_{cb}\left(1 - \frac{V_{be}}{V_{ce}}\right) \text{ on the output port}$$

   Assume that the input and output voltages are approximately constant and keep in mind that V_{ce} is negative under Common Emitter Configuration.

7. Write short notes on :– **20**

   (a) DC Characterization of BJT

   (b) Realizations of RF filters using Kuroda Identities

   (c) Terminations used in microstrip lines

   (d) Equivalent circuits of Resistors, Inductors and Capacitors.

TE | EXTC | IV (REV) 8|12|12

S & S

405/407

12-p3-d-upq-SH-KSL12-C

Con. 10167–12. KR–5396

(3 Hours) [Total Marks : 100

N.B. :(1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from the remaining **six**.
(3) **Assumptions made** should be **clearly** stated.
(4) **Figures to the right** indicate **marks**.

1. (a) Determine whether the signals are power or energy signals. 20
(i) $x(t) = 0{\cdot}9e^{-3t}\,u(t)$ (ii) $x[n] = u[n]$

(b) Convolve $h[n] = n+1 \; ; \; 0 \le n \le 3$
with $x[n] = n^2 \; ; \; 0 \le n \le 2$

(c) Sketch x(t) and odd part of x(t)
$x(t) = 2r(t) - 2r(t-1) - 2u(t-3)$

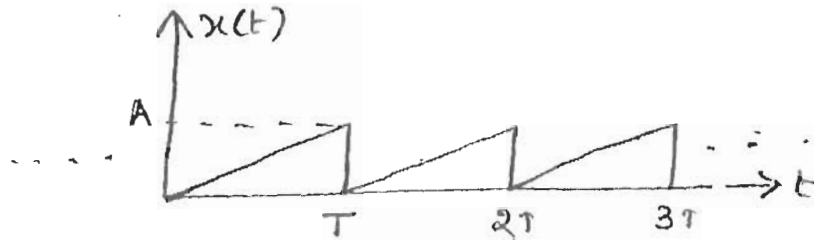
(d) Determine whether each of the signal is periodic. If so find its fundamental period—

(i) $x(t) = 3\cos\sqrt{2}t + 4\cos 5\pi t$

(ii) $x[n] = \dfrac{\cos 4\pi n}{12}$

(e) Check dynamicity, Linearity, Time Variance and Causality of
$y[n] = x[n] + x[n+2]$.

2. (a) Determine the exponential Fourier series of the signal x(t). 10



(b) 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

3. (a) Sketch $x(t) = t \; ; \; 0 < t < 1$ 10
$= 1 \; ; \; 1 < t < 2$
$= 3-t \; ; \; 2 < t < 3$

Then Sketch (i) $x(2-t)$
(ii) $x(t-3)$
(iii) $x(2t)$
(iv) $0{\cdot}5\,x(-t)$

TURN OVER

(b) Consider an analog signal

$x(t) = 5 \cos 50\pi t + 2 \sin 200\pi t - 2 \cos 100\pi t$

(i) Determine Nyquist sampling rate 2

(ii) If the given x(t) is sampled at the rate of 200 Hz, what is the discrete time signal obtained after sampling. 3

(c) Find the DTFT of $x[n] = \{ 2, 1, 2 \}$ and compute its magnitude at $w = 0$ and $w = \frac{\pi}{2}$. 5

4. (a) Find z–Transform and draw ROC of 5

(i) $x[n] = (0{\cdot}1)^n u[n] + (0{\cdot}3)^n u[-n-1]$

(ii) $x[n] = (0{\cdot}5)^n [u[n] - u[n-2]]$

(b) Prove convolution property of z-transform 5

(c) Determine the response of an LTI discrete time system governed by the difference equation. $y[n] - 2y[n-1] - 3y[n-2] = x[n] + 4x[n-1]$ 10

for the input $x[n] = 2^n u[n]$ with initial conditions $y(-2) = 0$, $y(-1) = 5$.

5. (a) (i) Using Laplace transform determine the total response of the system described by the equation. $y''(t) + 5y'(t) + 4y(t) = x'(t)$ 6+4

The initial conditions are $y(0) = 0$ and $y'(t)\big|_{t=0}^{=1}$. The input to the system is $x(t) = e^{-2t} u(t)$.

(ii) Also find the Impulse response of the above system assuming initial conditions = 0.

(b) Realise Direct Form I, Direct Form II First order cascade and First order parallel structures if 10

$$H(z) = \frac{1 + 3z^{-1} + 2z^{-2}}{\left(1+\frac{1}{8}z^{-1}\right)\left(1+\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)}$$

6. (a) Find $x[n]$ if $X(z) = \dfrac{\frac{5}{6}z^{-1}}{\left(1 - \frac{7}{12}z^{-1} + \frac{1}{12}z^{-2}\right)}$ **10**

for (i) ROC $|z| > \frac{1}{3}$

(ii) ROC $\frac{1}{4} < |z| < \frac{1}{3}$

(iii) ROC $|z| < \frac{1}{4}$

(b) Prove time shifting property of Fourier transform **5**

(c) Determine the unit step response of the system whose impulse response is given as $h(t) = 3tu(t)$. **5**

7. (a) The state space representation of a discrete time system is given as— **10**

$$A = \begin{bmatrix} 2 & -1 \\ 3 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

$$C = \begin{bmatrix} 1 & 3 \end{bmatrix} \quad D = [3]$$

Derive the transfer function $H(z)$ of the system.

(b) Using suitable method obtain the state transition matrix STM $\phi(t)$ for the system matrix. **10**

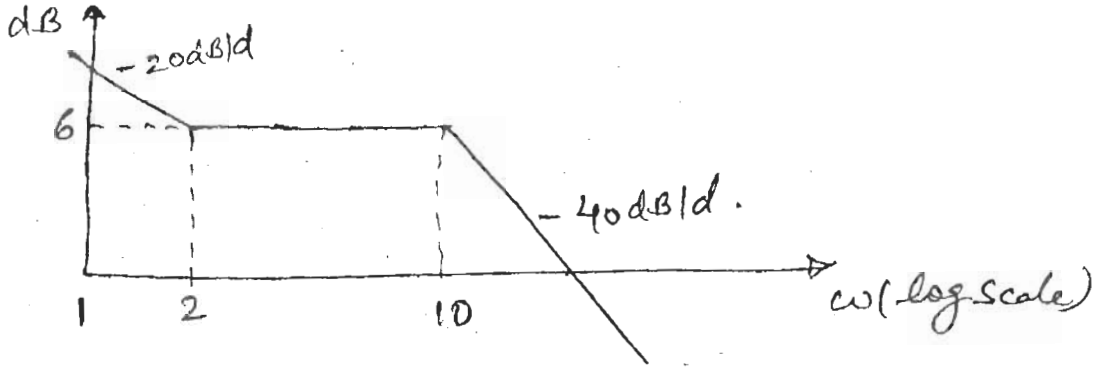
$$A = \begin{bmatrix} 2 & 0 \\ 3 & 1 \end{bmatrix}$$

Con. 7646-12. **KR-5516**

(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory**.
(2) Solve any **four** out of remaining **six** questions.
(3) **Figures** to the **right** indicate full **marks**.

1. (a) Obtain the transfer function from the magnitude plot shown below :— **5**



(b) What do you mean by steady state error ? What information is contained in the specification $K_V = 1000$? **5**

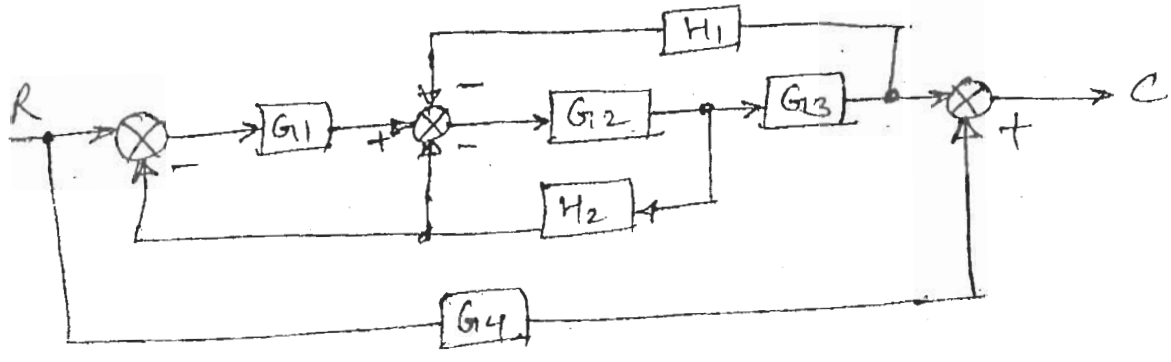
(c) A unity feedback control system has an open loop transfer function — **5**

$$G(s) = \frac{K}{s\left(s^2 + 4s + 13\right)}.$$

Determine :
(i) Centroid, number and angle of asymptotes.
(ii) Breakaway points if any.

(d) Compare absolute stability and relative stability. **5**

2. (a) Find the transfer function from the block diagram using Block diagram reduction rules. **10**



(b) Derive the transfer function of field controlled DC servomotor. **10**

[TURN OVER

3. (a) Construct the Signal Flow Graph from the following set of equations and find the overall transmittance using Mason's Gain Formula. **10**

$x_2 = g_{21}\, x_1 + g_{23}\, x_3$

$x_3 = g_{31}\, x_1 + g_{32}\, x_2 + g_{33}\, x_3$

$x_4 = g_{42}\, x_2 + g_{43}\, x_3$

(b) Sketch the root locus of a Unity Feedback Control System with **10**

$$G(s) = \frac{K}{s(s+1)(s+3)}$$ and determine :

(i) K for marginal stability

(ii) Frequency of oscillations for marginal stability

(iii) K for damping ratio of 0·5.

4. (a) For a unity feedback system with open loop transfer function given below determine the range of K for stability :— **10**

$$G(s) = \frac{K}{(s+2)(s+4)(s^2+6s+2s)}$$

(b) Sketch the Bode plot for **10**

$$G(s)\,H(s) = \frac{10}{s(1+0\cdot1s)(1+0\cdot5s)}$$ and find

(i) Gain crossover frequency

(ii) Phase crossover frequency

(iii) Gain margin

(iv) Phase margin.

Also comment on System Stability.

5. (a) Derive the time response expression for a second order control system subjected to unit step input. **10**

(b) Sketch the Nyquist plot for $G(s)\,H(s) = \frac{50}{(s+1)(s+2)}$ and comment on the closed loop stability of the system. **10**

6. (a) For a system with the transfer function $G(s) = \frac{16}{s^2 + 1\cdot6s + 16}$. **10**

Find : (i) rise time

(ii) peak time

(iii) settling time

(iv) damped frequency of oscillations

(v) peak overshoot.

(b) What is sensitivity ? Explain the effect of system parameter variations on the sensitivity of open loop and closed loop control systems. **10**

7. Write short notes on any **two** of the following :— **20**

(a) Static error coefficients and steady state errors

(b) Stopper motors

(c) Error compensation techniques.

TE | ETRX | CMPN | ST | EXTC | V CRE(..)
EVS (18|12)12

vs-Con-2012

Con. 7666–12. KR–5585

(2 Hours) [Total Marks : 50

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from Question Nos. **2** to **7**.

Q.1] Answer **Any Five** of the following: (10)

(a) What is Ecological Succession?

(b) What are the adverse effects of Acid rain.?

(c) What is 'Biological prospecting'?

(d) What are the reasons of Thermal pollution?

(e) What are the powers of forest officer?

(f) Explain the terms: Bio-order and Material Order

(g) **Explain** importance of value education.

Q.2] (a) Explain the role played by Information Technology to the field of Environment and Human Health, (5)

(b) Explain sources and effects of soil pollution. (5)

Q.3] (a) Explain briefly the salient features of Forest Conservation Act (5)

(b) Why HIV-Aids is so widespread? What are its effects on human health and environment? (5)

[TURN OVER

Q. 4] (a) What steps taken for conservation of biodiversity ? (5)

(b) Explain urban problems pertaining to Energy. (5)

Q.5](a) Describe Grassland Ecosystem. What will happen if grassland ecosystem disappear? What measures can be taken for its conservation? (5)

(b) Explain which remedial steps are taken in mitigation earthquakes? (5)

Q 6] (a) What problems faced by women and children? What is being done for their welfare? (5)

(b) What is solid waste? Describe various methods of solid waste management? (5)

Q 7] (a) What are land resources? What are the reasons for degradation of land? (5)

(b) What is Population Explosion? Describe the effects of population on Environment. (5)

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