CBCS SCHEME

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17MAT41

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Engineering Mathematics - IV

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. From Taylor's series method, find y(0.1), considering upto fourth degree term if y(x) satisfying the equation $\frac{dy}{dx} = x - y^2$, $y(0) = 1$. **(06 Marks)**

b. Using Runge-Kutta method of fourth order $\frac{dy}{dx} + y = 2x$ at $x = 1.1$ given that $y = 3$ at $x = 1$ initially. **(07 Marks)**

c. If $\frac{dy}{dx} = 2e^x - y$, $y(0) = 2$, $y(0.1) = 2.010$, $y(0.2) = 2.040$ and $y(0.3) = 2.090$, find $y(0.4)$ correct upto four decimal places by using Milne's predictor-corrector formula. **(07 Marks)**

OR

2 a. Using modified Euler's method find y at $x = 0.2$ given $\frac{dy}{dx} = 3x + \frac{1}{2}y$ with $y(0) = 1$ taking $h = 0.1$. **(06 Marks)**

b. Given $\frac{dy}{dx} + y + zy^2 = 0$ and $y(0) = 1$, $y(0.1) = 0.9008$, $y(0.2) = 0.8066$, $y(0.3) = 0.722$. Evaluate $y(0.4)$ by Adams-Bashforth method. **(07 Marks)**

c. Using Runge-Kutta method of fourth order, find $y(0.2)$ for the equation $\frac{dy}{dx} = \frac{y - x}{y + x}$, $y(0) = 1$ taking $h = 0.2$. **(07 Marks)**

Module-2

3 a. Apply Milne's method to compute $y(0.8)$ given that $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ and the following table of initial values.

x	0	0.2	0.4	0.6
y	0	0.02	0.0795	0.1762
y'	0	0.1996	0.3937	0.5689

(06 Marks)

b. Express $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$ in terms of Legendre polynomials. **(07 Marks)**

c. Obtain the series solution of Bessel's differential equation $x^2y'' + xy' + (x^2 + n^2)\,y = 0$ leading to $J_n(x)$. **(07 Marks)**

OR

4 a. Given $y'' - xy' - y = 0$ with the initial conditions $y(0) = 1$, $y'(0) = 0$, compute $y(0.2)$ and $y'(0.2)$ using fourth order Runge-Kutta method. **(06 Marks)**

b. Prove $J_{-1/2}(k) = \sqrt{\frac{2}{\pi x}}\cos x$. **(07 Marks)**

c. Prove the Rodfigues formula $P_n(x) = \frac{1}{2^n n!}\frac{d^n y}{dx^n}(x^2 - 1)^n$ **(07 Marks)**

Module-3

5 a. Derive Cauchy-Riemann equations in Cartesian form. **(06 Marks)**

b. Discuss the transformation $w = z^2$. **(07 Marks)**

c. By using Cauchy's residue theorem, evaluate $\int_C \frac{e^{2z}}{(z+1)(z+2)}dz$ if C is the circle $|z| = 3$. **(07 Marks)**

OR

6 a. Prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$ **(06 Marks)**

b. State and prove Cauchy's integral formula. **(07 Marks)**

c. Find the bilinear transformation which maps $z = \infty$, i, 0 into $w = -1$, $-i$, 1. **(07 Marks)**

Module-4

7 a. Find the mean and standard of Poisson distribution. **(06 Marks)**

b. In an examination 7% of students score less than 35 marks and 89% of the students score less than 60 marks. Find the mean and standard deviation if the marks are normally distributed given A(1.2263) = 0.39 and A(1.4757) = 0.43 **(07 Marks)**

c. The joint probability distribution table for two random variables X and Y is as follows:

X \ Y	-2	-1	4	5
1	0.1	0.2	0	0.3
2	0.2	0.1	0.1	0

Determine:

i) Marginal distribution of X and Y

ii) Covariance of X and Y

iii) Correlation of X and Y **(07 Marks)**

OR

8 a. A random variable X has the following probability function:

x	0	1	2	3	4	5	6	7
P(x)	0	K	2k	2k	3k	K^2	$2k^2$	$7k^2+k$

Find K and evaluate $P(x \geq 6)$, $P(3 < x \leq 6)$. **(06 Marks)**

b. The probability that a pen manufactured by a factory be defective is 1/10. If 12 such pens are manufactured, what is the probability that

i) Exactly 2 are defective

ii) Atleast two are defective

iii) None of them are defective. **(07 Marks)**

c. The length of telephone conversation in a booth has been exponential distribution and found on an average to be 5 minutes. Find the probability that a random call made

i) Ends in less than 5 minutes

ii) Between 5 and 10 minutes. **(07 Marks)**

Module-5

9 a. A die is thrown 9000 times and a throw of 3 or 4 was observed 3240 times. Show that the dia cannot be regarded as an unbiased die. **(06 Marks)**

b. A group of 10 boys fed on diet A and another group of 8 boys fed on a different disk B for a period of 6 months recorded the following increase in weight (lbs):

Diet A:	5	6	8	1	12	4	3	9	6	10
Diet B:	2	3	6	8	10	1	2	8		

Test whether diets A and B differ significantly t.05 = 2.12 at 16df. **(07 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$$ **(07 Marks)**

OR

10 a. Define the terms:

i) Null hypothesis

ii) Type-I and Type-II error

iii) Confidence limits **(06 Marks)**

b. The t.p.m. of a Markov chain is given by $P = \begin{bmatrix} 1/2 & 0 & 1/2 \\ 1 & 0 & 0 \\ 1/4 & 1/2 & 1/4 \end{bmatrix}$. Find the fined probabilities vector. **(07 Marks)**

c. Two boys B_1 and B_2 and two girls G_1 and G_2 are throwing ball from one to another. Each boy throws the ball to the other boy with probability 1/2 and to each girl with probability 1/4. On the other hand each girl throws the ball to each boy with probability 1/2 and never to the other girl. In the long run how often does each receive the ball? **(07 Marks)**

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17MATDIP41

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the rank of the matrix:

$$A = \begin{bmatrix} 2 & 3 & 5 & 4 \\ 0 & 2 & 3 & 4 \\ 4 & 8 & 13 & 12 \end{bmatrix}$$ by elementary row transformations. **(08 Marks)**

b. Solve by Gauss elimination method

$2x + y + 4z = 12$
$4x + 11y - z = 33$
$8x - 3y + 2z = 20$ **(06 Marks)**

c. Find all the eigen values for the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ **(06 Marks)**

OR

2 a. Reduce the matrix

$$\begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$$ into its echelon form and hence find its rank. **(06 Marks)**

b. Applying Gauss elimination method, solve the system of equations

$2x + 5y + 7z = 52$
$2x + y - z = 0$
$x + y + z = 9$ **(06 Marks)**

c. Find all the eigen values for the matrix $A = \begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$ **(08 Marks)**

Module-2

3 a. Solve $\frac{d^4y}{dx^4} - \frac{2d^3y}{dx^3} + \frac{d^2y}{dx^2} = 0$ **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} - \frac{6dy}{dx} + 9y = 5e^{-2x}$ **(06 Marks)**

c. Solve $\frac{d^2y}{dx^2} + y = \sec x$ by the method of variation of parameters. **(08 Marks)**

OR

4 a. Solve $\frac{d^3y}{dx^3} + y = 0$ **(06 Marks)**

b. Solve $y'' + 3y' + 2y = 12x^2$ **(06 Marks)**

c. Solve by the method of undetermined coefficients :
$y'' - 4y' + 4y = e^x$ **(08 Marks)**

Module-3

5 a. Find the Laplace transforms of $\sin 5t \cos 2t$ **(06 Marks)**

b. Find the Laplace transforms of $(3t + 4)^3$ **(06 Marks)**

c. Express $f(t) = \begin{cases} \sin 2t & 0 < t < \pi \\ 0 & t > \pi \end{cases}$,
in terms of unit step function and hence find L[f(t)]. **(08 Marks)**

OR

6 a. Find the Laplace transforms of $\frac{\sin^2 t}{t}$ **(06 Marks)**

b. Find the Laplace transform of $2^t + t \sin t$ **(06 Marks)**

c. If $f(t) = t^2$, $0 < t < 2$ and $f(t + 2) = f(t)$, for $t > 2$, find L[f(t)]. **(08 Marks)**

Module-4

7 a. Find the Laplace Inverse of
$$\frac{1}{(s+1)(s-1)(s+2)}$$ **(08 Marks)**

b. Find the inverse Laplace transform of $\frac{3s+7}{s^2-2s-3}$. **(06 Marks)**

c. Solve $y'' + 2y' - 3y = \sin t$, $y(0) = 0$, $y'(0) = 0$. **(06 Marks)**

OR

8 a. Find the inverse Laplace transform of
$$\log\left(\frac{s+a}{s+b}\right)$$ **(06 Marks)**

b. Find the inverse Laplace transform of $\frac{4s-1}{s^2+25}$ **(06 Marks)**

c. Find the inverse Laplace of $y'' - 5y' + 6y = e^t$ with $y(0) = y'(0) = 0$. **(08 Marks)**

Module-5

9 a. State and prove Addition theorem on probability. **(05 Marks)**

b. A student A can solve 75% of the problems given in the book and a student B can solve 70%. What is the probability that A or B can solve a problem chosen at random. **(06 Marks)**

c. Three machines A, B, C produce 50%, 30% and 20% of the items in a factory. The percentage of defective outputs of these machines are 3, 4 and 5 respectively. If an item is selected at random, what is the probability that it is defective? If a selected item is defective, what is the probability that it is from machine A? **(09 Marks)**

OR

10 a. Find the probability that the birth days of 5 persons chosen at random will fall in 12 different calendar months. **(05 Marks)**

b. A box A contains 2 white balls and 4 black balls. Another box B contains 5 white balls and 7 black balls. A ball is transferred from box A to box B. Then a ball is drawn from box B. Find the probability that it is white. **(06 Marks)**

c. State and prove Baye's theorem. **(09 Marks)**

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17EC42

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Signals and Systems

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain with an example :
i) Even and odd signal
ii) Energy and power signal
iii) Time shifting
iv) Time scaling
v) Prescenduce rule. **(10Marks)**

b. Sketch the following :
$y(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$ **(02Marks)**

c. Given the signal x(t) as shown in the Fig.1(c) sketch the following :
i) x(2t + 2) and ii) x(t/2 – 1). **(08Marks)**

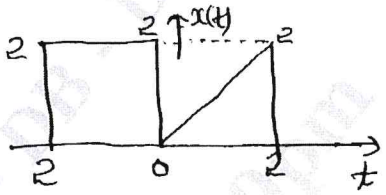

Fig.1(c)

OR

2 a. Find the even the odd components of the following signals :
i) $x(t) = \cos t + \sin t + \sin t \cdot \cos t$
ii) $x(n) = \{-3, 1, \underset{\uparrow}{2}, -4, 2\}$. **(06 Marks)**

b. For the signal shown in Fig.Q2(b), find the total energy. **(08 Marks)**

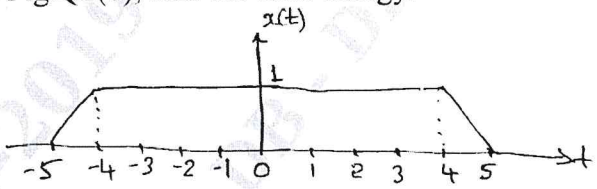

Fig.Q2(b)

c. Verify the following system for linearity and time invariance :
i) $y(t) = t \cdot x(t)$ ii) $y(n) = x[n] + n$. **(06 Marks)**

Module-2

3 a. What do you mean by impulse response of an LTI system? Starting from fundamentals, deduce the equation for the response of an LTI system if the input sequences x(n) and the impulse response h(n) are given. **(08 Marks)**

b. Determine the output of an LTI system for an input $x(t) = u(t) - u(t-2)$ and impulse response $h(t) = u(t) - u(t-2)$. **(06 Marks)**

c. An LTI system is characterized by an impulse response $h(n) = (3/4)^n u(n)$. Find the response of the system when the input $x(n) = u(n)$. Also evaluate the output of the system at $n = +5$ and $n = -5$. **(06 Marks)**

OR

4 a. LTI system has an impulse response :

$$h(n)=\begin{cases}1 & ; \ n=+/-1\\ 2 & ; \ n=0\\ 0 & ; \ \text{otherwise}\end{cases}$$

Determine the output of this system in response to the input :

$$x(n)=\begin{cases}2 & ; \ n=0\\ 3 & ; \ n=1\\ -2 & ; \ n=2\\ 0 & ; \ \text{otherwise}\end{cases}$$

(06 Marks)

b. Determine the discrete time convolution of input $x(n) = \beta^n u(n)$ and impulse response $h(n) = u(n-3)$. Assume magnitude of β to be less than 1. **(08 Marks)**

c. Prove $[x(n) * h_1(n)] * h_2(n) = x(n) * [h_1(n) * h_2(n)]$. **(06 Marks)**

Module-3

5 a. Evaluate the step response for the following impulse responses

i) $h(n) = (\frac{1}{2})^n u(n)$

ii) $h(t) = u(t+1) - u(t-1)$. **(08 Marks)**

b. Check for the following impulse responses memoryless, causal and stable.

i) $h(t) = e^{2t} u(t-1)$

ii) $h(n) = (\frac{1}{2})^n u(n)$. **(06 Marks)**

c. Evaluate the DTFS representation for the signal :

$$x[n]=\sin\left[\frac{4\pi}{21}n\right]+\cos\left[\frac{10\pi}{21}n\right]+1$$

Sketch magnitudes and phase spectra. **(06 Marks)**

OR

6 a. An inter connection of LTI system is shown in Fig.Q6(a). The impulse responses are $h_1(n) = (\frac{1}{2})^n u(n+2)$, $h_2(n) = \delta(n)$ and $h_3(n) = u(n-1)$. Find the impulse response h(n) of the overall system. **(06 Marks)**

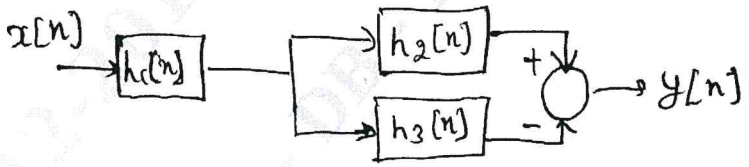

Fig.Q6(a)

b. State the following properties of continuous time Fourier series

i) Convolution ii) Time shift iii) Linearity iv) Differential in time domain. **(04 Marks)**

c. Find the complex Fourier coefficient for the periodic waveform x(t) as shown in the Fig.Q6(c). Also draw the amplitude and phase spectra. **(10 Marks)**

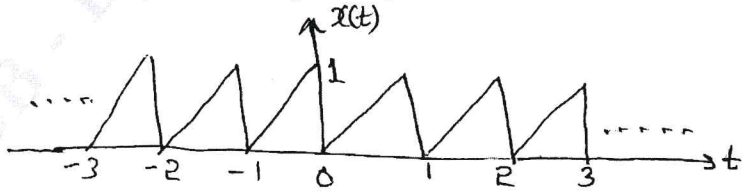

Fig.Q6(c)

Module-4

7 a. Find the Fourier transform of the signal $x(t) = e^{-at}$; $a > 0$. Also sketch magnitude and phase spectra. **(08 Marks)**

b. State and prove the following properties of discrete time Fourier transform.
i) Convolution
ii) Frequency differentiation. **(08 Marks)**

c. Find the DTFT of the signal $x[n] = u[n] - u[n-6]$. **(04 Marks)**

OR

8 a. Obtain the DTFT of the rectangular pulse is defined as :
$x[n] = 1 \; ; |n| \leq M$
$= 0 \; ; |n| > M$ **(08 Marks)**

b. Specify the Nyquist rate for the following signals
i) $x(t) = \cos(5\pi t) + 0.5\cos(10\pi t)$
ii) $x(t) = \text{sin c}(200t)$. **(04 Marks)**

c. Using properties of Fourier transform, find the Fourier transform of the signal :
$$x(t) = \frac{d}{dt}\left[te^{-2t}\sin u(t)\right].$$ **(08 Marks)**

Module-5

9 a. Determine the Z–transform of the signal $x[n] = a^n u[n]$. Indicate the ROC and locations of poles and zeros of X(z) in the z–plane. **(06 Marks)**

b. Find the Z-transform and the ROC of the discrete sinusoid signal $x(n) = \sin[\Omega n]\, u(n)$. **(08 Marks)**

c. Find the inverse Z–transform of $x(z) = \dfrac{\frac{1}{4}z^{-1}}{(1-\frac{1}{2}z^{-1})(1-\frac{1}{4}z^{-1})}$ ROC $|z| > \frac{1}{2}$. **(06 Marks)**

OR

10 a. Find the impulse response for the following difference equation :
$y(n) - 4y(n-1) + 3y(n-2) = x(n) + 2x(n-1)$. **(08 Marks)**

b. Find the Z –transform and ROC of $x(n) = a^{n-1}\, u(n-1)$ using properties of Z–transforms. **(06 Marks)**

c. Using Z-transform find the convolution of the following two sequences :
$$h[n] = \begin{cases} \left[\frac{1}{2}\right]^n; & 0 \leq n \leq 2 \\ 0 \; ; & \text{otherwise} \end{cases}$$
And $x[n] = \delta[n] + \delta[n-1] + \delta[n-2]$. **(06 Marks)**

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17EC43

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Control Systems

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define closed loop control systems and list its advantages and disadvantages with examples. **(04 Marks)**

b. For the mechanical system shown in Fig.Q.1(b), write i) The mechanical network ii) the equations of motion and iii) the force-current analogous electrical network. **(08 Marks)**

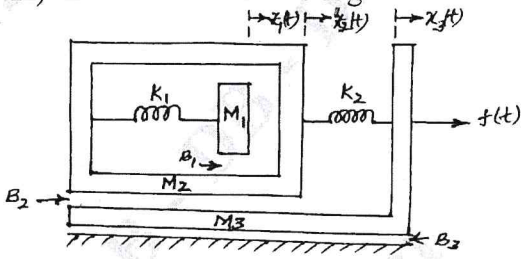

Fig.Q.1(b)

c. For the system represented by the following equations, find the transfer function X(S)/U(S) by signal flow graph technique.

$x(t) = x_1(t) + \beta_3 u(t)$

$x_1^1(t) = -a_1 x_1 + x_2 + \beta_2 u(t)$

$x_2^1(t) = -a_2 x_1 + \beta_1 u(t)$ **(08 Marks)**

OR

2 a. Define analogous systems. Show that two systems shown in Fig.Q.2(a) are analogous systems, by comparing their transfer functions. **(08 Marks)**

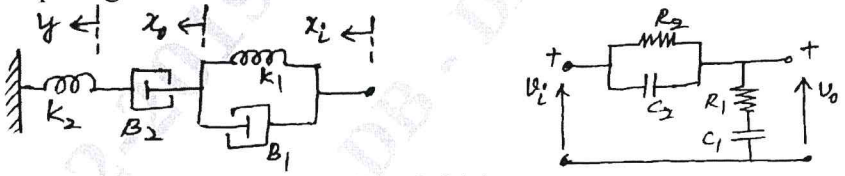

Fig.Q.2(a)

b. For the block diagram shown in Fig.Q.2(b), determine the transfer function C(S)/R(S) using block diagram reduction technique. **(08 Marks)**

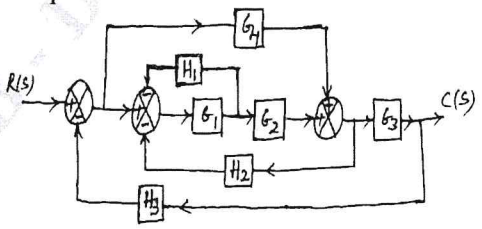

Fig.Q.2(b)

c. Define the following terms in connection with signal flow graph:
   i) Node
   ii) Forward path gain
   iii) Feedback loop
   iv) Non-touching loops. **(04 Marks)**

Module-2

3 a. Define the following time response specifications for an underdamped second order system:
   i) Rise time, t_r
   ii) Peak time, t_p
   iii) Peak-overshoot, M_p
   iv) Settling time, t_s **(04 Marks)**

b. A system is given by the differential equation $y''(t)+y'(t)+y(t)=x(t)$, where y(t) in the output. Determine all time domain specifications for unit step input. **(08 Marks)**

c. The open loop transfer function of a unity feedback system is given by $G(s)=\frac{K}{S(ST+1)}$
   i) By what factor should the amplifier gain K be multiplied in order that the damping ratio is increased from 0.2 to 0.8?
   ii) By what factor should K be multiplied so that the system overshoot for unit step excitation is reduced from 60% to 20%? **(08 Marks)**

OR

4 a. Derive the expressions for i) Rise time, t_r and ii) Peak overshoot, M_p for the underdamped response of a second order system for a unit step input. **(06 Marks)**

b. For the system shown in Fig.Q.4(b), compute the values of K and τ to give an overshoot of 20% and peak time of 2 sec for an unit step excitation. **(08 Marks)**

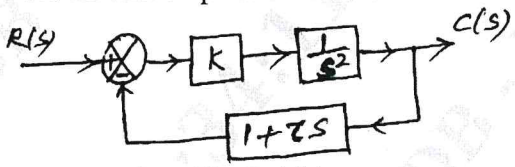

Fig.Q.4(b)

c. Find the position, velocity and acceleration error constant for a control system having open loop transfer function $G(S)H(S)=\frac{10}{S(S+1)}$. Also find the steady state error for the input $r(t) = 1 + t$. **(06 Marks)**

Module-3

5 a. State and explain Routh's stability criterion for determining the stability of the system and mention its limitations. **(06 Marks)**

b. Determine the number of roots that are
   i) in the right half of s-plane
   ii) on the imaginary axis and
   iii) in the left half of s-plane
   for the system with the characteristic equation $s^6 + s^5 - 2s^4 - 3s^3 - 7s^2 - 4s - 4 = 0$. **(06 Marks)**

c. Sketch the root locus plot of a certain control system, whose characteristic equation is given by $s^3 + 10s^2 + ks + k = 0$, comment on the stability. **(08 Marks)**

OR

6 a. For a system with characteristic equation $s^4 + ks^3 + s^2 + s + 1 = 0$, determine the range of K for stability. **(04 Marks)**

b. Determine the values of 'k' and 'a' for the open loop transfer function of a unity feedback system is given by $G(s) = \frac{K(s+1)}{s^3 + as^2 + 3s + 1}$, so that the system oscillates at a frequency of 2rad/sec. **(06 Marks)**

c. Draw the root locus diagram for the system shown in Fig.Q.6(c), show all the steps involved in drawing the root locus. Determine:

i) The least damped complex conjugate closed loop poles and the value of 'K' corresponding to these roots

ii) Minimum damping ratio. **(10 Marks)**

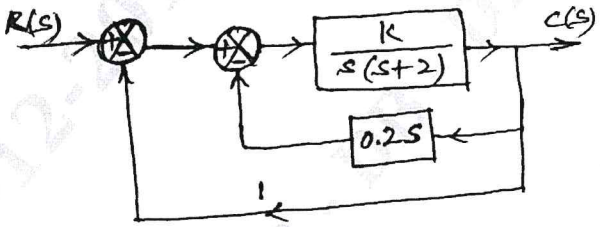

Fig.Q.6(c)

Module-4

7 a. Define the following terms in connection with bode plots:

i) Gain cross over frequency

ii) Phase crossover frequency

iii) Gain margin

iv) Phase margin. **(04 Marks)**

b. A negative feedback control system is characterized by an open loop transfer function $G(S)H(S) = \frac{20}{S(S+1)(S+2)}$. Sketch the polar plot and hence determine w_{gc}, w_{pc}, G_M and P_M. Comment on the stability. **(06 Marks)**

c. A unity feedback control system has $G(s) = \frac{100(1+0.1s)}{s(s+1)^2(0.01s+1)}$. Draw the Bode plots and hence determine W_{gc}, W_{pc}, GM and PM. Comment on the stability. **(10 Marks)**

OR

8 a. A unity feedback control system has $G(s) = \frac{200(s+2)}{s(s^2+10s+100)}$. Draw the bode plots and hence determine stability of the system. **(10 Marks)**

b. Using Nyquist stability criterion, find the range of K for closed loop stability for the negative feedback control system having the open loop transfer function $G(S)H(S) = \frac{K}{S(S^2+2S+2)}$. **(10 Marks)**

Module-5

9 a. State the advantages of state variable analysis. **(04 Marks)**

b. Obtain the state model for the electrical system shown in Fig.Q.9(b). Take $i_o(t)$ as output. **(06 Marks)**

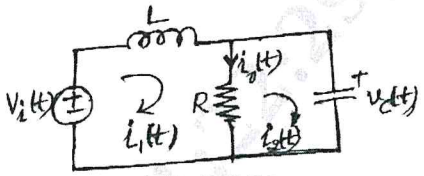

Fig.Q.9(b)

c. For a system represented by the state model

$$\begin{bmatrix} x_1'(t) \\ x_2'(t) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -3 & -4 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t) \text{ and } y(t) = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}$$

Determine:

i) The state transition matrix, $\phi(t)$ and

ii) The transfer function of the system. **(10 Marks)**

OR

10 a. Define state transition matrix and list its properties. **(04 Marks)**

b. Consider a state model with matrix $A = \begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix}$. Determine the model matrix M. **(06 Marks)**

c. Obtain the time response of the following non homogeneous state equation:

$$\begin{bmatrix} x_1'(t) \\ x_2'(t) \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u(t)$$

where u(t) is a unit step function, when $x(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ **(10 Marks)**

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CBCS SCHEME

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17EC44

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Principles of Communication Systems

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Describe time-domain analysis of amplitude modulation with relevant spectrum. **(08 Marks)**

b. Explain with neat circuit working of switching modulator with relevant signals. **(07 Marks)**

c. Explain COSTAS RECEIVER with neat block diagram. **(05 Marks)**

OR

2 a. Describe coherent detection of DSB-SC signal waves with block diagram and spectra. **(08 Marks)**

b. Explain the Frequency Translation with block diagram and relevant spectra. **(07 Marks)**

c. Explain Time-Domain approach in VSB transmission of analog and digital television. **(05 Marks)**

Module-2

3 a. Explain single tone-frequency modulation. Derive necessary FM equation. **(08 Marks)**

b. Calculate the carrier swing, carrier frequency freq deviation and modulation index for an FM wave, which reaches max freq of 99.047 MHz and minimum frequency of 99.023 MHz. The frequency of modulating signal is 7 kHz. **(08 Marks)**

c. Explain Direct Method of generating FM wave. Draw block diagram of Generating WBFM wave with frequency stabilization. **(04 Marks)**

OR

4 a. Explain FM demodulation using PLL. Develop non-linear model of PLL. **(10 Marks)**

b. Explain with block diagram FM Stereo Multiplexing. **(10 Marks)**

Module-3

5 a. Derive expression for overall noise figure when two-port network are in cascade. **(08 Marks)**

b. For the network connection shown in Fig.Q5(b), determine overall noise figure and also find equivalent noise temperature.

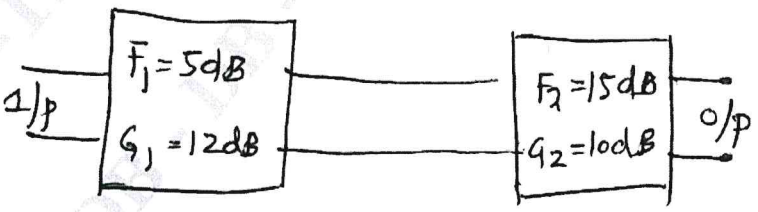

Fig.Q5(b) **(07 Marks)**

c. Explain: (i) Thermal noise (ii) White noise **(05 Marks)**

OR

6 a. Explain noise equivalent bandwidth and show that effective bandwidth $B_\eta = \frac{1}{4RC}$. **(06 Marks)**

b. Define equivalent noise temperature. Define $Te = Te_1 + \frac{Te_2}{G} + \frac{Te_3}{G_1 G_2} + ...$ **(08 Marks)**

c. Mention properties of auto-correlation function. **(06 Marks)**

Module-4

7 a. Discuss noise in AM Receiver. Derive $FOM = \frac{Ka^2 P_m}{1 + Ka^2 P_m}$. **(10 Marks)**

b. Explain the need of pre-emphasis and de-emphasis in FM. Derive $I = \frac{2W^3}{3\int_{-w}^{w} f^2 |H_{de}(f)^2| df}$ **(10 Marks)**

OR

8 a. Discuss threshold effect in FM. **(08 Marks)**

b. Derive expression for FOM in case of FM, $FOM = \frac{3K_f^2 P_m}{W^2}$. **(12 Marks)**

Module-5

9 a. A continuous time signal X(t) has a bandwidth F_3 = 10 kHz and it is sampled at F_s = 22 kHz using 8bit/sample. The signal is properly scaled. So that |X(n)| < 128 for all n.

(i) Determine your best estimate of the variance of the quantization error σ_e^2.

(ii) We want to increase the sampling rate by 16 times. How many bits per samples you would use in order to maintain the same level of quantization? **(08 Marks)**

b. State and prove sampling theorem. **(08 Marks)**

c. Mention advantages of digital communication. **(04 Marks)**

OR

10 a. Explain TDM with neat block diagram. **(10 Marks)**

b. Find the Nyquist rate and Nyquist interval for:

i) $m_1(t) = \frac{1}{2\pi}\cos(4000\pi t)\cos(1000\pi t)$

ii) $m_2(t) = \frac{\sin 500\pi t}{\pi t}$ **(10 Marks)**

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CBCS SCHEME

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17EC45

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define the following parameter of Op-Amp and also mention its typical values of 741: i) CMRR ii) Slew rate iii) Power supply voltage rejection. **(06 Marks)**

b. Design an inverting amplifier using a 741 Op-Amp. The voltage gain is to be 50 and output voltage amplitude is to be 2.5V. **(07 Marks)**

c. Derive the expression for output voltage of a difference amplifier and also explain the common mode nulling. **(07 Marks)**

OR

2 a. Discuss the methods of offset nulling in Op-Amp circuit. **(06 Marks)**

b. Design a Non-inverting amplifier using 741-Op-Amp, is to amplify the input voltage of 100mV to a level of 3V output. **(07 Marks)**

c. Explain the various methods of Biasing Op-Amp. **(07 Marks)**

Module-2

3 a. Sketch and explain high Z_{in} capacitor coupled voltage follower with necessary design steps and also show that the input impedance is very high as compared to direct coupled voltage follower. **(08 Marks)**

b. Design inverting amplifier circuit is to be capacitor coupled and to have a signal frequency range of 10Hz to 1kHz. If load resistance is 250Ω with Av = 50 and V_0 = 3V. Use 741 Op-Amp. **(08 Marks)**

c. What is Precision Rectifiers? Mention the advantages of it. **(04 Marks)**

OR

4 a. Sketch precision full wave rectifier using HWR and summing circuit and explain it. **(08 Marks)**

b. What is instrumentation amplifier? Compare differential input/output amplifier and a difference amplifier. **(06 Marks)**

c. Design a basic current amplifier circuit has an input current of 1mA and a 100Ω load resistor. The current gain is 5. **(06 Marks)**

Module-3

5 a. Prove that $V_{0(comp)} = \left(1+\frac{R_2}{R_{TC}}\right)\frac{KT}{q}\ell_n\left(\frac{V_{in}}{V_{ref}}\right)$ of a log amplifier. **(08 Marks)**

b. Sketch and explain the working of phase shift oscillator using Op-Amp and also write the design equations. **(08 Marks)**

c. What are the applications of analog multipliers? **(04 Marks)**

OR

6 a. Draw an Op-Amp sample and hold circuit. Sketch the input signal, control, output waveforms and explain the circuit operation. **(08 Marks)**

b. Explain the operation of a inverting Schmitt triggering with two different level of trigger points using diodes. **(08 Marks)**

c. For the voltage detector shown in Fig.Q.6(c). Design a value of R_1 and R_2. Assume $V_{R_2} = 1.5V$. **(04 Marks)**

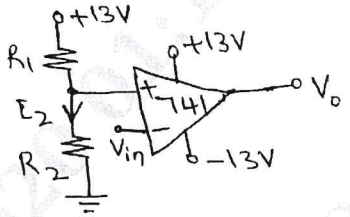

Fig.Q.6(c)

Module-4

7 a. Sketch the circuit and frequency response of a first order low pass filter and explain its operation. **(06 Marks)**

b. Design a second order high pass filter to have a cut off frequency of 12kHz. Use a 715 Op-Amp with $I_{B(max)} = 1.5\mu A$. **(07 Marks)**

c. List and explain the characteristics of three terminal IC regulators. **(07 Marks)**

OR

8 a. Draw the functional block diagram of a 723 regulator and explain it. **(06 Marks)**

b. Explain how fixed regulator can be used as adjustable regulator. Design fixed voltage regulator using 7805 to get an output of 7.5V. Assume $I_{R_1} = 25mA$ and $I_Q = 4.2mA$. **(07 Marks)**

c. Discuss the differences between wide band and narrow band pass filter. Sketch typical frequency response for each. Write the equations relating Q, B, f_1 and f_2. **(07 Marks)**

Module-5

9 a. Draw the block diagram of a PLL and explain the functions of each block. **(06 Marks)**

b. A 555 Astable multivibrator has $R_A = 2.2K\Omega$, $R_B = 6.8K\Omega$ and $C = 0.01\mu F$. Calculate:

i) t_{high}
ii) t_{low}
iii) free running frequency
iv) Duty cycle

and also draw the connection diagram **(07 Marks)**

c. Derive the expression of pulse width of a monostable multivibrator using 555 IC timer and also design a monostable multivibrator with pulse width of 0.25msec. Assume $C = 0.1\mu F$. **(07 Marks)**

OR

10 a. Derive the expression of output voltage of a R – 2R ladder type DAC. **(08 Marks)**

b. Draw the block diagram of a successive approximation type ADC and explain it. **(08 Marks)**

c. Mention the applications of monostable multivibrator using 555 timer. **(04 Marks)**

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17EC46

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Microprocessors

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define Microprocessor. Describe the architecture of 8086 with neat block diagram. **(10 Marks)**

b. Explain flag register of 8086 with its format. **(08 Marks)**

c. Explain the formation of opcode for MOV AX, BX. Opcode for MOV instruction is "100010". **(02 Marks)**

OR

2 a. Explain the following addressing modes of 8086:
(i) Register Addressing mode (ii) Based Indexed mode.
(iii) Immediate mode (iv) Direct addressing mode **(08 Marks)**

b. Write 8086 program to find the smallest number out of N 16 bit unsigned numbers stored in a memory block starting with the address 2000H. Store the result at word location 3000H. **(08 Marks)**

c. Explain the significance of following pins of 8086:
(i) ALE (ii) RESET (iii) $\overline{TEST}$ (iv) M/$\overline{IO}$ **(04 Marks)**

Module-2

3 a. Explain the following instruction with examples:
(i) LEA (ii) IDIV (iii) XLAT (iv) TEST **(08 Marks)**

b. Write a complete assembly language program in 8086 which determines all the occurrences of a character in a given string. **(08 Marks)**

c. What are assembler directives? Explain any three. **(04 Marks)**

OR

4 a. List and explain the string manipulation instructions. Also give its advantages. **(10 Marks)**

b. Write an ALP to copy a 100 byte block of data from LOC1 to LOC2 using the MOVS instructions. **(06 Marks)**

c. Write an ALP to find whether the given number is 2 out of 5 code. **(04 Marks)**

Module-3

5 a. Explain the stack structure of 8086 and the operations of PUSH and POP instructions with examples. **(08 Marks)**

b. Differentiate between procedure and macro. **(06 Marks)**

c. Write an ALP to change a sequence of sixteen 2 byte numbers from ascending to descending order. Store the new series at different address. Use LIFO property of the stack. **(06 Marks)**

OR

6 a. Explain the type of interrupts and the action taken by the 8086 when an interrupt occurs in detail. **(06 Marks)**

b. Explain the interrupt acknowledgement cycle of 8086 with the neat timing diagram. **(06 Marks)**

c. Write a program to generate a delay of 100ms using an 8086 system that runs on 10 MHz frequency. Show the calculations. **(08 Marks)**

Module-4

7 a. Sketch the minimum mode configuration of 8086 and explain the operation briefly. **(08 Marks)**

b. Interface two 4k×8 EPROM and two 4k×8 static RAM chips of 8086. The addresses of RAM and ROM should start from FC000H and FE000H respectively. **(08 Marks)**

c. Draw the timing diagram for $\overline{RQ}/\overline{GT}$ for maximum mode. **(04 Marks)**

OR

8 a. Write the control word format of 8255 PIA. **(06 Marks)**

b. Show an interface of keyboard of 8086 and explain with a flowchart. **(10 Marks)**

c. How is key Debounce achieved through hardware? **(04 Marks)**

Module-5

9 a. Explain the internal architecture of 8087. **(06 Marks)**

b. Write a program to read analog input connected to the last channel of ADC0808 interfaced to 8086 using 8255 and digital value to be stored at location 3000h. **(06 Marks)**

c. Explain the following INT 21K DOS function calls:
(i) Function 01H (ii) Function 02H (iii) Function 09H (iv) Function OAH **(08 Marks)**

OR

10 a. Write an ALP to rotate a stepper motor by 100 steps in clockwise direction for a 1.8 degree connected to 8255 port. Show details of calculations. Motor is rotating at 12 rpm and processor speed is 10 MHz. **(08 Marks)**

b. Explain Von-Neumann and Harvard CPU architecture and USC and RISC CPU architecture. **(08 Marks)**

c. Write a program to generate triangular wave using DAC 0800. **(04 Marks)**

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15EC42

Fourth Semester B.E. Degree Examination, July/August 2021
Microprocessor

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions.*

1 a. With a relevant diagram, explain the register organization of 8086. **(08 Marks)**

b. List any three the advantages of memory segmentation. **(03 Marks)**

c. The contents of different registers are shown below. Form the effective addresses for the instructions given below. Offset (displacement) = 5000H.
[AX] = 1000H, [BX] = 2000H, [SI] = 3000H, [DI] = 4000H, [BP] = 5000H, [SP] = 6000H, [CS] = 0000H, [DS] = 1000H, [SS] = 2000H, [IP] = 7000H.
i) MOV AX, [5000H]
ii) MOV AX, [BX]
iii) MOV AX, 5000H[Bx]
iv) MOV AX, [BX] [SI]
v) MOV AX, 5000H [BX] [SI]. **(05 Marks)**

2 a. Explain PUSH AX and POP AX instructions with steps involved. **(05 Marks)**

b. Write an 8086 ALP to multiply two 8 bit signed numbers. Give example for different cases. **(06 Marks)**

c. If the machine code for OPCODE MOV is 100010, find the hex codes for,
i) MOV AX, BX
ii) MOV AX, [BX] **(05 Marks)**

3 a. Explain different string handling instructions. **(05 Marks)**

b. Write an 8086 ALP for the addition of two 3 × 3 matrices shown below. The matrices are stored in the form of lists (row wise). Store the result of addition in the third list.

$$MAT1 = \begin{bmatrix} 01H & 02H & 03H \\ 04H & 05H & 06H \\ 07H & 08H & 09H \end{bmatrix} \quad MAT2 = \begin{bmatrix} 11H & 22H & 33H \\ 44H & 55H & 66H \\ 77H & 88H & 99H \end{bmatrix}$$ **(05 Marks)**

c. Explain the following instructions with example
i) AAA ii) SAR iii) NEG. **(06 Marks)**

4 a. Explain the following assembler directives with example.
i) ORG ii) PTR iii) PROC. **(06 Marks)**

b. Write an 8086 ALP to convert an 8 bit binary number into equivalent BCD code. **(05 Marks)**

c. If [CL] = 36, find the contents of register BL after execution of following set of instructions

```
      MOV BL, 1
      MOV AL, 0
UP :  CMP CL, 0
      JZ END
      SUB CL, BL
      INC AL
      ADD BL, 02
      JMP UP
END : MOV BL, AL
```
(05 Marks)

5 a. What is an interrupt vector table? With a diagram, explain the structure of interrupt vector table of 8086. **(06 Marks)**

b. Write an 8086 ALP to generate a delay of 1 minute if 8086 system frequency is 10MHz. Show the calculation for delay. **(06 Marks)**

c. With timing diagram, explain the interrupt acknowledgement cycle of 8086. **(04 Marks)**

6 a. Write an 8086 procedure to convert a packed BCD number in AL to ASCII equivalent in AX. **(04 Marks)**

b. Differentiate between procedure and macro. **(04 Marks)**

c. Explain any four ways to pass parameters to procedure. **(08 Marks)**

7 a. Sketch the minimum mode configuration of 8086 and briefly explain the operation. **(06 Marks)**

b. Design an interface between 8086 CPU and two chips of 16K×8 EPROM and two chips of 32K×8 RAM. Select the starting address of EPROM suitably. The RAM address must start at 00000H. **(10 Marks)**

8 a. Give the steps for interfacing an IO device to 8086. **(03 Marks)**

b. With a neat block diagram, explain the internal architecture of 8255. **(08 Marks)**

c. Explain the structure of control word register format of 8255 for BSR mode. **(05 Marks)**

9 a. Draw a schematic diagram for interfacing DAC0800 to 8086 using 8255. Write an ALP to generate a triangular wave of frequency 500Hz. Assume 8086 system frequency as 8MHz. The amplitude of the triangular wave should be +5V. **(08 Marks)**

b. With a diagram, explain the internal architecture of 8253/54. **(08 Marks)**

10 a. Give any four differences between 8088 and 8086 microprocessors. **(04 Marks)**

b. With a diagram, explain the interconnection of 8087 with 8086 microprocessor. **(08 Marks)**

c. Using INT 21H DOS function call, write an ALP to display the message "MICROPROCESORS" on the display screen of the computer. **(04 Marks)**

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15EC43

Fourth Semester B.E. Degree Examination, July/August 2021
Control Systems

Time: 3 hrs. Max. Marks:80

Note: ***Answer any FIVE full questions.***

1 a. List the merits and demerits of open loop and closed loop control systems. Give at least one example each? **(05 Marks)**

b. Explain the block diagram rule regarding :
i) Combining blocks in cascade
ii) Moving a summing point after a block
iii) Moving a take-off point beyond a block. **(05 Marks)**

c. For the electrical circuit shown in Fig.Q1(c) construct the block diagram.

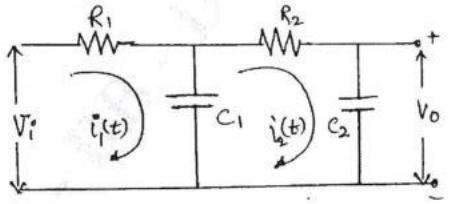

Fig.Q1(c) **(06 Marks)**

2 a. For the two port network shown in Fig.Q2(a), obtain transfer function of $V_1(s)/I_1(s)$.

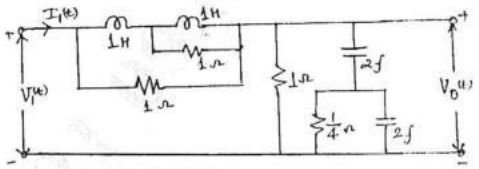

Fig.Q2(a) **(05 Marks)**

b. For the system shown in Fig.Q2(b), i) Write the differential equation describing the system ii) Draw Force – voltage analogous electrical circuit.

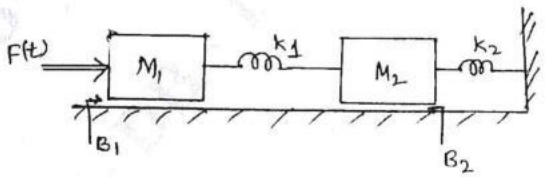

Fig.Q2(b) **(05 Marks)**

c. For the signal graph shown in Fig.Q2(c), find the transfer function, using Masoris gain formula.

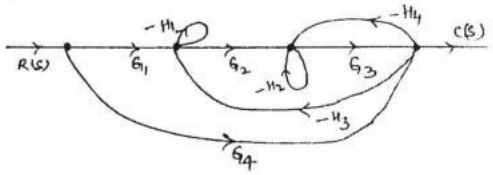

Fig.Q2(c) **(06 Marks)**

3 a. Derive the time response of second order system for the underdamped case, subjected to unit step input. **(10 Marks)**

b. For the unity feedback system $G(s)=\frac{s(s+1)}{s^2(s+3)(s+10)}$. Determine the type of the system, error co-efficients and steady state error for input $r(t)=1+3t+\frac{t^2}{2}$. **(06 Marks)**

4 a. Explain the following time domain specifications of a second order system :
i) Rise time ii) Peak time iii) Maximum over shoot iv) Settling time. **(04 Marks)**

b. The open loop transfer function of a unity feedback control system is given as $G(S)=\frac{k}{S(TS+1)}$. By what factor the system gain K has to be multiplied to decrease overshoot from 75% to 25%. **(06 Marks)**

c. For the system shown in Fig.Q4(c), determine the value of 'a' which gives damping factor 0.7. What is the steady state error to unit ramp input for valve of 'a'.

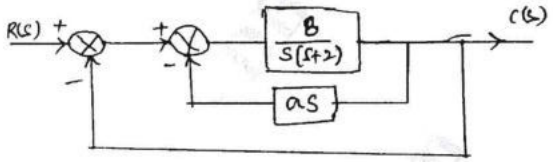

Fig.Q4(c) **(06 Marks)**

5 a. Explain the terms 'Relative stability' and 'Conditional Stability'. **(04 Marks)**

b. State and explain Routh-Hurwitz criterion. **(04 Marks)**

c. Sketch the root loci to determine the stability of the system $G(s)=\frac{k}{s(s+1)(s+3)}$. **(08 Marks)**

6 a. State the different rules for the construction of root locus. **(08 Marks)**

b. The open loop transfer function of a unity feedback system is given by $G(s)=\frac{k}{s(s+3)(s^2+s+1)}$.
Find the value of K, that will cause sustained oscillation and hence find the oscillation frequency. **(08 Marks)**

7 a. Define the following with reference to Bode plots :
i) Gain margin
ii) Phase margin
iii) Gain cross over frequency
iv) Phase cross over frequency. **(06 Marks)**

b. Construct the bode plot for a unity feedback control system with $G(s)=\frac{10(s+10)}{s(s+2)(s+5)}$. Find its gain margin and phase margin. Comment on the stability. **(10 Marks)**

8 a. Sketch the polar plot of $G(s)=\frac{1}{s+2}$. Show all the steps involved. **(06 Marks)**

b. Sketch the Nyquist plot for the open – loop transfer function $G(s)H(s)=\frac{10}{(s+2)(s+4)}$.
Determine the stability of the closed loop system by Nyquist criterion. **(10 Marks)**

9 a. List the properties of state transition matrix. **(06 Marks)**

b. What is sampled data control system? **(02 Marks)**

c. Obtain the state model for the electric network shown in Fig.9(c). Select i_L and V_c as state variables.

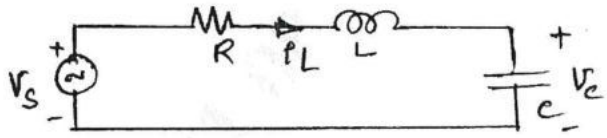

Fig.Q9(c) **(08 Marks)**

10 a. What is signal reconstruction? Explain it with sample and hold circuit. **(08 Marks)**

b. Obtain the state transition matrix Q(t) of the following system.

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Also obtain the inverse of the state transition matrix $\phi'(t)$. **(08 Marks)**

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15EC44

Fourth Semester B.E. Degree Examination, July/August 2021
Signals and Systems

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions.*

1 a. Check whether the following system is i) linear or nonlinear ii) Time invariant or time variant iv) Stable or unstable v) invertible or non invertible $y(n) = \log(x(n))$ **(06 Marks)**

b. Sketch the following signals and determine their even and odd components
$x(n) = u(n+2) - 3\,u(n-1) = 2u(n-5)$ **(06 Marks)**

c. Represent the given signal x(t) shown in Fig Q1(c) using basic signals.

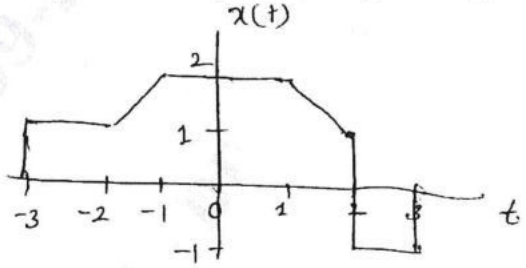

Fig Q1(c) **(04 Marks)**

2 a. Check whether the following signal are periodic or not. If periodic, determine the fundamental period :

i) $x(n) = \cos\left(\frac{\pi n}{7}\right)\sin\left(\frac{\pi n}{3}\right)$ ii) $x(t) = \left[2\cos^2\left(\frac{\pi t}{2}\right) - 1\right]\cos(\pi t)\sin(\pi t)$ **(06 Marks)**

b. A rectangular pulse $x(t) = \begin{cases} A, & \text{for } 0 \le t \le T \\ 0, & \text{Elsewhere} \end{cases}$ in applied to an integrator circuit, find the total energy of the output y(t) of the integrator. **(05 Marks)**

c. A staircase signal x(t) that may be viewed as a superposition of four rectangular pulses. Starting with rectangular pulse shown in Fig Q2(c), constant and express x(t) in forms of g(t)

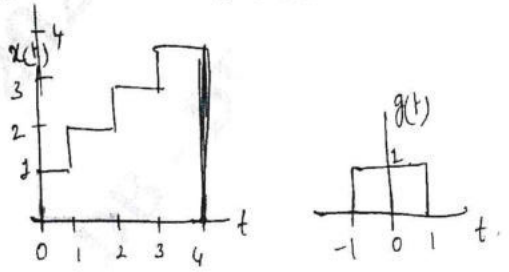

Fig Q2(c)

(05 Marks)

3 a. Find the overall impulse response of a cascade of two systems having identical impulse responses, $h(t) = 2[u(t) - u(t-1)]$. **(08 Marks)**

b. Find the discrete time convolution sum given below.
$y(n) = \beta^n u(n) \times \alpha^n u(n)$; $|\beta| < 1$; $|\alpha| < 1$. **(08 Marks)**

4 a. A LTI system has impulse response $h(t) = t\,u(t) + (10 - 2t)\,u(t - 5) - (10 - t)\,u(t - 10)$. Determine the output for the following input $x(t) = \delta(t + 2) + \delta(t - 5)$. **(05 Marks)**

b. Evaluate the discrete time convolution sum given below $y(n) = u(n) \times u(n - 3)$. **(08 Marks)**

c. State three properties of discrete time convolution. **(03 Marks)**

5 a. Find the step response of a system whose impulse response is given by $h(t) = u(t + 1) - u(t - 1)$. **(04 Marks)**

b. A system consists of several subsystem connected as shown in Fig Q5(b). Find the operator H relating x(t) and y(t) for the following subsystem operators.

$H_1 : y_1(t) = x_1(t)\, x_1(t - 1)$

$H_2 : y_2(t) = |\, x_2(t)\,|$

$H_3 : y_3(t) = 1 + 2x_3(t)$

$H_4 : y_4(t) = \text{Cos}\,(y_3(t))$

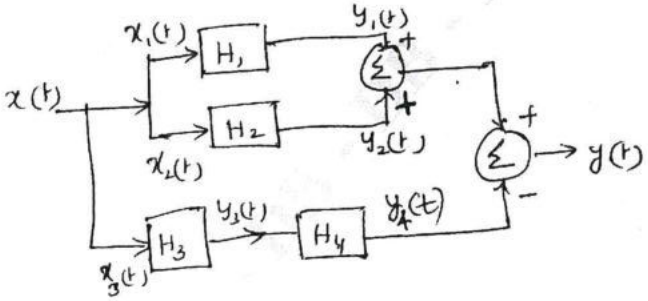

Fig Q5(b) **(05 Marks)**

c. Obtain the DTFS coefficient of $x(n) = \text{Cos}\left(\frac{6\pi}{13}n + \frac{\pi}{6}\right)$.

Draw : i) Magnitude spectrum ii) Phase spectrum. **(07 Marks)**

6 a. State the following properties of DTFS.

i) Linearity ii) Time shift iii) frequency shift iv) Parseval's Relationship v) Convolution vi) Modulation. **(06Marks)**

b. Evaluate the FS representation for the signal, $x(t) = \text{Sin}\,(2\pi t) + \text{Cos}\,(3\pi t)$. Sketch the magnitude and phase spectra. **(07 Marks)**

c. For the impulse response h(n) given below determine whether the corresponding system is i) memoryless ii) causal iii) stable.

$h(n) = 2u(n) - 2u(n - 1)$. **(03 Marks)**

7 a. Compute the DTFT of the signal

$$x(n) = \left(\frac{1}{2}\right)^n \{u(n+3) - u(n-2)\}$$ **(06 Marks)**

b. State and prove the following properties of Fourier Transform.

i) Frequency differentiation ii) Linearity. **(06 Marks)**

c. State Sampling theorem. **(04 Marks)**

8 a. Specify the Nyquist rate and Nyquist intervals for the following signals.

i) $g(t) = \text{Sin c}\,(200t)$ ii) $g_2(t) = \text{Sinc}^2\,(200t)$. **(04 Marks)**

b. Obtain the Fourier transform of the signal $x(t) = e^{-at}\,u(t)$; $a > 0$. Draw its magnitude and phase spectra. **(06 Marks)**

c. State and explain the significance of following terms under DTFT

i) Parseval's relation ii) Convolution iii) Time shift. **(06 Marks)**

9 a. Explain the properties of ROC. **(04 Marks)**

b. Determine the z-transform of $x(n) = -u(-n-1) + \left(\frac{1}{2}\right)^n u(n)$. Find the ROC and pole-zero locations of x(z) in the Z-plane. **(06 Marks)**

c. A causal system has input x(n) and output y(n). Find the impulse response of the system, if

$x(n) = \delta(n) + \frac{1}{4}\delta(n-1) + \frac{1}{8}\delta(n-2)$

$y(n) = \delta(n) - \frac{3}{4}\delta(n-1)$ **(06 Marks)**

10 a. State and prove the following properties Z-transform i) Initial value theorem ii) Time reversal property. **(06 Marks)**

b. Find the inverse Z-transform of $x(z) = \frac{z^{-1}}{-2z^{-2} - z^{-1} + 1}$ ROC : $|< |z| < 2$. **(06 Marks)**

c. Determine whether the system is causal and stable $H(z) = \frac{2z+1}{z^2 + z - 5/16}$. **(04 Marks)**

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15EC45

Fourth Semester B.E. Degree Examination, July/August 2021
Principle of Communication Systems

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions.***

1 a. Explain in detail Quaderture carrier multiplexing and demultiplexing systems. **(05 Marks)**

b. With relevant equations and diagrams explain the generation of AM waves using switching modulator. **(05 Marks)**

c. Consider a two stage modulator where the message signal occupies a band of 0.3KHz to 4 kHz and the two carrier frequencies are f_1 = 10KHz and f_2 = 100KHz. Evaluate the following :
   i) Sidebands of DSB – SC waves at the output of product modulators
   ii) Sideband at the output of Band pass filters
   iii) Passbands and guard bands of two BPF's
   iv) The order of the two filters assuming at least 15dB attenuation between the passband and stop band. **(06 Marks)**

2 a. Explain the working of practical synchronous cost as receiver system for demodulating DSB – SC wave. **(06 Marks)**

b. Define percentage modulation with relevant equation illustrate the time domain and frequency domain characteristics of single Tone amplitude modulated wave. **(05 Marks)**

c. An audio frequency signal $10\text{Sin } 2\pi \times 500t$ is used to amplitude modulate a carrier of $50 \text{ Sin } 2\pi \times 10^5 t$. Calculate i) Modulation index ii) Sideband frequencies iii) Amplitude of each sideband iv) Bandwidth v) Total power delivered to the load of 600Ω vi) Plot the frequency spectrum. **(05 Marks)**

3 a. Define modulation index, frequency deviation and derive the time domain and frequency domain representation of wide band FM. **(07 Marks)**

b. With relevant diagram, explain the balanced slope method of FM demodulation. **(05 Marks)**

c. An angle modulated signal is represented by $\delta(t) = 10 \text{ Cos}[2\pi \times 10^6 t + 5 \text{ Sin } 2000\pi t + 10 \text{ Sin } 3000 \pi t]$volts. Find the following :
   i) The power in the modulated signal across 1Ω resistor
   ii) Frequency deviation
   iii) The deviation ratio
   iv) The phase deviation
   v) The approximate transmission Bandwidth, B_T. **(04 Marks)**

4 a. With block diagram, explain the linear model of PLL. **(08 Marks)**

b. Write short notes on Non linearity and its effects in FM system. **(04 Marks)**

c. Explain FM stereo multiplexing in detail. **(04 Marks)**

5 a. For a random process X(t), define mean, correlation and covariance function. Explain the properties of autocorrelation function. **(06 Marks)**

b. In a communication receiver, the first stage is a tuned amplifier with an available power gain of 20dB and a noise figure of 10dB. The output of the amplifier is given to the mixer stage whose noise figure is 20dB. Determine the overall noise figure of the system. **(05 Marks)**

c. Show that the area under probability density function curve is always equal to unity. **(05 Marks)**

6 a. Define white noise and plot the power spectral Density and autocorrelation function of Ideal low pass filtered white noise. **(08 Marks)**

b. Define Noise equivalent Bandwidth and derive the expression for the same. **(08 Marks)**

7 a. Show that the figure of merit of a noisy FM receiver for single tone modulation is $\frac{3}{2}\beta^2$. **(08 Marks)**

b. With neat diagram, explain in detail the noisy receiver model. **(05 Marks)**

c. Explain the capture effect in FM. **(03 Marks)**

8 a. Derive the equation for the figure of merit of an AM receiver operating on a single tone AM. **(06 Marks)**

b. Explain FM threshold effect and its reduction methods. **(04 Marks)**

c. Give the importance of pre-emphasis and de-emphasis in frequency modulation. **(06 Marks)**

9 a. State and explain sampling theorem. State Nyquist rate and Nyquist interval. **(10 Marks)**

b. Calculate the nyquist rate and nyquist interval for

i) $x(t) = 3 \text{ Cos } 50\pi t + 10 \text{ Sin } 300\pi t + \text{Cos } 100\pi t$

ii) $x(t) = \frac{1}{2\pi} \text{Cos } (4000\pi t) \text{ Cos } (1000\pi t)$ **(06 Marks)**

10 a. Explain Quantization process Quantization noise and show that the output signal to noise ratio of an uniform quantize increases exponentially with the increasing number of bit per sample. **(10 Marks)**

b. With neat block diagram, explain TDM system. **(06 Marks)**

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15EC46

Fourth Semester B.E. Degree Examination, July/August 2021
Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions.

1 a. Explain the basic operational amplifier circuit with necessary diagram and expression. **(08 Marks)**

b. Derive the output voltage equation of 3 input inverting summing circuit and show how it can be converted into averaging circuit. **(08 Marks)**

2 a. Sketch the circuit of difference amplifier. Derive the equation for the output voltage and explain its operation. **(08 Marks)**

b. Explain direct coupled voltage follower with necessary diagram. Also compare voltage follower with emitter follower. **(08 Marks)**

3 a. Design a high Z_{in} capacitor coupled non inverting amplifier to have a low cut off frequency of 200 Hz. The input and output voltages are to be 15 mV and 3V respectively and minimum load resistance is 12 KΩ. Use LF353 BIFET op-amp. Assume R_2 = 1 MΩ (feedback resistor) **(08 Marks)**

b. Draw the circuit of an instrumentation amplifier and explain. Also show the method of nulling common mode output and how dc output nulling can be level shifted. **(08 Marks)**

4 a. Explain precision voltage source using op-amp and Zener diode. Also find the relationship between V_0 and V_2 for the same circuit. **(08 Marks)**

b. Discuss the operation of high input impedance full wave precision rectifier with necessary waveforms. **(08 Marks)**

5 a. Explain the working of RC phase shift oscillator with necessary expression and waveform. **(08 Marks)**

b. Design a differentiating circuit to give an output of 5V when the input changes by 1V in a time of 100 μs. Use an op-amp with a bipolar input stage. **(08 Marks)**

6 a. Explain the operation of fundamental log amplifier. Also derive its output voltage. **(08 Marks)**

b. Explain the operation of inverting Schmitt trigger using 741 op-amp, design a circuit for inverting Schmitt trigger to have trigger point of UTP = 0V and LTP = −1V with supply of ±12V. **(08 Marks)**

7 a. Design a second order low pass filter to have a cut off frequency of 1 kHz. **(08 Marks)**

b. Explain the functional diagram of 723 general purpose regulator. **(08 Marks)**

8 a. Explain single stage band pass filter with necessary design equation. **(08 Marks)**

b. Explain how fixed regulator used as adjustable regulator and also design on adjustable regulator using 7805 such that V_0 = 7.5 V, I_Q = 4.2 mA and I_{R_1} = 25 mA. **(08 Marks)**

9 a. Explain with internal diagram the operation of monostable multivibrator using 555 timer with necessary waveforms and equation. **(08 Marks)**

b. With necessary diagram, explain R-2R DAC. What output voltage would be produced by a DAC whose output range is 0 to 5V and whose input binary number is

(i) 1011 (for 4 bit DAC)

(ii) 11001011 (for 8 bit DAC) **(08 Marks)**

10 a. With a neat block diagram, explain the operation PLL related to

(i) Lock in range

(ii) Capture range

(iii) Pull-in time **(08 Marks)**

b. A 555 Astable multivibrator has $R_A = 2.2\ K\Omega$ and $R_B = 6.8\ K\Omega$ and $C = 0.01\ \mu F$. Calculate :

(i) t_{HIGH}

(ii) t_{LOW}

(iii) Free running frequency

(iv) Duty cycle D

Draw the connection diagram. **(08 Marks)**

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17EC42

Fourth Semester B.E. Degree Examination, July/August 2021
Signals and Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Distinguish between :
   i) Periodic and non-periodic signals
   ii) Even and odd signals. **(04 Marks)**

b. Determine whether the following systems are linear, causal, dynamic, time-variants and stable. i) $y(n) = 3x(n-1)$ ii) $y(t) = x(t^2)$. **(08 Marks)**

c. Given the signal x(t) as shown, sketch the following : i) $x(-2t+3)$ ii) $x(t/2-2)$.

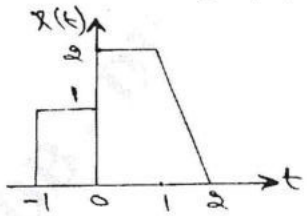

Fig.Q1(c) **(08 Marks)**

2 a. Check whether the following signals are periodic or not. If periodic, determine their fundamental period. i) $x(t) = \cos 2t + \sin 3t$ ii) $x(n) = \cos\left(\frac{\pi n}{5}\right)\sin\left(\frac{\pi n}{3}\right)$. **(06 Marks)**

b. Sketch the even and odd parts of the following signal, $x(t) = u(t+2) + u(t) - 2u(t-1)$. **(08 Marks)**

c. Express : x(t) interms of g(t), if x(t) and g(t) are as shown in Fig.Q2(c).

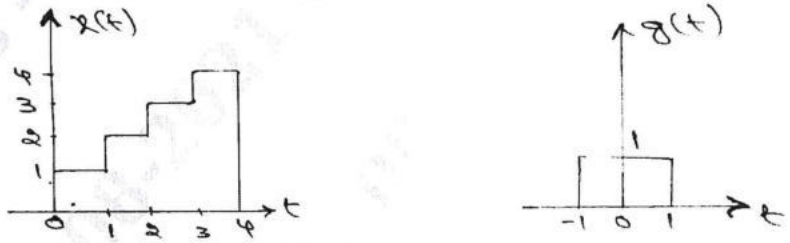

Fig.Q2(c) **(06 Marks)**

3 a. Prove the following :
   i) $x(t) * \delta(t-t_0) = x(t-t_0)$
   ii) $x(n) * h(n) = h(n) * x(n)$. **(04 Marks)**

b. Compute the convolution integral of $x(t) = e^{-3t}[u(t) - u(t-2)]$ and $h(t) = e^{-t}u(t)$. **(08 Marks)**

c. Evaluate $y(t) = x(t) * h(t)$. x(t) and h(t) are shown in Fig.Q3(c).

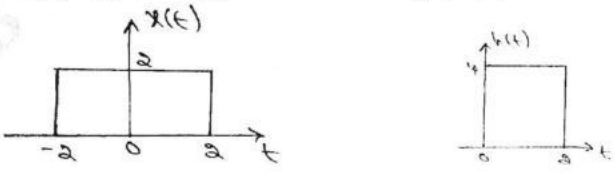

Fig.Q3(c) **(08 Marks)**

4 a. Evaluate $y(n) = x(n) * h(n)$. If $x(n)$ and $h(n)$ are given as :
$x(n) = \{2, \underset{\uparrow}{4}, -2, 1, 7\}$ and $h(n) = \{2, 3, \underset{\uparrow}{1}, 4\}$. **(05 Marks)**

b. Compute the convolution sum of $x(n) = a^n u(n)$ and $h(n) = b^n u(n)$. **(07 Marks)**
i) when $a > b$ ii) when $a < b$ iii) when $a = b$.

c. Determine the response of an LTI system with input $x(n) = (1/3)^n u(n)$ and impulse response $h(n) = u(n) - u(n-5)$. **(08 Marks)**

5 a. Calculate the step response of the LTI systems represented by following impulse responses.
i) $h(n) = (1/2)^n u(n-3)$ ii) $h(t) = \begin{cases} 1, & -2 \le t \le 0 \\ 0, & \text{elsewhere} \end{cases}$. **(06 Marks)**

b. State any six properties of CTFS. **(06 Marks)**

c. Determine the DTFS coefficients of $x(n) = \sin\left(\frac{4\pi n}{21}\right) + \cos\left(\frac{10\pi n}{21}\right) + 1$. Also sketch its magnitude and phase spectrum. **(08 Marks)**

6 a. Check the following LTI system for memoryless, causality and stability :
i) $h(t) = e^t u(-1, -t)$ ii) $h(n) = \{2, \underset{\uparrow}{3}, -1, 4\}$. **(06 Marks)**

b. Determine the Fourier series coefficients of the signal shown in Fig.6(b) and also plot $|X \times (k)|$ and $< X(k)$.

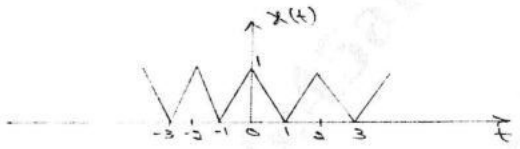

Fig.Q6(b) **(08 Marks)**

c. State the following properties DTFS :
i) Time shifting
ii) Frequency shifting
iii) Convolution
iv) Modulation
v) Parseval's theorem
vi) Duality. **(06 Marks)**

7 a. Determine the Fourier transforms of the following :
i) $x(t) = e^{at} u(-t)$ ii) $x(t) = e^{-a|t|}$, $a > 0$. **(08 Marks)**

b. State and prove the following properties of DTFT :
i) Convolution in time ii) Parseval's theorem. **(06 Marks)**

c. Determine the Nyquist sampling rate and Nyquist sampling interval for the following signals:
i) $x(t) = \frac{1}{2\pi}[\cos(4000\pi t)\cos(1000\pi t)]$ ii) $y(t) = \sin C^2(200t)$. **(06 Marks)**

8 a. State and prove the following properties of CTFT :
i) Time shifting ii) Frequency differentiation. **(08 Marks)**

b. Determine the DTFTs of the following :
i) $x(n) = (1/2)^n u(n-4)$ ii) $x(n) = -a^n u(-n-1)$. **(08 Marks)**

c. State the sampling theorem and briefly explain how to practically reconstruct the signal. **(04 Marks)**

9 a. Define region of convergence. Mention its properties. **(04 Marks)**

b. Using appropriate properties, find the z – transforms of the following signals :

i) $x(n) = n(n+1)\,u(n)$ ii) $x(n) = n(\frac{1}{3})^{n+3}\,u(n+3)$. **(08 Marks)**

c. Evaluate the inverse Z – transform of the following for all possible ROC's.

$$X(z) = \frac{z(z^2 - 4z + 5)}{(z-3)(z^2 - 3z + 2)}.$$ **(08 Marks)**

10 a. State and prove the following properties of Z-transform :

i) Time Reversal ii) Scaling in Z–domain. **(06 Marks)**

b. Find the Z–transform of $x(n) = 2^n u(n) + 3^n u(-n-1)$ and draw its pole – zero plot. **(04 Marks)**

c. Compute the response of the system : $y(n) = 0.7y(n-1) - 0.12y(n-2) + x(n-1) + x(n-2)$ to the input $x(n) = n\,u(n)$. Also check whether the system is stable. **(10 Marks)**

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17EC43

Fourth Semester B.E. Degree Examination, July/August 2021
Control Systems

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Write the difference between open loop and closed loop control system. **(04 Marks)**

b. For the mechanical system shown in Fig. Q1 (b). Write the analogous electrical network based on force-current analogy. **(08 Marks)**

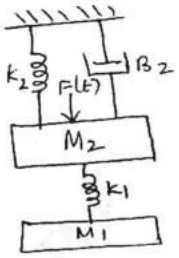

Fig. Q1 (b)

c. Obtain the overall transfer function of the block diagram, shown in Fig. Q1 (c) by block diagram reduction technique. **(08 Marks)**

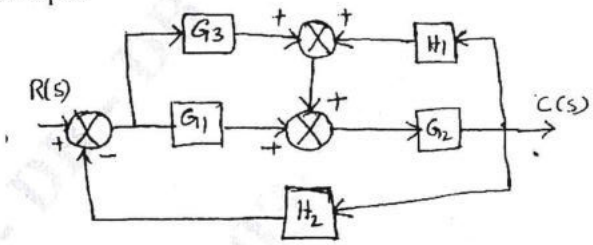

Fig. Q1 (c)

2 a. For the rotational system shown in Fig. Q2 (a), draw the torque voltage analogous circuit. **(08 Marks)**

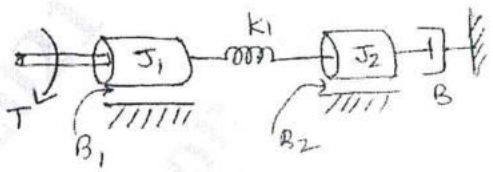

Fig. Q2 (a)

b. Explain Mason's gain formula for determining the transfer function from signal flow graph. **(04 Marks)**

c. For the system described by the signal flow graph shown in Fig. Q2 (c), obtain the closed loop transfer function $\frac{C(s)}{R(s)}$ using Mason's Gain formula. **(08 Marks)**

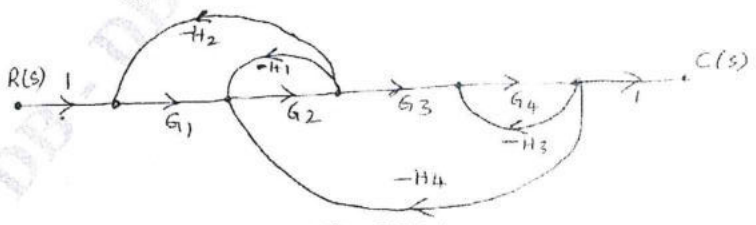

Fig. Q2 (c)

3 a. Derive an expression for rise time in a second order underdamped system subjected to unit step input. **(04 Marks)**

b. The transfer function of a second order system subjected to a unit step input, given by $\frac{C(s)}{R(s)} = \frac{16}{s^2 + 2s + 16}$

Calculate the rise time, peak time, peak overshoot and settling time. **(08 Marks)**

c. For a negative unity feed back control system with $G(s) = \frac{100}{s^2(s+4)(s+12)}$. Determine

(i) Type of the system (ii) Error co-efficients (iii) Steady state error when the input $r(t) = 2t^2 + 5t + 10$ **(08 Marks)**

4 a. With general block diagram, explain PD controller and PI controller. **(06 Marks)**

b. In PD controller system shown in Fig. Q4 (b), determine the value of T_d, so that the system will be critically damped, calculate its settling time. **(06 Marks)**

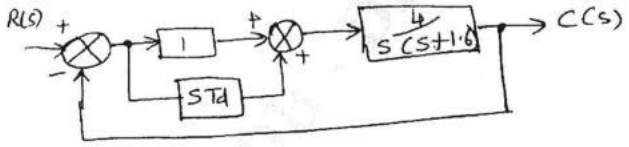

Fig. Q4 (b)

c. For the system shown in Fig. Q4 (c), obtain the closed loop transfer function, damping ratio, natural frequence, damping frequency and the expression for the output response if subjected to unit step input. **(08 Marks)**

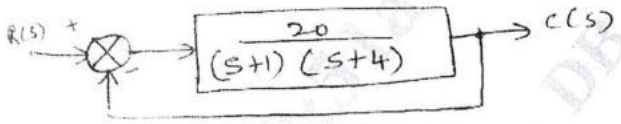

Fig. Q4 (c)

5 a. Investigate the stability of a closed loop system whose characteristic equation is given by, $s^5 + s^4 + 2s^3 + 3s + 5 = 0$ using R–H criteria. **(06 Marks)**

b. The open loop transfer function of a unity feedback system is given by, $G(s) = \frac{K}{s(s+3)(s^2+s+1)}$, using RH criteria find the value of 'K' that will cause sustained oscillation, hence find the oscillation frequency. **(06 Marks)**

c. Consider the characteristic equation, $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$, using RH criteria investigate the stability of the system. **(08 Marks)**

6 a. Determine the value of 'K' and 'a' so that the system shown in Fig. Q6 (a) oscillates with frequency of 2 rad/sec. **(06 Marks)**

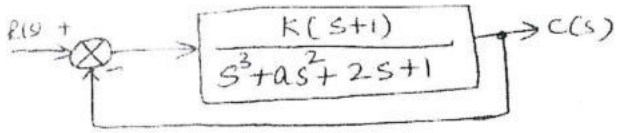

Fig. Q6 (a)

b. Sketch the Root locus for a unity feedback system with $G(s) = \frac{K}{s(s^2+8s+17)}$. From root locus determine the value of K for a damping factor of 0.5. **(14 Marks)**

7 a. Construct the Bode plot for a unity feedback control system having $G(s) = \frac{K}{s(1+s)(1+0.1s)}$, find the (i) Value of K for a gain margin of 10 dB. (ii) Value of K to give a phase margin of 24°. **(12 Marks)**

b. Find the transfer function of the system whose Bode plot is given in Fig. Q7 (b). **(08 Marks)**

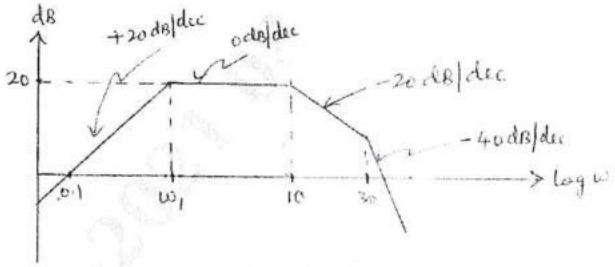

Fig. Q7 (b)

8 a. Plot the polar plot for the open loop transfer function, $G(s)H(s) = \frac{1}{1+0.1s}$. **(06 Marks)**

b. A unity feedback system has $G(s) = \frac{10}{s(s+1)(s+2)}$. Draw Nyquist plot and comment on closed loop stability. **(14 Marks)**

9 a. With a block diagram, explain a system with digital controller. **(06 Marks)**

b. Obtain state transition matrix for $A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$. **(08 Marks)**

c. State the properties of state transition matrix. **(06 Marks)**

10 a. Explain signal reconstruction using sampler and zero order hold. **(06 Marks)**

b. Obtain the state model for the system represented by a differential equation,

$$\frac{d^3y}{dt^3} + 3\frac{d^2y}{dt^2} + 6\frac{dy}{dt} + 7y(t) = 2u(t)$$ **(06 Marks)**

c. For the electrical network shown in Fig. Q10 (c), find the state space representation if the output is the current through the resistor. **(08 Marks)**

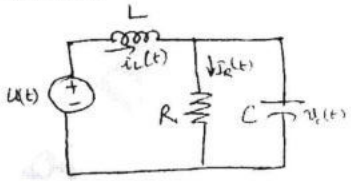

Fig. Q10 (c)

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17EC44

Fourth Semester B.E. Degree Examination, July/August 2021
Principles of Communication Systems

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Explain the operation of the switching modulator with circuit diagram. waveforms and relevant expressions. **(08 Marks)**

b. Explain the operation of the costas receiver for detection of DSB-SC waves. **(06 Marks)**

c. Explain the importance of vestigial sideband modulation in communication system. Describe the frequency domain description with message spectrum and VSB modulated wave spectrum. **(06 Marks)**

2 a. Explain the operation of the envelope detector with circuit diagram, waveforms and relevant mathematical expressions. **(08 Marks)**

b. Explain the principle of operation of the Quadrature-carrier-Multiplexing with block diagram approach. **(06 Marks)**

c. Explain the principle of operation of the frequency-division-multiplexing with suitable block-diagram. **(06 Marks)**

3 a. Explain the narrow band frequency modulation, with block diagram approach. Explain the generation of narrowband FM using DSB-SC modulator. **(07 Marks)**

b. An FM wave with a frequency deviation of 10kHz at a modulation frequency of 5kHz is applied to two frequency doublers connected in cascade. Determine the frequency deviation and the modulation index of the FM wave at the output of second frequency multiplier. What is the frequency of the adjacent side-frequencies of this FM wave? **(05 Marks)**

c. Explain the operation of the superhetero dyne receiver. Mention the function of each block with suitable diagram. **(08 Marks)**

4 a. Explain the Demodulation of FM signals using circuit diagram and relevant graphs (Any one of the method). **(07 Marks)**

b. Briefly explain about FM stereo multiplexing with multiplexer of FM stereo transmitter and Demultiplexer of FM stereo receiver. **(08 Marks)**

c. Derive an expression for linear model of phase locked loop in FM system. **(05 Marks)**

5 a. Explain the conditional probability with mathematical expressions. State and prove Baye's rule. **(07 Marks)**

b. Define and write the expressions for mean, correlation and covariance function. **(07 Marks)**

c. Explain the properties of auto correlation function with mathematical expressions. **(06 Marks)**

6 a. Briefly explain the noises such as shot noise, thermal noise and white noise. **(09 Marks)**

b. Derive an expression for noise equivalent Bandwidth, with relevant circuit and equations. **(07 Marks)**

c. Briefly explain the Noise factor and noise figure with equations. **(04 Marks)**

7 a. Derive an expression for noise in DSBSC receivers with model and relevant expressions. **(08 Marks)**

b. Find the figure of merit when the depth of modulation is i) 100% ii) 50% iii) 30% **(04 Marks)**

c. Explain the FM threshold effect with phasor diagram, graph and relevant expressions. **(08 Marks)**

8 a. An AM receiver operating with a sinusoidal wave and 80% modulation has an output signal to noise ratio of 30dB. Calculate the corresponding carrier to noise ratio. Prove the formula used (optional). **(04 Marks)**

b. Explain the FM threshold reduction process with graph representing the extending threshold effect and block diagram of FM feedback demodulator. **(08 Marks)**

c. Explain the significance of Pre-emphasis and De-emphasis in FM system. **(08 Marks)**

9 a. Why we digitize Analog sources? Explain the sampling process with graph showing CT and its DT signal. **(08 Marks)**

b. Explain the pulse width modulation with generation circuit, waveforms. Mention the advantages, disadvantages and applications of PWM. **(08 Marks)**

c. Explain the Digital Multiplexing with diagram. Mention the number of inputs and rates. **(04 Marks)**

10 a. Explain the generation of pulse amplitude modulation with block diagram and waveforms. Mention the importance of flat-top sampling with waveform. **(08 Marks)**

b. For a pulse-amplitude modulation transmission of noise signal with W = 3kHz. Calculate Bandwidth B_T, if $f_s = 8kHz$ and $\tau = 0.1Ts$. **(04 Marks)**

c. Explain the Application to vocoders such as voice model and vocoder with relevant block-diagrams. **(08 Marks)**

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CBCS SCHEME

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17EC45

Fourth Semester B.E. Degree Examination, July/August 2021
Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions.

1 a. With a neat circuit diagram and relevant equations, explain the basic op-amp circuit. **(07 Marks)**

b. Define the following terms as applied to an op-amp and mention their typical values for IC741: (i) CMRR (ii) Slew rate (iii) PSRR (iv) Input offset voltage **(08 Marks)**

c. Show that $V_{O_{CM}} = \frac{V_{i_{CM}}}{CMRR} \times A_V$ **(05 Marks)**

2 a. Explain the operation of direct coupled non inverting amplifier. Mention the design steps. **(07 Marks)**

b. Explain the working of a three input inverting summer amplifier and show how it can be modified into averaging circuit. **(08 Marks)**

c. For the op-amp circuit shown in Fig.Q2(c), calculate the gain.

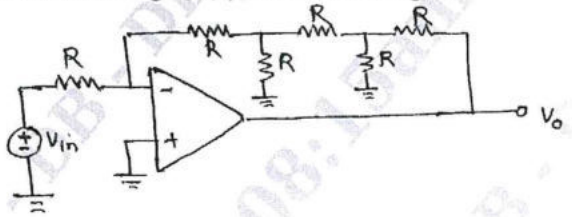

Fig.Q2(c) **(05 Marks)**

3 a. With a neat circuit diagram, explain the operation of high input impedance capacitor coupled non inverting amplifier. **(09 Marks)**

b. A capacitor coupled voltage follower circuit is to be designed to have a lower cut-off frequency of 120 Hz. The load resistance is 8.2 KΩ and the op-amp used has a maximum bias current of 600 nA. Design a suitable circuit. Calculate the new cut-off frequency when the load resistance is changed to 4.7 KΩ. **(06 Marks)**

c. Explain the operation of capacitor coupled inverting amplifier using single polarity supply. **(05 Marks)**

4 a. With a neat circuit diagram, explain the operation of instrumentation amplifier. **(09 Marks)**

b. Design a low resistance voltage source to provide an output of 8V using 741 op-amp with ±15V supply and maximum output current is to be 60 mA. Use a suitable Zener diode. For 741 op-amp $I_{B_{(max)}} = 500$ nA. **(06 Marks)**

c. Explain how a fullwave precision rectifier is implemented using Halfwave rectifier and a summer. **(05 Marks)**

5 a. With a neat circuit diagram, explain the operation of inverting Schmitt trigger circuit. **(08 Marks)**

b. Explain the working of Wien bridge oscillator using op-amp. **(06 Marks)**

c. Design a capacitor coupled Zero Cross Detector (ZCD) using 741 op-amp having $I_{B_{(max)}} = 500$ nA and minimum signal frequency of 500 Hz. the supply voltage are ± 12V. **(06 Marks)**

6 a. Draw an op-amp sample and hold circuit. Sketch the signal, control and output waveforms and explain the operation of the circuit. **(08 Marks)**

b. Explain the operation of logarithmic amplifier using op-amp. **(06 Marks)**

c. Design a RC phase shift oscillator to have an output frequency of 3.5 kHz using 741 op-amp with a supply voltage of ±12V. **(06 Marks)**

7 a. List the advantages and limitations of Active filters. **(06 Marks)**

b. Explain the operation of First order low pass filter using op-amp and mention the design steps. **(08 Marks)**

c. A single stage band pass filter is to be designed using 715 op-amp. The center frequency is to be 3.3 kHz with a passband approximately 50 Hz on each side. Determine the suitable component values. For 715 op-amp choose $I_{B_{(max)}} = 1.5\ \mu A$. **(06 Marks)**

8 a. With a neat circuit diagram, explain the working of voltage follower series regulator. **(06 Marks)**

b. Explain the functional block of 723 general purpose regulator. **(08 Marks)**

c. Design an adjustable regulator using IC7810 regulator to get an output voltage of 15 V and 25 mA. Given Quiscent current = 4.2 mA. **(06 Marks)**

9 a. With a neat block diagram, explain the operation of Phase Locked Loop (PLL). Also define: (i) Pull in time (ii) Lock range (iii) Capture range for a PLL **(08 Marks)**

b. Explain the working of 3-bit R-2R Ladder types DAC. **(06 Marks)**

c. What output voltage is produced by a DAC whose output range is 0 to 10V and whose input binary is :
(i) 10 (for a 2 bit DAC)
(ii) 0110 (for a 4 bit DAC)
(iii) 10111100 (for a 8 bit DAC) **(06 Marks)**

10 a. With a neat functional diagram, explain the operation of monostable multivibrator using 555 timer and obtain the expression for its pulse width. **(08 Marks)**

b. With a neat block diagram, explain the working of successive approximation type ADC. **(06 Marks)**

c. A 555 timer Astable multivibrator has $R_A = 2.2\ K\Omega$, $R_B = 6.8\ K\Omega$ and $C = 0.01\ \mu F$. Calculate T_{high}, T_{Low}, free running frequency and duty cycle. Draw the circuit. **(06 Marks)**

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17EC46

Fourth Semester B.E. Degree Examination, July/August 2021
Microprocessors

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. What advantage does 8086 processor have by having two independent units Bust Interface Units (BIU) and Execution Unit (EU)? **(04 Marks)**

b. With suitable examples, explain various addressing modes of 8086 processor. **(08 Marks)**

c. The machine code of an instruction is 8907H, explain how these two bytes are interpreted? What is the Instruction? Given, Opcode of MOV instruction '100010'. **(08 Marks)**

2 a. Explain the following :
i) Offset address ii) Physical address
iii) Paragraph Boundary iv) Memory relocation. **(04 Marks)**

b. Explain the (MOD – REG – R/M) byte of an 8086 instructions. **(08 Marks)**

c. At a certain instant during the execution of a program the 8086 processor has the following data in the registers AX = 1234H , BX = 5678H , SI = 1200H , DI = ABCDH , CS = AB00H and IP = 789AH , DS = ES = 4567H.
State the addressing modes and find physical addresses of source and destination of data, when each of the following instruction is executed.
i) MOV BX , AX ii) MOV [BX + DI + 120FH] , AB46H
iii) MOV AX, [1200H] iv) LODSW. **(08 Marks)**

3 a. Use appropriate logical instruction which performs :
i) Set higher nibble of AL register ii) Clear AX register
iii) Invert even bits of BX register iv) Clear 5^{th} and 6^{th} bits of CH register. **(04 Marks)**

b. Write an 8086 ALP to transfer a block of data stored at SRC to another memory area DST. The length of the block is specified at location BLK – LEN. **(08 Marks)**

c. Consider the registers of 8086 loaded with the following data :
ES = 1234H , DS = 1224H , DI = 200H , SI = 100H , CX = 10H , DFlag = '1'.
If now, the instruction REP MOVSW is completely executed workout the contents of above defined registers after the execution of the REP MOVSW instruction. **(08 Marks)**

4 a. What are Assembler directives? With examples, explain the data definition directives DB, DW and DD. **(04 Marks)**

b. Write an 8086 ALP to arrange an array of 'N' bytes in ascending order. **(08 Marks)**

c. Explain five string primitives of 8086. Also specify necessary initializations to be done before using the string instructions. **(08 Marks)**

5 a. Distinguish between MACROS and Procedures. **(04 Marks)**

b. Explain working of Interrupt and Trap flags of 8086 processor. Write a procedure to set trap flag and procedure to reset trap flag. **(08 Marks)**

c. With neat schematic, explain generation of NMI interrupt during power failure. **(08 Marks)**

6 a. Explain how the 8086 processor finds the address of interrupt service subroutine for particular interrupt. **(04 Marks)**

b. Explain Interrupt system of 8086 processor. Write the sequence of events takes place when an interrupt occurs. **(08 Marks)**

c. What is meant by Modular Programming? Also write a procedure to generate a delay of 2 msec, for the 8086 operated at 5 MHz. **(08 Marks)**

7 a. Compare memory mapped I/O and I/O mapped I/O interfacing schemes. **(04 Marks)**

b. Why the address demultiplexing is required in 8086 processor? Explain how it is done for minimum mode of operation. **(08 Marks)**

c. What is Wait State? How do you introduce it? Explain with necessary timing diagram with respect to 8086 processor. **(08 Marks)**

8 a. Explain the function of following 8086 pins :

i) $\overline{BHE}$ ii) ALE iii) INTR iv) $DT/\overline{R}$. **(04 Marks)**

b. Sketch memory read bus cycle of 8086 and explain. **(08 Marks)**

c. Explain 8255 modes of operations. **(08 Marks)**

9 a. Write 8255 control word to set PC_5. **(04 Marks)**

b. Interface a stepper motor to 8086 processor using 8255 and write an ALP to it for 180^0 in clock wise direction. **(08 Marks)**

c. Explain Mode - 0 and Mode – 3 operations of 8254. **(08 Marks)**

10 a. Bring out the differences between CICS and RISC processors. **(04 Marks)**

b. Describe any five DOS functions related with INT21H. **(08 Marks)**

c. Using DOS functions write an 8086 ALP to read a two digit hexadecimal number and display the same on the console. **(08 Marks)**

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