CBCS SCHEME

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17MAT41

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 100

Note:1) *Answer any FIVE full questions, choosing ONE full question from each module.*
2) *Use of Statistical tables allowed.*

Module-1

1 a. Use Taylor's series to obtain approximate value of y at x = 0.1 for the differential equation $\frac{dy}{dx} = 2y + 3e^x$, $y(0) = 0$. **(06 Marks)**

b. Apply Runge Kutta method of fourth order to find an approximate value of y when x = 0.2 for the equation $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, $y(0) = 1$ taking h = 0.2. **(07 Marks)**

c. Using Milne's predictor – corrector method, find y when x = 0.8 given $\frac{dy}{dx} = x - y^2$, $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$, $y(0.6) = 0.1762$. **(07 Marks)**

OR

2 a. Given that $\frac{dy}{dx} = \log(x + y)$ and y(1) = 2, then find y(1.2) in step of 0.2 using modified Euler's method carry out two iterations. **(06 Marks)**

b. Using fourth order Runge-Kutta method to find y at x = 0.2 equation given that $\frac{dy}{dx} = x + y$, y(0) = 1 and h = 0.2. **(07 Marks)**

c. Given $\frac{dy}{dx} = x^2(1 + y)$ and y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979. Evaluate y(1.4) by Adam's-Bashforth predictor-corrector method. **(07 Marks)**

Module-2

3 a. Using Runge-Kutta method, solve $\frac{d^2y}{dx^2} = x\frac{dy}{dx} - y^2$ for x = 0.2, correct to three decimal places, with initial conditions $y(0) = 1$, $y'(0) = 0$. **(06 Marks)**

b. If α and β are two distinct roots of $J_n(x) = 0$, then $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$ if $\alpha \neq \beta$. **(07 Marks)**

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

OR

4 a. Apply Milne's predictor-corrector method to compute y(0.4) given the differential equation $\frac{d^2y}{dx^2} = 1 + \frac{dy}{dx}$ and the following initial values:
$y(0) = 1, y(0.1) = 1.1103, y(0.2) = 1.2427, y(0.3) = 1.399$
$y'(0) = 1,\ y'(0.1) = 1.2103,\ y'(0.2) = 1.4427,\ y'(0.3) = 1.699$ (06 Marks)

b. With usual notation, show that
$$J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$$ (07 Marks)

c. With usual notation, derive the Rodrigue's formula $P_n(x) = \frac{1}{(2^n)n!} \frac{d^n}{dx^n}(x^2-1)^n$. (07 Marks)

Module-3

5 a. Find the bilinear transformation which map the points z = 0, 1, ∞ into the points $w = -5, -1, 3$ respectively. (06 Marks)

b. Derive Cauchy-Riemann equations in Cartesian form. (07 Marks)

c. Evaluate $\int_C \frac{z^2}{(z-1)^2(z+2)} dz$ where $C: |z| = 2.5$ by residue theorem. (07 Marks)

OR

6 a. If f(z) is a regular function of z, 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. Discuss the transformation $W = Z^2$. (07 Marks)

c. Evaluate $\int_C \frac{e^{2z}}{(z+1)(z+2)}$, where C is the circle $|z| = 3$, using Cauchy residue theorem. (07 Marks)

Module-4

7 a. The probability density function of a variate x given by the following table:

X	−3	−2	−1	0	1	2	3
P(X)	K	2K	3K	4K	3K	2K	K

Find the value of K, mean and variance. (06 Marks)

b. In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and S.D. of 60 hours. Estimate the number of bulbs likely to burn for, (i) more than 2150 hours, (ii) less than 1950 hours, (iii) more than 1920 hours and but less than 2160 hours.
Given : $A(0 < z < 1.83) = 0.4664$, $A(0 < z < 1.33) = 0.4082$ and $A(0 < z < 2) = 0.4772$ (07 Marks)

c. A joint probability distribution is given by the following table:

X \ Y	−3	2	4
1	0.1	0.2	0.2
3	0.3	0.1	0.1

Determine the marginal probability distributions of X and Y. Also find COV(X, Y). (07 Marks)

OR

8 a. Derive mean and variance of the Poisson distribution. **(06 Marks)**

b. In a certain town the duration of a shower is exponentially distributed within mean 5 minute. What is the probability that a shower will last for,

(i) less than 10 minutes (ii) 10 minutes or more

(iii) between 10 and 12 minutes. **(07 Marks)**

c. Given,

X \ Y	0	1	2	3
0	0	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	0

(i) Find Marginal distribution of X and Y.

(ii) Find E(X), E(Y) and E(XY). **(07 Marks)**

Module-5

9 a. A coin was tossed 400 times and the head turned up 216 times. Test the hypothesis that the coin is unbiased at 5% level of significance. **(06 Marks)**

b. Five dice were thrown 96 times and number 1, 2 or 3 appearing on the face of the dice follows the frequency distribution as follows:

No. of dice showing 1, 2 or 3 :	5	4	3	2	1	0
Frequency :	7	19	35	24	8	3

Test the hypothesis that the data follow a binomial distribution at 5% level of significance $\left(\chi^2_{0.05} = 11.07 \text{ for d.f is } 5\right)$. **(07 Marks)**

c. A student's study habits are as follows:
If he studies one night, he is 70% sure not to study the next night. On the other hand if he does not study one night he is 60% sure not to study the next night. In the long run how often does he study? **(07 Marks)**

OR

10 a. If $p = \begin{pmatrix} 0 & \frac{2}{3} & \frac{1}{3} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix}$, find the fixed probabilities vector. **(06 Marks)**

b. A random sample of 10 boys had the following I.Q's : 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Does this supports the hypothesis that the population mean of I.Q's is 100 at 5% level of significance? ($t_{0.05} = 2.262$ for 9 d.f) **(07 Marks)**

c. Explain : (i) Transient state (ii) Absorbing state (iii) Recurrent state. **(07 Marks)**

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CBCS SCHEME

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17MATDIP41

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 & -1 \\ 2 & -1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$. **(07 Marks)**

b. Find the inverse of the matrix $\begin{bmatrix} 3 & 1 \\ 1 & 2 \end{bmatrix}$ using Cayley-Hamilton theorem. **(07 Marks)**

c. Find the Eigen values of the matrix $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$. **(06 Marks)**

OR

2 a. Solve the system of equation by Gauss elimination method,

$2x + y + 4z = 12$

$4x + 11y - z = 33$

$8x - 3y + 2z = 20$ **(07 Marks)**

b. Using Cayley-Hamilton theorem find A^{-1}, given

$A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$. **(07 Marks)**

c. Find the rank of the matrix by reducing in to row echelon form, given

$A = \begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$. **(06 Marks)**

Module-2

3 a. Solve by method of undetermined co-efficient $y'' - 4y' + 4y = e^x$. **(07 Marks)**

b. Solve $\frac{d^3y}{dx^3} - 2\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 8y = 0$. **(07 Marks)**

c. Solve $y'' + 2y' + y = 2x$. **(06 Marks)**

OR

4 a. Solve $\frac{d^2y}{dx^2} + y = \sec x \tan x$ by method of variation of parameter. **(07 Marks)**

b. Solve $y'' - 4y' + 13y = \cos 2x$. **(07 Marks)**

c. Solve $6\frac{d^2y}{dx^2} + 17\frac{dy}{dx} + 12y = e^{-x}$. **(06 Marks)**

Module-3

5 a. Express the following function into unit step function and hence find $L[f(t)]$ given $f(t)=\begin{cases} t, & 0<t<4 \\ 5, & t>4 \end{cases}$. (07 Marks)

b. Find $L\left[\dfrac{1-e^{-at}}{t}\right]$. (07 Marks)

c. Find $L[t.\cos at]$. (06 Marks)

OR

6 a. Find $L[\sin 5t.\cos 2t]$. (07 Marks)

b. Find $L\left[e^{-t}\cos^2 3t\right]$. (07 Marks)

c. Find $L[\cos 3t.\cos 2t.\cos t]$. (06 Marks)

Module-4

7 a. Employ Laplace transform to solve the equation $y''+5y'+6y=5e^{2x}$ given $y(0)=2,\ y'(0)=1$. (07 Marks)

b. Find $L^{-1}\left[\dfrac{1}{s(s+1)(s+2)(s+3)}\right]$. (07 Marks)

c. Find $L^{-1}\left[\dfrac{s+5}{s^2-6s+13}\right]$. (06 Marks)

OR

8 a. Using Laplace transforms solve $y''+4y'+4y=e^{-t}$ given $y(0)=0,\ y'(0)=0$. (07 Marks)

b. Find $L^{-1}\left[\log\left(\dfrac{s+a}{s+b}\right)\right]$. (07 Marks)

c. Find $L^{-1}\left[\dfrac{2s-5}{4s^2+25}\right]+L^{-1}\left[\dfrac{8-6s}{16s^2+9}\right]$. (06 Marks)

Module-5

9 a. State and prove Baye's theorem. (07 Marks)

b. A shooter can hit a target in 3 out of 4 shots and another shooter can hit the target in 2 out of 3 shots. Find the probability that the target is being hit.
(i) When both of them try.
(ii) By only one shooter. (07 Marks)

c. If A and B are any two mutually exclusive events of S, then show that $P(A\cup B)=P(A)+P(B)-P(A\cap B)$. (06 Marks)

OR

10 a. Three machines A, B and C produce respectively 60%, 30%, 10% of the total number of items of a factory. The percentages of defective out put of these machines are respectively 2%, 3% and 4%. An item is selected at random and is found defective. Find the probability that the item non produced by machine C. (07 Marks)

b. Prove the following : (i) $P(\phi)=0$ (ii) $P(\overline{A})=1-P(A)$ (07 Marks)

c. If A and B are events with $P(AUB)=\dfrac{7}{8}$, $P(A\cap B)=\dfrac{1}{4}$ and $P(\overline{A})=\dfrac{5}{8}$ find P(A), P(B) and $P(A\cap\overline{B})$. (06 Marks)

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CBCS SCHEME

USN | | | | | | | | | | | **17EC42**

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Signals and Systems

Time: 3 hrs. Max. Marks: 100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Missing data, if any, may be suitably assumed.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain the following with an example each :
i) Even and odd signal
ii) Aperiodic and periodic signal
iii) Energy and power signal. **(06 Marks)**

b. Sketch the following signal :
i) $y(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$
ii) $y(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$ **(06 Marks)**

c. Verify the following properties of system :
memoryless, casual, stable and some invariant $y(n) = n\,x(n)$. **(08 Marks)**

OR

2 a. Sketch the even and odd parts of the signal shown in the Fig.Q2(a).

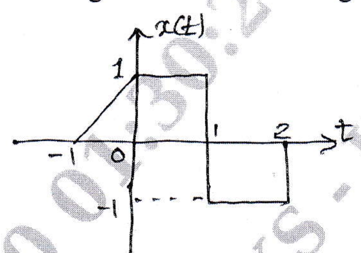


Fig.Q2(a) **(06 Marks)**

b. Classify the following the following as an energy or power signal
i) $y(t) = r(t) - r(t-2)$
ii) $x(t) = (1 + e^{-5t})u(t)$. **(08 Marks)**

c. Determine whether the following signals are periodic or not. If periodic find its fundamental time period.

i) $x[n] = 5\sin\left(\frac{7\pi n}{12}\right) + 8\cos\left(\frac{14\pi n}{8}\right)$

ii) $x(t) = \cos t + \sin\sqrt{2}t$. **(06 Marks)**

Module-2

3 a. Prove the following properties of convolution :
i) Commutative ii) Distributive. **(06 Marks)**

b. Determine the convolution of the following two signals $x(t) = e^{-3t}u(t)$ and $h(t) = u(t+2)$. **(07 Marks)**

c. Find the convolution of the following sequences
$x(n) = \beta^n u(n)$ with $|\beta| < 1$ and $h(n) = u(n-3)$. **(07 Marks)**

OR

4 a. Determine the convolution sum of the given sequence
$x(n) = \{\underset{\uparrow}{1}, 2, 3, 1\}$ and $h(n) = \{1, \underset{\uparrow}{2}, 1, -1\}$ sketch output. **(06 Marks)**

b. The impulse response of the system is given by h(t) = u(t). Determine the output of the system for an input $x(t) = e^{-\alpha t}\, u(t)$. **(08 Marks)**

c. Prove the associative property of convolution. **(06 Marks)**

Module-3

5 a. Find the step response for the impulse response $h(t) = u(t + 1) - u(t - 1)$. **(06 Marks)**

b. Find the overall impulse response of a cascade of two systems having identical impulse responses $h(t) = 2[u(t) - u(t - 1)]$. **(06 Marks)**

c. Find the Fourier series coefficients X(k) for the signal $x(t) = \sum_{m=-\infty}^{\infty}[\delta(t - \tfrac{1}{2}m)]$. Sketch the magnitude and phase spectra. **(08 Marks)**

OR

6 a. Determine whether following system with the given impulse response is memoryless, causal and stable $h[n] = \left[\frac{1}{2}\right]^n u[n]$. **(06 Marks)**

b. Evaluate the DTFS representation for the signal x(n) shown in Fig.6(b) and sketch its spectra.

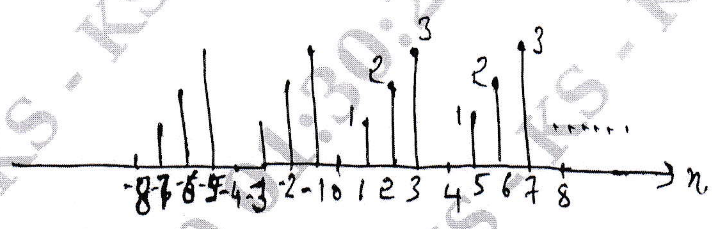


Fig.Q6(b) **(08 Marks)**

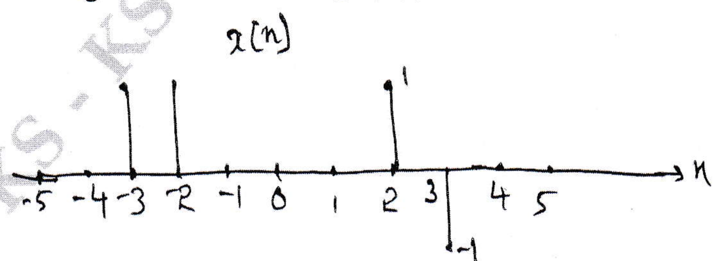
c. Find the Fourier series representation for the signal $x(t) = \sin(2\pi t) + \cos(3\pi t)$. Sketch the magnitude and phase spectra. **(06 Marks)**

Module-4

7 a. Prove the following properties of Fourier transform :
i) Time shifting
ii) Time domain convolution. **(08 Marks)**

b. Find the Fourier transform of the signal. **(06 Marks)**

c. Find the DTFT of the signal shown in the Fig.Q7(c).



OR

8 a. Explain the concept of sampling theorem and reconstruction of signals. **(06 Marks)**

b. Find the DTFT of the sequence $x(n) = -a^n u[-n-1]$. **(08 Marks)**

c. Find the Fourier transform of the signal $x(t) = e^{-3t}u(t-1)$. **(06 Marks)**

Module-5

9 a. Explain the properties of ROC. **(05 Marks)**

b. Find the Z-transform and the ROC of the discrete sinusoid signal.
$x[n] = [\sin(\Omega n)]u[n]$. **(07 Marks)**

c. Find the transfer function and difference equation if the impulse response is

$$h[n] = \left[\frac{1}{3}\right]^n u[n] + \left[\frac{1}{2}\right]^n u[n-1].$$ **(08 Marks)**

OR

10 a. Using power series expansion technique or long division method find the inverse z-transform of the following X(z).

i) $X(z) = \dfrac{z}{2z^2 - 3z + 1}$; ROC $|z| < \frac{1}{2}$

ii) $X(z) = \dfrac{z}{2z^2 - 3z + 1}$; ROC $|z| > 1$. **(08 Marks)**

b. Determine the z-transform of the following signal $x[n] = 2^n u[n]$.
Also obtain ROC and locations of poles and zeroes of X(z). **(06 Marks)**

c. Using z-transform find the convolution of the following two sequences

$h[n] = \left\{\underset{\uparrow}{1}, \frac{1}{2}, \frac{1}{4}\right\}$ and

$x[n] = \delta[n] + \delta[n-1] + 4\delta(n-2)$. **(06 Marks)**

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CBCS SCHEME

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17EC43

Fourth Semester B.E. Degree Examination, Aug./Sept. 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. Draw the general block diagrams of an automatic control system and explain. **(05 Marks)**

b. Show that the two system shown in Fig Q1(b) are analogous systems.

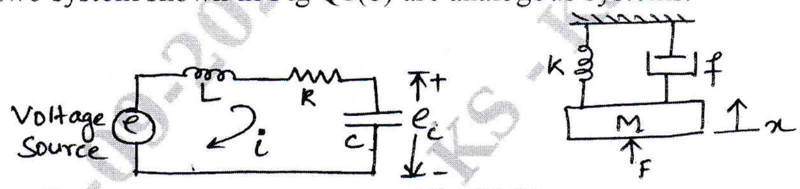

Fig Q1(b) **(05 Marks)**

c. Obtain the Force-current analogous electrical network for the mechanical system shown in Fig Q1(c).

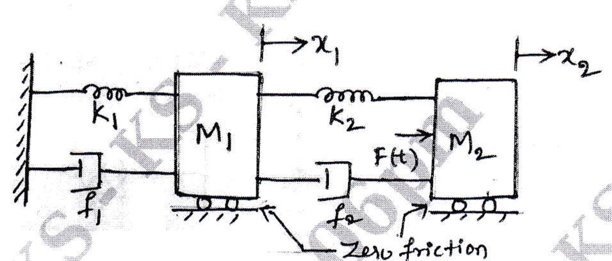

Fig Q1(c). **(10 Marks)**

OR

2 a. Obtain the transfer function for the block diagram, shown in Fig Q2(a). Using block diagram reduction.

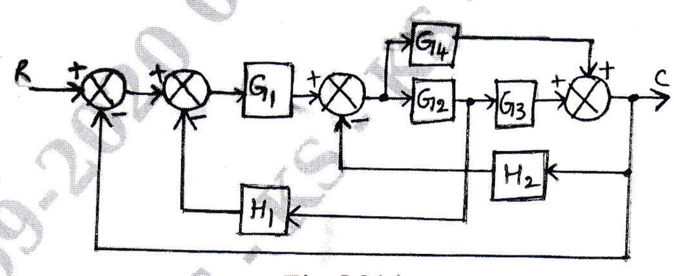

Fig Q2(a) **(10 Marks)**

b. Obtain the transfer function of the system shown in Fig Q2(b). Using Mason's gain formula.

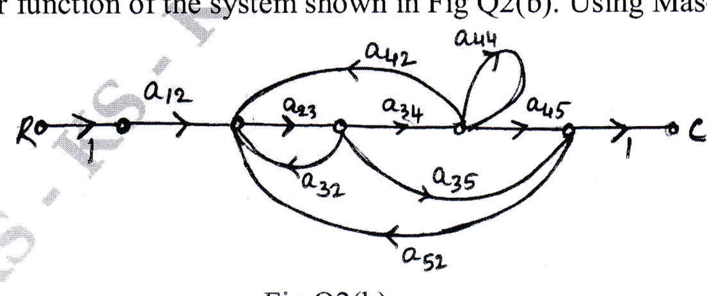

Fig Q2(b) **(10 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-2

3 a. Obtain the time response of a first order system subjected to unit step input. Plot the response. **(06 Marks)**

b. Derive an expression for Peak time t_p of an under damped second order systems, subjected to step input. **(06 Marks)**

c. For the system shown in Fig Q3(c), determine K and T so that the maximum overshoot is 25% and the settling time is 3 seconds for a 5% tolerance band when subjected to step input.

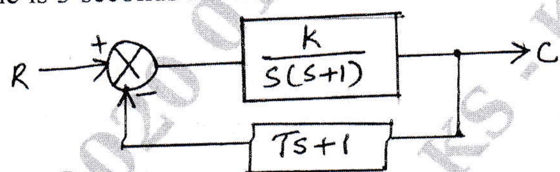

Fig Q3(c) **(08 Marks)**

OR

4 a. Obtain the steady state error e_{ss} of Type – 0, Type – 1 and Type – 2 systems for standard inputs. **(10 Marks)**

b. A unity feedback system is characterized by an open loop transfer function $G(s) = \dfrac{K}{s(s+10)}$.

Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K determine settling time, peak overshoot and time to peak overshoot for a unit step input. **(10 Marks)**

Module-3

5 a. Define Routh's stability criterion. Describe the necessary conditions for stability. **(10 Marks)**

b. The open loop transfer function of unity negative feedback control system is given by,

$$G(s) = \frac{K}{s(s^2+s+1)(s+4)}.$$

i) Using the Routh's criterion, calculate the range of 'K' values for the system to be stable

ii) Determine the value of K which causes sustained oscillations in the closed loop system. What is the corresponding frequency of sustained oscillations? **(10 Marks)**

OR

6 a. State Angle criterion and Magnitude criterion of Root locus. For a system with $G(s) = H(s)\dfrac{K}{s(s+2)(s+4)}$, find whether $s = -0.75$ is on Root locus or not, using Angle criterion. **(04 Marks)**

b. The open loop transfer function of a control system is given by $G(s) = \dfrac{K}{s(s+1)(s+2)}$.

Sketch the complete root locus. Find the critical value of K and location of roots on jw – axis. **(16 Marks)**

Module-4

7 a. Derive an expression for Resonant Peak M_r and Resonant frequency W_r for a second order system in frequency response analysis. **(08 Marks)**

b. Sketch the Bode plot for the system having $G(s) = \dfrac{20}{s(1+0.1s)}$. **(12 Marks)**

OR

8 a. Explain the concept of Polar – Plots by considering a simple RC filter circuit. **(10 Marks)**

b. State and explain Nyquist criterion **(05 Marks)**

c. Write a short note on Lead compensator. **(05 Marks)**

Module-5

9 a. Draw the block diagram of a typical system with Digital controller and explain. **(06 Marks)**

b. What is uniform sampling? Mention the circumstances that lead to the use of sampled data control system. **(06 Marks)**

c. Define state and state variable. Compare the transfer function approach and state variable approach of analyzing control system. **(08 Marks)**

OR

10 a. Obtain the state model of the mechanical system shown in Fig Q10(a).

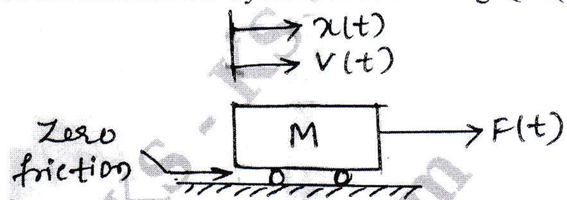

Fig Q10(a) **(10 Marks)**

b. Construct the state model for a system characterized by differential equation

$$\frac{d^3y}{dt^3}+6\frac{d^2y}{dt^2}+11\frac{dy}{dt}+6y=u$$ **(10 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | | **17EC44**

Fourth Semester B.E. Degree Examination, Aug./Sept.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. Explain the operation of the switching modulator with suitable circuit diagram and waveforms. **(08 Marks)**

b. With suitable block diagram approach explain the operation of the Costas receiver. Write the relevant expressions. **(06 Marks)**

c. What is the significance of VSB modulation? With spectrum of message signal and spectrum of VSB modulated wave explain briefly. **(06 Marks)**

OR

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

b. With suitable block diagram approach explain the operation of the quadrature carries multiplexing process. **(06 Marks)**

c. With relevant block diagram, explain the operation of the frequency division multiplexing method. **(06 Marks)**

Module-2

3 a. A 93.2MHz carrier is frequency modulated by a 5KHz sine wave. The resultant FM signal has a frequency deviation of 40KHz.

i) Find the carrier frequency swing of the FM signal

ii) What are the highest and lowest frequencies obtained by the frequency modulated waves

iii) Calculate the modulation index of the same? **(04 Marks)**

b. Explain the operation of the FM stereo multiplexing system (transmitter) using block diagram and spectrum. **(08 Marks)**

c. Explain the operation of the super heterodyne receiver with block diagram. Mention the function of each block. **(08 Marks)**

OR

4 a. A modulating signal $5 \cos 2\pi\ 15 \times 10^3 t$, angle modulates a carrier $A \cos \omega_c t$. Find the modulation index and the bandwidth for the FM system. Determine the change in the bandwidth and modulation index if FM is reduced to 5KHz. What is the conclusion of the two results? **(05 Marks)**

b. With relevant block diagram approach explain the operation of the linear model of phase locked loop. Derive an expression. **(07 Marks)**

c. Explain the process of demodulation of FM waves. Write suitable circuit and relevant graphs. **(08 Marks)**

Module-3

5 a. Explain the properties of the auto correlation functions. Mention the three properties. **(06 Marks)**

b. Explain the noise equivalent bandwidth in noise system, with circuit and derivation. **(08 Marks)**

c. Three 5kΩ resistors are connected in series. For room temperature ($KT = 4 \times 10^{-21}$) and an effective noise bandwidth of 1MHz. Determine :

i) The noise voltage appearing across each resistor

ii) The noise voltage appearing across the series combination

iii) What is the rms noise voltage which appears across same three resistors connected in parallel under the same conditions? **(06 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

6 a. Mathematically write the expression and define briefly for :
i) Conditional probability ii) Mean. (06 Marks)
b. Explain the shot noise with relevant expression. And also explain the white noise with power spectral density and auto correlation function. (08 Marks)
c. An amplifier is fed from a 100Ω, 15μV rms sinusoidal signal source. Its equivalent input noise resistance and equivalent input short current are 250Ω and 6μA, respectively. Calculate the individual noise voltages at the input and the input signal to noise ratio. Assume noise bandwidth is 10MHz and temperature is 30°C. (06 Marks)

Module-4

7 a. Explain the noise in DSBSC receivers using model of DSBSC receiver using coherent detection. (08 Marks)
b. Explain the significance of pre-emphasis and de-emphasis in FM system with circuit, relevant graph and derivation. (08 Marks)
c. Find the figure of merit when the depth of modulation is :
i) 100% ii) 150% iii) 30%. (04 Marks)

OR

8 a. Explain the noise in FM receivers. Derive an expression for "Figure of Merit' for FM receiver. (08 Marks)
b. Explain the FM threshold effect with nature of graph representing the relationship between P and $(SNR)_0$. And also explain the FM threshold reduction with block diagram and relevant graph. (08 Marks)
c. 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. (04 Marks)

Module-5

9 a. Why digitize analog signals? Explain the sampling process with CT and DT signals. (08 Marks)
b. With block diagram approach. Explain pulse amplitude modulation. Draw the suitable (relevant) waveforms. (08 Marks)
c. For a PAM transmission of voice signal with W = 3KHz, calculate B_T. if f_s = 8KHz and τ = 0.1Ts. (04 Marks)

OR

10 a. With suitable PPM generator circuit and relevant waveforms explain the operation of pulse position modulation. (08 Marks)
b. Write on applications to vocoders, considering speech model used in voice coders and block diagram of vocoder. (08 Marks)
c. An analog waveform with bandwidth 15Hz is to be quantized with 200 levels and transmitted via binary PCM signal. Find the rate of transmission and bandwidth required. If 10 such signals are to be multiplexed find the bandwidth requirement. (04 Marks)

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CBCS SCHEME

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17EC45

Fourth Semester B.E. Degree Examination, Aug./Sept.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 parameters :
(i) Input Offset Voltage
(ii) CMRR
(iii) Slewrate
Mention their typical values for opamp 741. **(06 Marks)**

b. Suggest the circuit for two signal which are received as an input at the same time and output must be taken together. Sketch the circuit. Derive the equation for the output voltage. (Note: Output and Inputs are considered DC voltages). Explain the operation. **(08 Marks)**

c. A non-inverting amplifier is to amplify a 100 mV signal to a level of 3V. Using a 741 opamp, design a suitable circuit. (Let I_{Bmax} = 500 nA). **(06 Marks)**

OR

2 a. What is the significance of a typical gain versus frequency graph for an operational amplifier? Sketch and explain. **(06 Marks)**

b. With a neat circuit diagram, explain basic operational amplifier circuit. **(06 Marks)**

c. Which are different biasing methods used for opamp? Explain with neat diagram. **(04 Marks)**

d. Compare emitter follower and voltage follower. **(04 Marks)**

Module-2

3 a. Explain how the upper cutoff frequency can be set for inverting and non-inverting amplifiers. **(06 Marks)**

b. Design High input impedance capacitor coupled voltage follower using as opamp having lower cutoff frequency of 50 Hz and maximum input bias current of 500 nA. The load resistance is 3.6 kΩ. If the open loop gain is 2×10^5, find value of input impedance of the circuit. **(08 Marks)**

c. With a neat circuit diagram explain the working of capacitor coupled difference amplifier. Derive the equation. **(06 Marks)**

OR

4 a. Realize the precision voltage source using opamp and explain. **(06 Marks)**

b. Draw the circuit diagram of current amplifier using opamp. Explain the circuit operation. **(06 Marks)**

c. With a suitable circuit diagram, explain the operation of instrumentation amplifier consisting of a differential input/output amplifier input stage and a difference amplifier output stage. The circuit has adjustable voltage gain, common mode output nulling and dc output voltage level shifting. **(08 Marks)**

Module-3

5 a. Design a RC phase-shift oscillator with following specifications: $f_0 = 5$ kHz, Supply voltage = ±15V, IC 741 is to be used. (Assume $I_{Bmax} = 500$ nA). **(06 Marks)**

b. Explain the operation of an inverting Schmitt trigger circuit with different UTP and LTP levels. Also indicate the input/output characteristics for the circuit. **(08 Marks)**

c. Explain sample and hold circuit with a neat circuit diagram using opamp. **(06 Marks)**

OR

6 a. Show the realization of logarithmic amplifier using an opamp. Obtain the expression for the output voltage. **(08 Marks)**

b. Write a note on multiplier IC and its applications. **(06 Marks)**

c. With waveforms, explain the working of :
(i) Zero-crossing detector (ii) Voltage-level detector. **(06 Marks)**

Module-4

7 a. Design a single-stage bandpass filter to have a voltage gain of 1 and a pass band from 300 Hz to 30 kHz. **(06 Marks)**

b. Design a second order low pass filter using 741 for a cutoff frequency of 5 kHz. Draw its frequency response and comment on the same. **(08 Marks)**

c. Show how a bandstop filter circuit can be constructed using low-pass and high-pass filters. Sketch the expected frequency response and explain. **(06 Marks)**

OR

8 a. State and explain the following terms for 3 pin IC regulators:
(i) Load regulation
(ii) Source regulation
(iii) Drop out voltage. **(06 Marks)**

b. Design an adjustable voltage regulator circuit to get $V_0 = 7.5$V with load current of 25 mA using 7805 regulator IC. Given $I_Q = 4.2$ mA. **(06 Marks)**

c. With a neat schematic, explain the salient features of 723 regulator. **(08 Marks)**

Module-5

9 a. Define capture range, lock-in range and pull-in time. Also specify which range is greater-capture range or 'Lock-in range'? **(08 Marks)**

b. Explain about voltage to frequency conversion factor. Which IC can be used to obtain this factor? Derive the equation for that IC. **(06 Marks)**

c. What output voltage would be produced by a D/A converter whose output range is 0 to 10V and whose input binary number is
(i) 10 (for a 2-bit DAC)
(ii) 0110 (for a 4-bit DAC)
(iii) 10111100 (for a 8-bit DAC) **(06 Marks)**

OR

10 a. Explain the working of a monostable multivibrator using 555 timer with a neat functional diagram and waveforms. Derive the equations for its pulse width. **(08 Marks)**

b. Explain the principle of switch type analog phase detector. **(06 Marks)**

c. A 555 astable multivibrator has $R_A = 2.2$ kΩ and $R_B = 6.8$ kΩ and C = 0.01 μF. Calculate (i) T_{on} (ii) T_{off} (iii) Free-running frequency (iv) Duty cycle, D. **(06 Marks)**

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17EC46

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
Microprocessors

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain with neat diagram, the flag register of 8086 processor. **(08 Marks)**

b. Show with an example, how the physical address is calculated for an instruction in 8086. **(04 Marks)**

c. Write an ALP to add a sequence of 10-8 bit numbers and save that result in memory location RESULT. Ensure carry is properly handled. **(08 Marks)**

OR

2 a. Draw a neat architectural diagram of 8086 processor and explain each block. **(10 Marks)**

b. Explain the immediate and register addressing mode of 8086 with one example. **(04 Marks)**

c. Write an ALP to find the absolute difference between registers AX and BX and place the result in DX. **(06 Marks)**

Module-2

3 a. Explain the working of following instructions with examples RCR, DAA, IMUL, DIV and SCAS. **(10 Marks)**

b. Write an ALP to find the number of EVEN and ODD numbers from a sequence of 20-8 bit numbers. In the memory and save the result COUNT at EVEN and ODD. **(10 Marks)**

OR

4 a. Explain the working of following instructions with examples: XLAT, AAA, REP, LOOP and ROL. **(10 Marks)**

b. Write an ALP to find the number of positive and negative numbers from a sequence of 20-8 bit numbers in the memory and save the counted result at NEG and POS. **(10 Marks)**

Module-3

5 a. Explain any four differences between MACRO and PROCEDURE. **(04 Marks)**

b. Write an ALP to convert a two digit ASCII number saved in memory into its equivalent binary number with a macro ASC2BIN. **(12 Marks)**

c. Explain the working of stack memory of 8086 with an example. **(04 Marks)**

OR

6 a. Write procedure to generate a delay of 20 msec using 8086 processor running at 10 MHz. Show the calculations for the delay. **(08 Marks)**

b. Explain the interrupt vector table of 8086 briefly. **(04 Marks)**

c. Explain the interrupt acknowledgement cycle of 8086 with a neat diagram. **(08 Marks)**

Module-4

7 a. Sketch the minimum mode operation of 8086 and explain its operation. **(10 Marks)**

b. Interface two $4K \times 8$ EPROM and two $4K \times 8$ static RAM chips to 8086. Address of ROM at FE000H and RAM at FC000H. **(10 Marks)**

OR

8 a. Explain mode 0 and BSR mode of operation of 8255 PIO device with neat diagram of control register. **(10 Marks)**

b. In an 8086 system, 8255 is mapped at IO location con. Read the 4 bit port PC4-7 of the 8255 and output the values to the LED connected on PCO-3. Write the ALP for this along with appropriate setup. **(10 Marks)**

Module-5

9 a. Write an ALP to rotate the stepper motor in clockwise direction by 180° and then in anticlockwise direction by 180° with suitable "delay" procedure. **(08 Marks)**

b. Write an ALP to generate a triangular wave of 500 Hz using the DAC0800 interface to the 8086 CPU at 8 MHz. Amplitude of triangular wave should be +5 V. Show the interface diagram. **(12 Marks)**

OR

10 a. Explain the following DOS function calls of INT21H:

(i) Function 01H (ii) Function 02H (iii) Function 4CH

(iv) Function 06H (v) Function 09H **(10 Marks)**

b. Mention 4 differences between RISC and CISC architecture. **(04 Marks)**

c. Explain how to generate interrupt on terminal count using a 8254 timer with a diagram. **(06 Marks)**

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