CBCS SCHEME

USN | | | | | | | | | | |

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)**

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

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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CBCS SCHEME

USN 1KS18ME400 **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 $\dfrac{d^4y}{dx^4} - \dfrac{2d^3y}{dx^3} + \dfrac{d^2y}{dx^2} = 0$ **(06 Marks)**

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

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

OR

4 a. Solve $\dfrac{d^3y}{dx^3} + y = 0$ **(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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CBCS SCHEME

USN 1KS18EC405 **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)**

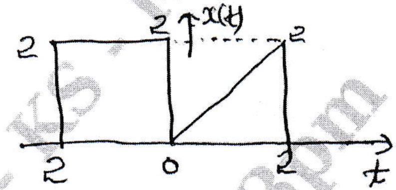

Fig.1(c)

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)**

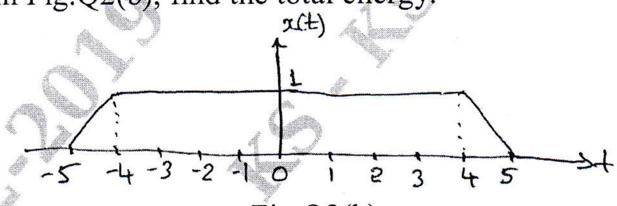

Fig.Q2(b)

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)**

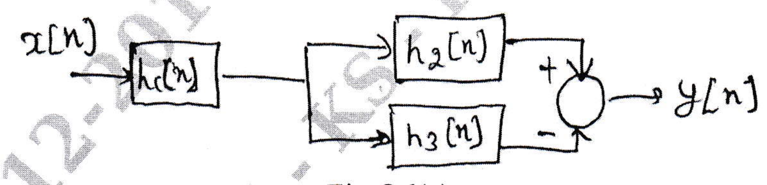

Fig.Q6(a)

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)**

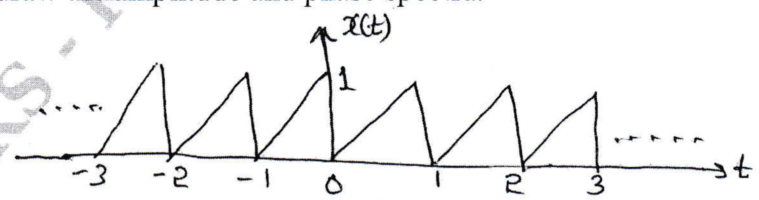

Fig.Q6(c)

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) $x(t) = \sin c\,(200t)$. **(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 :
$$h[n] = \begin{cases} \left[\frac{1}{2}\right]^n; & 0 \leq n \leq 2 \\ 0 \quad ; & \text{otherwise} \end{cases}$$
And $x[n] = \delta[n] + \delta[n-1] + \delta[n-2]$. **(06 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | |

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)**

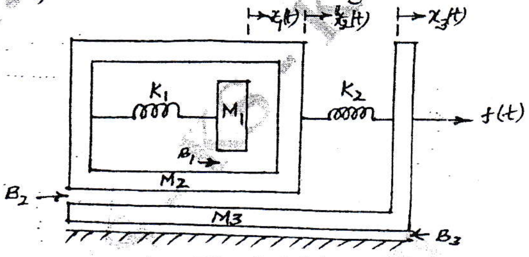

Fig.Q.1(b)

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)**

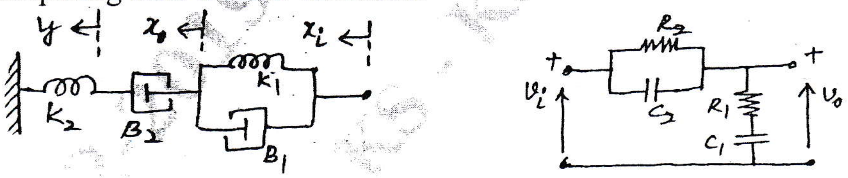

Fig.Q.2(a)

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)**

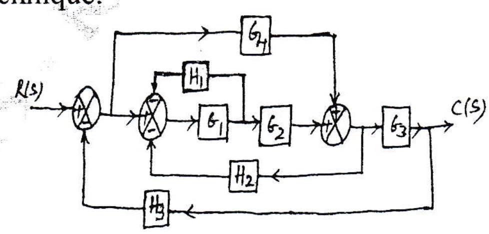

Fig.Q.2(b)

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)**

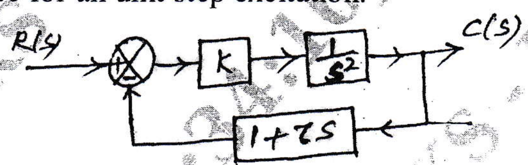

Fig.Q.4(b)

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 $G(s) = \dfrac{K(s+1)}{s^3 + as^2 + 3s + 1}$, 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)**

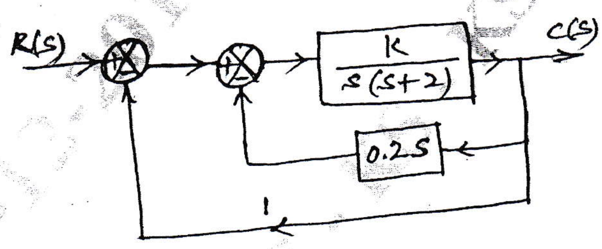

Fig.Q.6(c)

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 $G(S)H(S) = \dfrac{20}{S(S+1)(S+2)}$. 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 $G(s) = \dfrac{100(1+0.1s)}{s(s+1)^2(0.01s+1)}$. 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 $G(s) = \dfrac{200(s+2)}{s(s^2+10s+100)}$. 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 $G(S)H(S) = \dfrac{K}{S(S^2+2S+2)}$. **(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)**

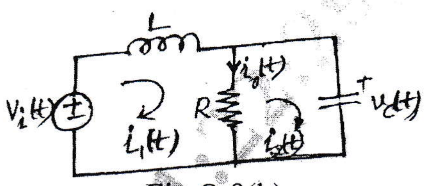

Fig.Q.9(b)

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 $\overrightarrow{x(0)} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ **(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)**

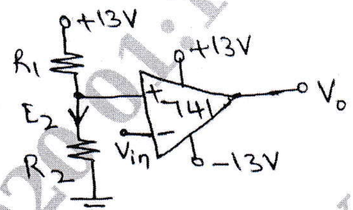

Fig.Q.6(c)

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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CBCS SCHEME

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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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