CBCS Scheme

USN | | | | | | | | | | 15MATDIP41

Fourth Semester B.E. Degree Examination, June/July 2017
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 80

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 :
$$\begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$$ by elementary row transformations. **(06 Marks)**

b. Solve the following system of equations by Gauss elimination method :
$2x + y + 4z = 12$
$4x + 11y - z = 33$
$8x - 3y + 2z = 20$. **(05 Marks)**

c. Find all the eigen values and eigen vector corresponding to largest eigen value of the matrix :
$$\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}.$$ **(05 Marks)**

OR

2 a. Solve the following system of equations by Gauss elimination method :
$x + y + z = 9$
$2x + y - z = 0$
$2x + 5y + 7z = 52$. **(06 Marks)**

b. Reduce the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$ into its echelon form and hence find its rank. **(05 Marks)**

c. Find the inverse of the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ using Cayley – Hamilton theorem. **(05 Marks)**

Module-2

3 a. Solve $(D^2 - 4D + 13)y = \cos 2x$ by the method of undetermined coefficients. **(06 Marks)**

b. Solve $(D^2 + 2D + 1)y = x^2 + 2x$. **(05 Marks)**

c. Solve $(D^2 - 6D + 25)y = \sin x$. **(05 Marks)**

OR

4 a. Solve $(D^2 + 1)y = \tan x$ by the method of variation of parameters. **(06 Marks)**

b. Solve $(D^3 + 8)y = x^4 + 2x + 1$. **(05 Marks)**

c. Solve $(D^2 + 2D + 5)y = e^{-x} \cos 2x$. **(05 Marks)**

Module-3

5 a. Find the Laplace transforms of :

i) $e^{-t}\cos^2 3t$ ii) $\dfrac{\cos 2t - \cos 3t}{t}$. **(06 Marks)**

b. Find:

i) $L\left[t^{-5/2} + t^{5/2}\right]$ ii) $L[\sin 5t \cdot \cos 2t]$. **(05 Marks)**

c. Find the Laplace transform of the function : $f(t) = E\sin\left(\frac{\pi t}{\omega}\right)$, $0 < t < \omega$, given that $f(t+\omega) = f(t)$. **(05 Marks)**

OR

6 a. Find :

i) $L\left[t^2 \sin t\right]$ ii) $L\left[\dfrac{\sin 2t}{t}\right]$. **(06 Marks)**

b. Evaluate : $\displaystyle\int_0^\infty \frac{\cos 6t - \cos 4t}{t}\,dt$ using Laplace transform. **(05 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)]. **(05 Marks)**

Module-4

7 a. Solve the initial value problem $\dfrac{d^2y}{dx^2} + \dfrac{5dy}{dx} + 6y = 5e^{2x}$, $y(0) = 2$, $y'(0) = 1$ using Laplace transforms. **(06 Marks)**

b. Find the inverse Laplace transforms : i) $\dfrac{3(s^2-1)^2}{2s^2}$ ii) $\dfrac{s+1}{s^2+6s+9}$. **(05 Marks)**

c. Find the inverse Laplace transform : $\log\left[\dfrac{s^2+4}{s(s+4)(s-4)}\right]$. **(05 Marks)**

OR

8 a. Solve the initial value problem :

$\dfrac{d^2y}{dt^2} + \dfrac{4dy}{dt} + 3y = e^{-t}$ with $y(0) = 1 = y'(0)$ using Laplace transforms. **(06 Marks)**

b. Find the inverse Laplace transform : i) $\dfrac{1}{s\sqrt{5}} + \dfrac{3}{s^2\sqrt{5}} - \dfrac{8}{\sqrt{5}}$ ii) $\dfrac{3s+1}{(s-1)(s^2+1)}$. **(05 Marks)**

c. Find the inverse Laplace transform : $\dfrac{2s-1}{s^2+4s+29}$. **(05 Marks)**

Module-5

9 a. State and prove Baye's theorém. **(06 Marks)**

b. A can hit a target 3 times in 5 shots, B 2 times in 5 shots and C 3 times in 4 shots. They fire a volley. What is the probability that i) two shots hit ii) atleast two shots hit? **(05 Marks)**

c. Find P(A), P(B) and $P(A \cap \overline{B})$, if A and B are events with $P(A \cup B) = \frac{7}{8}$, $P(A \cap B) = \frac{1}{4}$ and $P(\overline{A}) = \frac{5}{8}$. **(05 Marks)**

OR

10 a. Prove that P(A∪B) = P(A) + (B) – P(A∩B), for any two events A and B. **(06 Marks)**

b. Show that the events $\overline{A}$ and $\overline{B}$ are independent, if A and B are independent events. **(05 Marks)**

c. Three machines A, B and C produce respectively 60%, 30%, 10% of the total number of items of a factory. The percentage of defective output 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 was produced by machine C. **(05 Marks)**

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CBCS Scheme

USN | | | | | | | | | | | 15MAT41

Fourth Semester B.E. Degree Examination, June/July 2017
Engineering Mathematics–IV

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer FIVE full questions, choosing one full question from each module.***
2. ***Use of statistical tables are permitted.***

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 by Taylor's series method the value of y at x = 0.1 from $\frac{dy}{dx} = x^2y - 1$, $y(0) = 1$ (upto 4th degree term). **(05 Marks)**

b. The following table gives the solution of $5xy' + y^2 - 2 = 0$. Find the value of y at x = 4.5 using Milne's predictor and corrector formulae. **(05 Marks)**

x	4	4.1	4.2	4.3	4.4
y	1	1.0049	1.0097	1.0143	1.0187

c. Using Euler's modified method. Obtain a solution of the equation $\frac{dy}{dx} = x + \left|\sqrt{y}\right|$, with initial conditions y = 1 at x = 0, for the range $0 \le x \le 0.4$ in steps of 0.2. **(06 Marks)**

OR

2 a. Using modified Euler's method find y(20.2) and y(20.4) given that $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with $y(20) = 5$ taking h = 0.2. **(05 Marks)**

b. 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 Adams-Bashforth method. **(05 Marks)**

c. Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at x = 0.2 by taking h = 0.2 **(06 Marks)**

Module-2

3 a. Obtain the solution of the equation $2\frac{d^2y}{dx^2} = ux + \frac{dy}{dx}$ by computing the value of the dependent variable corresponding to the value 1.4 of the independent variable by applying Milne's method using the following data: **(05 Marks)**

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514
y′	2	2.3178	2.6725	3.0657

b. Express $f(x) = 3x^3 - x^2 + 5x - 2$ in terms of Legendre polynomials. **(05 Marks)**

c. Obtain the series solution of Bessel's differential equation $x^2y'' + xy' + (x^2 + n^2)y = 0$ **(06 Marks)**

OR

4 a. By Runge-Kutta method solve $\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$ for x = 0.2. Correct to four decimal places using the initial conditions y = 1 and $y' = 0$ at x = 0, h = 0.2. **(05 Marks)**

b. Prove that $J_{+\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$ **(05 Marks)**

c. Prove the Rodrigues formula,

$$\rho_n(x) = \frac{1}{2^n n!} \frac{d^n (x^2 - 1)^n}{dx^n}$$ **(06 Marks)**

Module-3

5 a. State and prove Cauchy's-Riemann equation in polar form. **(05 Marks)**

b. Discuss the transformation $W = e^z$. **(05 Marks)**

c. Evaluate $\int_C \left\{\frac{\sin(\pi z^2) + \cos(\pi z^2)}{(z-1)^2(z-2)}\right\} dz$

using Cauchy's residue theorem where 'C' is the circle $|z| = 3$ **(06 Marks)**

OR

6 a. Find the analytic function whose real part is, $\frac{\sin 2x}{\cosh 2y - \cos 2x}$. **(05 Marks)**

b. State and prove Cauchy's integral formula. **(05 Marks)**

c. Find the bilinear transformation which maps z = ∞, i, 0 into ω = -1, -i, 1. Also find the fixed points of the transformation. **(06 Marks)**

Module-4

7 a. Find the mean and standard deviation of Poisson distribution. **(05 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 less than 2160 hours.

[A(1.833) = 0.4664, A(1.5) = 0.4332, A(2) = 0.4772] **(05 Marks)**

c. The joint probability distribution of two random variables x and y is as follows:

x/y	-4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8

Determine:

(i) Marginal distribution of x and y.

(ii) Covariance of x and y

(iii) Correlaiton of x and y. **(06 Marks)**

OR

8 a. The probability that a pen manufactured by a factory be defective is $\frac{1}{10}$. If 12 such pens are manufactured what is the probability that, (i) Exactly 2 are defective (ii) at least 2 are defective (iii) none of them are defective. **(05 Marks)**

b. Derive the expressions for mean and variance of binomial distribution. **(05 Marks)**

c. A random variable X take the values -3, -2, -1, 0, 1, 2, 3 such that $P(x = 0) = P(x < 0)$ and $P(x = -3) = P(x = -2) = P(x = -1) = P(x = 1) = P(x = 2) = P(x = 3)$. Find the probability distribution. **(06 Marks)**

Module-5

9 a. In 324 throws of a six faced 'die' an odd number turned up 181 times. Is it reasonable to think that the 'die' is an unbiased one? **(05 Marks)**

b. Two horses A and B were tested according to the time (in seconds) to run a particular race with the following results:

Horse A:	28	30	32	33	33	29	34
Horse B:	29	30	30	24	27	29	

Test whether you can discriminate between the two horses.($t_{0.05}$=2.2 and $t_{0.02}$=2.72 for 11 d.f) **(05 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix, $A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$ **(06 Marks)**

OR

10 a. Define the terms: (i) Null hypothesis (ii) Type–I and Type–II error (iii) Confidence limits. **(05 Marks)**

b. Prove that the Markov chain whose t.p.m $P = \begin{bmatrix} 0 & 2/3 & 1/3 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/2 & 0 \end{bmatrix}$ is irreducible. Find the corresponding stationary probability vector. **(05 Marks)**

c. Three boys A, B, C are throwing ball to each other. A always throws the ball to B and B always throws the ball to C. C is just as likely to throw the ball to B as to A. If C was the first person to throw the ball find the probabilities that after three throws (i) A has the ball. (ii) B has the ball. (iii) C has the ball. **(06 Marks)**

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CBCS Scheme

USN | | | | | | | | | | **15EC42**

Fourth Semester B.E. Degree Examination, June/July 2017
Microprocessor

Time: 3 hrs. Max. Marks: 80

Note: ***Answer 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 the internal architecture of 8086 with its neat block diagram. **(08 Marks)**

b. Explain briefly any 4 addressing modes of data of 8086 with an example for each. **(06 Marks)**

c. If CS = 1000 H, DS = 25A0H, SS = 3210H, ES = 5890H, BX = 43A9H, BP = 3400H, find the physical address of the source data for the following instructions:
(i) MOV AL, [BX+1200H]
(ii) ADD BL, [BP+05] **(02 Marks)**

OR

2 a. Write down the instruction formats for the following two types of cases of 8086 and form the opcode for the indicated instruction:
(i) Register to Register; ADD AX, BX
(ii) Immediate to Register; ADD CX, 1200 H. **(06 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 2000 H. Store the result at word location 3000 H. **(08 Marks)**

c. Briefly explain the following 8086 instructions:
(i) XLAT (ii) NEG **(02 Marks)**

Module-2

3 a. Write a complete assembly language program in 8086 which replaces all the occurances of character '–' in a given string by '*'. **(08 Marks)**

b. Verify whether any of the following instructions are wrong and correct them with reasons. Assuming following is a program, what is the value of register BX and flags CY, Z, P, S at the end.
(i) MOV BX, 0804H
(ii) INC [BX+02]
(iii) ADD 06H, AL
(iv) SHR DX, 02
(v) XOR BL, BL **(08 Marks)**

OR

4 a. Briefly explain the operations of the string instructions of 8086, indicating the initializations required to use them. **(06 Marks)**

b. Write a complete assembly language program for block move of a source data (10 bytes) present in a memory block starting with address SOURCE to a destination block starting from address DSTN, using MOVS instruction. Consider overlapping of blocks also. **(08 Marks)**

c. Explain briefly any 4 assembler directives. **(02 Marks)**

Module-3

5 a. (i) Explain the stack structure of 8086 and the operations of PUSH and POP instructions.
(ii) Sketch the content of stack memory indicating the value of SP register before PUSH BX operation and after the PUSH BX operation. Assume SS = 2500 H, BX = 432AH and SP = 1000 H. **(08 Marks)**

b. Write a procedure in 8086 assembly language which computes the factorial of an 8 bit number passed through AL register. The factorial value (maximum 8 bit) is returned through AL register. **(08 Marks)**

OR

6 a. What are the sequence of actions taken by 8086 and the device, when a device interrupts 8086 over INTR line? Explain about the software and reserved internal interrupts of 8086. **(08 Marks)**

b. What are the differences between a procedure and a macro? Create a macro that would find the logical NAND value of two operands. **(04 Marks)**

c. What are the methods that can be used to pass parameters to a procedure? Explain any one of them with an example. **(04 Marks)**

Module-4

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

b. Interface two $4K \times 8$ EPROM and two $4K \times 8$ static RAM chips to 8086. The addresses of RAM and ROM should start from FC000H and FE000H respectively. **(08 Marks)**

OR

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

b. Interface a 7-segment LED to 8086 using a 74LS373 latch for I/O address 0CH. Write a program that simulates a single digit seconds counter on the LED digit. (Assume a one second software delay is available) **(08 Marks)**

Module-5

9 a. Interface ADC 0808/0809 to 8086 using 8255 and write a program to convert the analog voltage connected to the last channel. Store the digital value in the location 2000H. **(08 Marks)**

b. Interface a stepper motor to 8086 using 8255 and write a program to rotate the motor in clockwise direction 5 steps or in counter clockwise direction 10 steps, depending on whether the content of memory location 2000H is 00H or FFH respectively. **(08 Marks)**

OR

10 a. Explain the architecture of NDP-8087 with its internal block diagram. **(08 Marks)**

b. Write a program in 8086 using DOS 21H interrupt which waits for a key to be pressed from the keyboard. If the key is 'G' display the message 'GOOD' on the CRT and display the message 'VERY GOOD', if the key V is pressed. Display 'NOT VALID' if any other key is pressed. **(05 Marks)**

c. Explain mode-2 operation of 8254 timer briefly. What is the control word to be used to operate counter-1 in mode-2 binary? **(03 Marks)**

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CBCS Scheme

USN | | | | | | | | | | 15EC43

Fourth Semester B.E. Degree Examination, June/July 2017
Control Systems

Time: 3 hrs. Max. Marks: 80

Note: Answer 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 linear and non-linear control system. **(04 Marks)**

b. For the mechanical system shown in Fig.Q1(b):
i) Draw the mechanical network.
ii) Obtain equations of motion.
iii) Draw an electrical network based on force current analogy. **(06 Marks)**

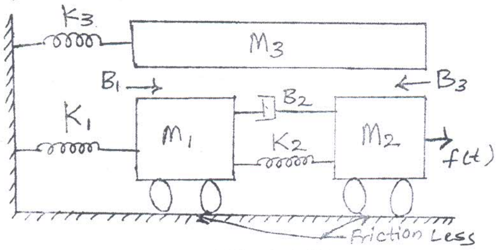

Fig.Q1(b)

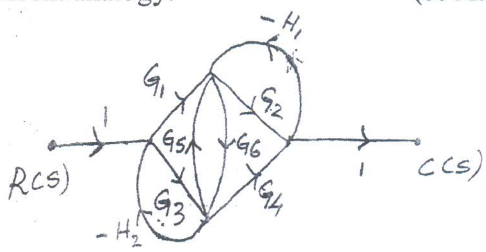

Fig.Q1(c)

c. For the signal flow graph shown in Fig.Q1(c), determine the transfer function $\frac{C(s)}{R(s)}$ using Mason's gain formula **(06 Marks)**

OR

2 a. For the circuit shown in Fig.Q2(a), 'K' is the gain of an ideal amplifier. Determine the transfer function $\frac{I(s)}{V_i(s)}$.

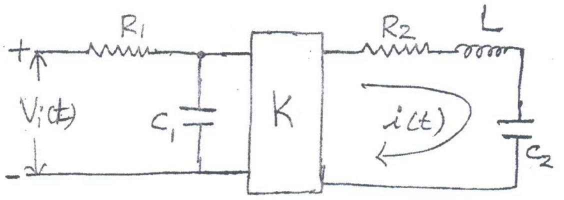

Fig.Q2(a) **(04 Marks)**

b. For the mechanical system shown in Fig.Q2(b):
i) Draw equivalent mechanical network.
ii) Write performance equations.
iii) Draw torque-voltage analogy.

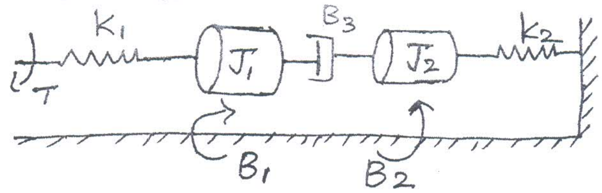

Fig.Q2(b) **(06 Marks)**

c. Obtain $\frac{C(s)}{R(s)}$ for the block diagram shown in Fig.Q2(c) using block diagram reduction techniques.

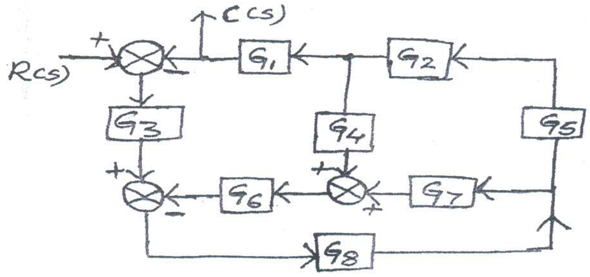

Fig.Q2(c) **(06 Marks)**

Module-2

3 a. List the standard test inputs used in control system and write their Laplace transform. **(04 Marks)**

b. Find K_p, K_v, K_a and steady state error for a system with open loop transfer function as

$$G(s)H(s) = \frac{10(s+2)(s+3)}{s(s+1)(s+4)(s+5)}$$

where the input is $r(t) = 3 + t + t^2$. **(06 Marks)**

c. For the system shown in Fig.Q3(c), obtain closed loop transfer function, damping ratio natural frequency and expression for the output response if subjected to unit step input.

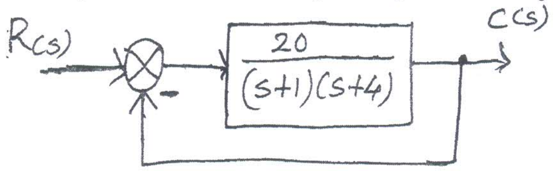

Fig.Q3(c) **(06 Marks)**

OR

4 a. Define rise time and maximum overshoot and write their formula. **(04 Marks)**

b. For a given system $G(s)H(s) = \frac{K}{s^2(s+2)(s+3)}$. Find the value of K to limit steady state error to 10 when input to system is $1 + 10t + 20t^2$. **(06 Marks)**

c. For a unity feedback control system with $G(s) = \frac{64}{s(s+9.6)}$. Write the output response to a unit step input. Determine:

i) The response at t = 0.1 sec.

ii) Settling time for ± 2% of steady state. **(06 Marks)**

Module-3

5 a. Explain Rouths-Harwitz stability criterion. **(04 Marks)**

b. $s^6 + 4s^5 + 3s^4 - 16s^2 - 64s - 48 = 0$. Find the number of roots of this equation with positive real part, zero real part and negative real part using RH criterion. **(06 Marks)**

c. Sketch the rough nature of the root locus of a certain control system whose characteristic equation is given by $s^3 + 9s^2 + Ks + K = 0$, comment on the stability. **(06 Marks)**

OR

6 a. The open loop transfer function of a unity feedback system is $G(s) = \dfrac{K(s+2)}{s(s+3)(s^2+5s+10)}$.

i) Find the value of K so that the steady state error for the input r(t)=tu(t) is less than or equal to 0.01.

ii) For the value of K found in part (i). Verify whether the closed loop system is stable or not using R-H criterion. **(06 Marks)**

b. Sketch the root locus plot for a negative feedback control system whose open loop transfer function is given by $G(s)H(s) = \dfrac{K}{s(s+3)(s^2+2s+2)}$ for all values of K ranging from 0 to ∞. Also find the value of K for a damping ratio of 0.5. **(10 Marks)**

Module-4

7 a. For a closed loop control system $G(s) = \dfrac{100}{s(s+8)}$, H(s) = 1. Determine the resonant peak and resonant frequency. **(04 Marks)**

b. Explain lag-lead compensator network and briefly discuss the effects of lead-lag compensator. **(04 Marks)**

c. Using Nyquist stability criterion, find the closed loop stability of a negative feedback control system whose open-loop transfer function is given by $G(s)H(s) = \dfrac{5}{s(s-1)}$. **(08 Marks)**

OR

8 a. Draw polar plot of $G(s)H(s) = \dfrac{100}{s^2+10s+100}$. **(06 Marks)**

b. For a unity feedback system $G(s) = \dfrac{242(s+5)}{s(s+1)(s^2+5s+121)}$. Sketch the bode plot and find ω_{gc}, ω_{pc}, gain margin and phase margin. **(10 Marks)**

Module-5

9 a. With block diagram, explain system with digital controller. **(04 Marks)**

b. Obtain the state model for the system represented by the differential equation $\dfrac{d^3y(t)}{dt^3} + 6\dfrac{d^2y(t)}{dt^2} + 11\dfrac{dy(t)}{dt} + 10y(t) = 3u(t)$. **(04 Marks)**

c. Find the transfer function of the system having state model.

$$\dot{X} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix}u \quad \text{and} \quad y = \begin{bmatrix} 1 & 0 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$ **(08 Marks)**

OR

10 a. Explain signal reconstruction scheme using sampler and zero order hold. **(04 Marks)**

b. Obtain the state model of given electrical network shown in Fig.Q10(b).

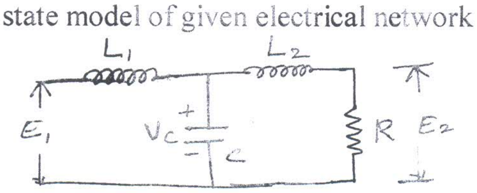

Fig.Q10(b) **(04 Marks)**

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

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CBCS Scheme

USN | | | | | | | | | | | **15EC44**

Fourth Semester B.E. Degree Examination, June/July 2017
Signals and Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Sketch the even and odd part of the signals shown in Fig. Q1(a) and (b). **(08 Marks)**

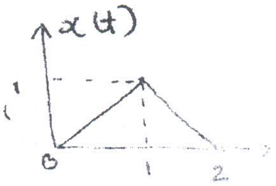

Fig. Q1(a)

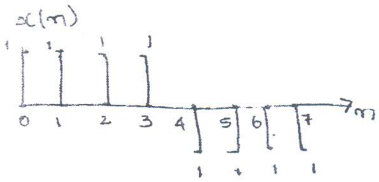

Fig. Q1(b)

b. Determine whether the following signal is periodic or not if periodic find the fundamental period. $x(n) = \cos\left(\frac{n\pi}{5}\right)\sin\left(\frac{n\pi}{3}\right)$ **(03 Marks)**

c. Express x(t) in terms g(t) if x(t) and g(t) are shown in Fig. Q1(c). **(05 Marks)**

Fig. Q1(c)

OR

2 a. Determine whether the following systems are memory less, causal, time invariant, linear and stable. i) y(n) = n x(n) ii) y(t) = x(t/2). **(08 Marks)**

b. For the signal x(t) and y(t) shown in Fig. Q2(b) sketch the following signals.
i) $x(t+1)\cdot y(t-2)$ ii) $x(t)\cdot y(t-1)$ **(08 Marks)**

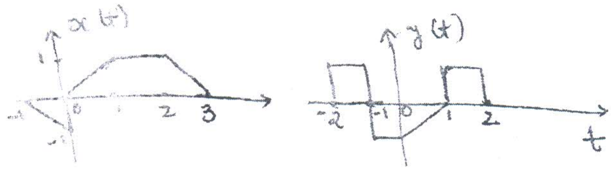

Fig. Q2(b)

Module-2

3 a. Prove the following :
i) $x(n)*[h_1(n)+h_2(n)] = x(n)*h_1(n)+x(n)*h_2(n)$
ii) $x(n)*u(n) = \sum_{k=-\infty}^{n} x(k)$. **(08 Marks)**

b. Compute the convolution sum of x(n) = u(n) – u(n – 8) and h(n) = u(n) – u(n – 5). **(08 Marks)**

OR

4 a. State and prove the associative, integral and commutative properties of convolution. **(08 Marks)**

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

Module-3

5 a. A system consists of several subsystems connected as shown in Fig. Q5(a). Find the operator H relating x(t) to y(t) for the following sub system operators. **(04 Marks)**

$H_1 : y_1(t) = x_1(t)\, x_1(t-1)$
$H_2 : y_2(t) = |x_2(t)|$
$H_3 : y_3(t) = 1+2x_3(t)$
$H_4 : y_4(t) = \cos(x_4(t))$

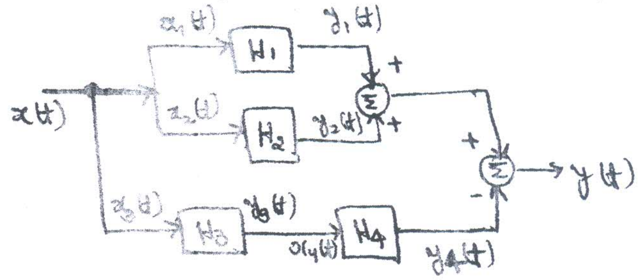

Fig. Q5(a)

b. Determine whether the following systems defined by their impulse responses are causal, memory less and stable.
i) $h(t) = e^{-2t} u(t-1)$ ii) $h(n) = 2u[n] - 2u(n-5)$ **(06 Marks)**

c. Evaluate the step response for the LTI systems represented by the following impulse responses. i) $h(t) = u(t+1) - u(t-1)$ ii) $h(n) = \left(\frac{1}{2}\right)^n u(n)$. **(06 Marks)**

OR

6 a. State the following properties of CTFS. i) Time shift ii) Differentiation in time domain iii) Linearity iv) Convolution v) Frequency shift vi) Scaling. **(06 Marks)**

b. Determine the DTFS coefficients for the signal shown in Fig.Q6 (b) and also plot $|x(k)|$ and $\arg\{x(k)\}$. **(10 Marks)**

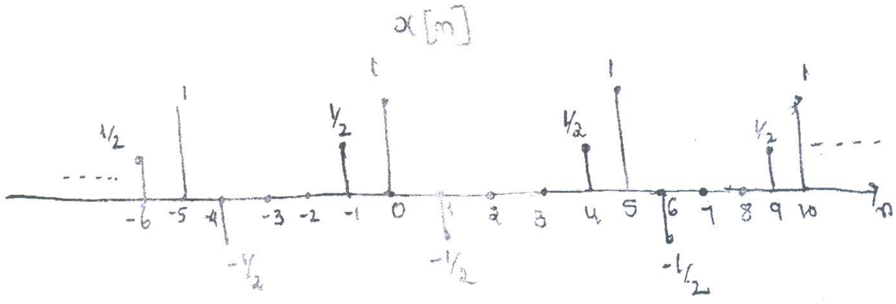
Fig. Q6(b)

Module-4

7 a. State and prove the following properties :

i) $y(t) = h(t) * x(t) \xleftrightarrow{FT} y(jw) = x(jw)H(jw)$

ii) $\frac{d}{dt}x(t) \xleftrightarrow{FT} jw\, x(jw)$ **(06 Marks)**

b. Find DTFT of the following signals.

i) $x(n) = \{1, 2, \underset{\uparrow}{3}, 2, 1\}$ ii) $x(n) = \left(\frac{3}{4}\right)^n u[n]$. **(10 Marks)**

OR

8 a. Specify the Nyquist rate for the following signals
i) $x_1(t) = \sin(200\pi t)$ ii) $x_2(t) = \sin(200\pi t) + \cos(400\pi t)$. **(04 Marks)**

b. Use partial fraction expansion to determine the time domain signals corresponding to the following FTs.

i) $x(jw) = \dfrac{-jw}{(jw)^2 + 3jw + 2}$

ii) $x(jw) = \dfrac{jw}{(jw+2)^2}$ **(08 Marks)**

c. Find FT of the signal $x(t) = e^{-2t} u(t-3)$. **(04 Marks)**

Module-5

9 a. Explain properties of ROC with example. **(06 Marks)**

b. Determine the z-transform of the following signals

i) $x(n) = \left(\frac{1}{4}\right)^n u(n) - \left(\frac{1}{2}\right)^n u(-n-1)$

ii) $x(n) = n\left(\frac{1}{2}\right)^n u(n)$ **(10 Marks)**

OR

10 a. Find the time domain signals corresponding to the following z-transforms.

$$x(z) = \frac{\left(\frac{1}{4}\right)z^{-1}}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{1}{4}z^{-1}\right)}$$ with ROC $\frac{1}{4} < |z| < \frac{1}{2}$. **(06 Marks)**

b. Determine the transfer function and the impulse response for the causal LTI system described by the difference equation

$$y(n) - \frac{1}{4}y(n-1) - \frac{3}{8}y(n-2) = -x(n) + 2x(n-1)$$ **(10 Marks)**

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CBCS Scheme

USN | | | | | | | | | | 15EC45

Fourth Semester B.E. Degree Examination, June/July 2017

Principles of Communication Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain with the help of a neat sketch and analysis, how switching modulator is used to generate amplitude modulation. (06 Marks)

b. Explain how Costas receiver can be used for demodulating the DSB-SC signal. (06 Marks)

c. Consider a message signal m(t) containing frequency components at 100, 200 and 400 Hz. This signal is applied to an SSB modulator together with a carrier at 100 kHz, with only the upper sideband retained. In the coherent detector used to recover m(t), the local oscillator supplies a sine wave of frequency 100.02 kHz.

i) Determine the frequency components of the detector output.

ii) Repeat the analysis assuming that only the lower sideband is transmitted. (04 Marks)

OR

2 a. Explain the operation of envelope detector with neat diagrams and waveforms. Bring out the significance of the RC time constant of the circuit in detection of the message signal without distortion. (06 Marks)

b. Derive an expression for SSB modulated wave for which upper side band is retained. (06 Marks)

c. Using the message signal $m(t) = \frac{1}{1+t^2}$, determine and sketch the modulated wave for amplitude modulation with the following values. (i) $\mu = 50\%$, (ii) 100%. (04 Marks)

Module-2

3 a. Derive the equation for frequency modulated wave. Define modulation index, maximum deviation of a frequency modulated signal. (06 Marks)

b. Explain generation of frequency modulated signal using direct method. (05 Marks)

c. The equation for a FM wave is $s(t) = 10\sin[5.7\times10^8 t + 5\sin 12\times10^3 t]$. Calculate :

i) Carrier frequency

ii) Modulating frequency

iii) Modulation index

iv) Frequency deviation

v) Power dissipated in 100Ω (05 Marks)

OR

4 a. With neat circuit diagram, explain FM demodulation using balanced slope detector. (06 Marks)

b. With relevant block diagram, explain FM stereo multiplexing. (05 Marks)

c. Explain the linear model of phase locked loop (PLL). (05 Marks)

Module-3

5 a. What is conditional probability? Prove that $P(B/A)=\dfrac{P(A/B)\cdot P(B)}{P(A)}$. (05 Marks)

b. With an example, explain what is meant by statistical averages. (06 Marks)

c. Define white noise. Plot power spectral density (PSD) and autocorrelation function (ACF) of white noise. (05 Marks)

OR

6 a. What do you mean by probability density function? Prove that the total volume under the surface of a probability density function (pdf) is always 1. (05 Marks)

b. Define mean, autocorrelation and auto-covariance function. (06 Marks)

c. What is noise equivalent band width? Derive an expression for the same. (05 Marks)

Module-4

7 a. With relevant equations, explain how noise is produced in a receiver model. (08 Marks)

b. Show that the figure-of-merit for DSB-SC system is unity. (08 Marks)

OR

8 a. Derive the expression for figure-of-merit of an AM receiver. (08 Marks)

b. Explain pre-emphasis and de-emphasis in frequency modulation (FM). (08 Marks)

Module-5

9 a. State sampling theorem for band limited signals. Explain the process of sampling. (07 Marks)

b. With neat block diagram, explain the generation of pulse-position modulation (PPM) waves. (05 Marks)

c. Twelve different message signals, each with a bandwidth of 10 kHz are to be multiplexed and transmitted. Determine the minimum bandwidth required for each method if the multiplexing/modulation method used is (i) FDM, SSB; (ii) TDM, PAM. (04 Marks)

OR

10 a. With relevant diagram, explain the generation and reconstruction of pulse code modulation (PCM) signal. (06 Marks)

b. With neat diagram, explain the concept of time division multiplexing (TDM). (06 Marks)

c. Determine the Nyquist rate and the Nyquist interval for :

(i) $g(t)=\sin c(200t)$ (ii) $m(t)=\dfrac{1}{\pi t}[\sin(500\pi t)]$. (04 Marks)

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CBCS Scheme

USN | | | | | | | | | | **15EC46**

Fourth Semester B.E. Degree Examination, June/July 2017
Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 80

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

b. Define CMRR of an operational amplifier. A741 op-amp is used in a non-inverting amplifier with a voltage gain of 50. Calculate the typical output voltage that would result from a common mode input with a peak level of 100 mV. **(05 Marks)**

c. Design an averaging circuit to give the average of two inputs which each range from 0.1 V to 1 V. Use 741 op-amp. **(05 Marks)**

OR

2 a. Sketch the circuit of an op-amp difference amplifier circuit. Discuss the working and common mode nulling capability with necessary circuit modification and equations. **(08 Marks)**

b. With a neat circuit diagram, explain direct coupled voltage follower. Also compare voltage follower with emitter follower. **(08 Marks)**

Module-2

3 a. Draw the circuit of a capacitor coupled non-inverting amplifier and explain with necessary design equations. Design a high input impedance capacitor coupled non-inverting amplifier with a gain of 100 and lower cut off frequency of 100 Hz. Assume the load resistance is 2.2 KΩ and input parasitic capacitance as 15 pF. **(10 Marks)**

b. Design a capacitor coupled inverting amplifier for a pass band gain of 100, lower cut off frequency of 120 Hz and upper cutoff frequency to be 5 kHz. Use LF353 BIFET opamp and assume load resistance as 2 KΩ. **(06 Marks)**

OR

4 a. Draw the circuit of an instrumentation amplifier and explain. Also show the method of nulling common mode outputs and how dc output voltage can be level shifted. **(09 Marks)**

b. Design a non-saturating precision half wave rectifier to produce a 2 V peak output from a 1 MHz sine wave input with a 0.5 V peak value. Use a bipolar op-amp with a supply voltage of $\pm 15V$. **(07 Marks)**

Module-3

5 a. Sketch the circuit of a symmetrical precision clipper and explain with necessary equations and waveforms. Using bipolar opamp design the circuit to clip a 100 kHz sine wave at $\pm 3V$ level. **(09 Marks)**

b. Explain the working of Weinbridge oscillator with the help of circuit diagram, waveforms and equations. **(07 Marks)**

OR

6 a. Sketch the circuit of fundamental log amplifier and explain its operation. Also derive an expression for its output voltage. Also mention its drawback. **(08 Marks)**

b. With a neat circuit diagram, explain the operation of inverting Schmitt trigger. Using 741 op-amp with a supply of ±12 V, design an inverting Schmitt trigger circuit to have trigger points of UTP = 0 V and LTP = -1 V. **(08 Marks)**

Module-4

7 a. Explain the operation of first order low pass filter with neat circuit diagram, frequency response and design steps. Using a 741 opamp, design a first order active low pass filter to have a cutoff frequency of 2 kHz. **(08 Marks)**

b. Draw the circuit of a single stage band pass filter and explain the operation with necessary design equations. **(08 Marks)**

OR

8 a. Draw the standard representation of 78XX series 3-terminal IC regulator and enumerate the characteristics of this type of regulators. Also define the following performance parameters of a voltage regulator. (i) Line regulation (ii) Load regulation (iii) Ripple rejection **(08 Marks)**

b. With a neat diagram, explain the operation of low voltage regulator using IC723. Design a voltage regulator circuit using LM723 to obtain V_0 = 5 V and I_0 = 2 A. **(08 Marks)**

Module-5

9 a. With a neat block schematic, explain the operating principle of PLL. Also define (i) Lock-in range (ii) Capture range and (iii) Pull-in time. **(08 Marks)**

b. Explain the working of Flash ADC with necessary diagram. An 8 bit ADC outputs all 1's when V_i = 2.55 V. Find its (i) resolution in mV/LSB and (ii) digital output when V_i = 1.28 V **(08 Marks)**

OR

10 a. Draw the internal schematic of IC555, configuring it for astable operation and explain with necessary equations and waveforms. **(08 Marks)**

b. With necessary circuit diagram and equations, explain R-2R DAC. What output voltage would be produced by a DAC whose output range is 0 to 10 V and whose input binary number is. (i) 1010 (for 4 bit DAC) (ii) 10111100 (for an 8 bit DAC). **(08 Marks)**

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