CBCS Scheme

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

15MAT41

Fourth Semester B.E. Degree Examination, June/July 2018
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Use Taylor's series method to find y at x = 1.1, considering terms upto third degree given that $\frac{dy}{dx} = x + y$ and $y(1) = 0$. **(05 Marks)**

b. Using Runge-Kutta method, find y(0.2) for the equation $\frac{dy}{dx} = \frac{y - x}{y + x}$; y(0) = 1, taking h = 0.2. **(05 Marks)**

c. Given $\frac{dy}{dx} = x^2 - y$, y(0) = 1 and the values y(0.1) = 0.90516, y(0.2) = 0.82127, y(0.3) = 0.74918, evaluate y(0.4), using Adams-Bashforth method. **(06 Marks)**

OR

2 a. Using Euler's modified method, find y(0.1) given $\frac{dy}{dx} = x - y^2$, y(0) = 1, taking h = 0.1. **(05 Marks)**

b. Solve $\frac{dy}{dx} = xy$; y(1) = 2, find the approximate solution at x = 1.2, using Runge-Kutta method. **(05 Marks)**

c. Solve $\frac{dy}{dx} = x - y^2$ with the following data y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762, compute y at x = 0.8, using Milne's method. **(06 Marks)**

Module-2

3 a. Using Runge-Kutta method of order four, solve $y'' = y + xy'$, y(0) = 1, y′(0) = 0 to find y(0.2). **(05 Marks)**

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

c. If α and β are two distinct roots of $J_n(x) = 0$ then prove that $\int_0^1 x J_n(\alpha x) J_n(\beta x) dx = 0$, if α ≠ β. **(06 Marks)**

OR

4 a. Given $y'' = 1 + y'$; y(0) = 1, y′(0) = 1, compute y(0.4) for the following data, using Milne's predictor-corrector method.
y(0.1) = 1.1103 y(0.2) = 1.2427 y(0.3) = 1.399
y′(0.1) = 1.2103 y′(0.2) = 1.4427 y′(0.3) = 1.699. **(05 Marks)**

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

c. Derive Rodrigue's formula $P_n(x) = \frac{1}{2^n n!} \frac{d^n}{dx^n}\left[(x^2 - 1)^n\right]$. **(06 Marks)**

Module-3

5 a. Derive Cauchy-Riemann equations in polar form. (05 Marks)

b. Evaluate $\oint_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2(z-2)} dz$ where C is the circle |z| = 3, using Cauchy's residue theorem. (05 Marks)

c. Find the bilinear transformation which maps z = ∞, i, 0 on to w = 0, i, ∞. (06 Marks)

OR

6 a. State and prove Cauchy's integral formula. (05 Marks)

b. If $u = \frac{\sin 2x}{\cosh 2y + \cos 2x}$, find the corresponding analytic function $f(z) = u + iv$. (05 Marks)

c. Discuss the transformation $w = z^2$. (06 Marks)

Module-4

7 a. Derive mean and standard deviation of the binomial distribution. (05 Marks)

b. If the probability that an individual will suffer a bad reaction from an injection of a given serum is 0.001, determine the probability that out of 2000 individual (i) exactly 3 (ii) more than 2 individuals will suffer a bad reaction. (05 Marks)

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

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

Determine: i) Marginal distribution of X and Y ii) Covariance of X and Y iii) Correlation of X and Y (06 Marks)

OR

8 a. Derive mean and standard deviation of exponential distribution. (05 Marks)

b. In an examination 7% of students score less than 35% marks and 89% of students score less than 60% marks. Find the mean and standard deviation if the marks are normally distributed. Given P(0 < z < 1.2263) = 0.39 and P(0 < z < 1.14757) = 0.43. (05 Marks)

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

Y \ X	-4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8

Compute: i) E(X) and E(Y) ii) E(XY) iii) COV(X, Y) iv) ρ(X, Y) (06 Marks)

Module-5

9 a. Explain the terms: i) Null hypothesis ii) Type I and Type II errors. (05 Marks)

b. The nine items of a sample have the values 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these differ significantly from the assumed mean of 47.5? (05 Marks)

c. Given the matrix $A = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ \frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix}$ then show that A is a regular stochastic matrix. (06 Marks)

OR

10 a. A die was thrown 9000 times and of these 3220 yielded a 3 or 4, can the die be regarded as unbiased? (05 Marks)

b. Explain: i) Transient state ii) Absorbing state iii) Recurrent state (05 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? (06 Marks)

CBCS Scheme

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

Fourth Semester B.E. Degree Examination, June/July 2018
Microprocessor

Time: 3 hrs. Max. Marks: 80

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

Module-1

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

b. Determine the physical address for the following instructions, if DS = 2000h, SS = 3000h, ES = 4000h, BP = 0010h, BX = 0020h, SP = 0030h, SI = 0040h, DI = 0050h,
i) MOV AL, [BP]
ii) MOV CX, [BX]
iii) MOV AL, [BP + SI]
iv) MOV ES : [BX], AL. **(08 Marks)**

OR

2 a. Write an 8086 ALP to add a data byte present at address 2000 : 0600h with a data byte present at address 3000 : 0700h and store the result at address 4000 : 0900h. **(06 Marks)**

b. Explain machine language formats for any 2 instructions. **(04 Marks)**

c. Given the opcode 8907h, explain how these two bytes are interpreted in machine language what is the resulting instruction. **(06 Marks)**

Module-2

3 a. Using string instruction, write an 8086 ALP to copy 5 words from source memory area to destination memory area. Give the significance of SI, DI, CX and the DF bit. **(10 Marks)**

b. List all the flag manipulation and processor control instructions. **(06 Marks)**

OR

4 a. What are assembler directives? Explain any 5 assembler directives. **(07 Marks)**

b. List and explain the string manipulation instructions. Also give its advantages. **(09 Marks)**

Module-3

5 a. Explain the operation of i) PUSH and POP instructions ii) call and ret instruction. **(06 Marks)**

b. Draw the interrupt vector table and write the sequence of operations that are performed when an interrupt is recognized. **(10 Marks)**

OR

6 a. Explain maskable and non-maskable interrupts. **(04 Marks)**

b. Differentiate between procedures and Macros. **(05 Marks)**

c. Write a program to generate a delay of 100ms using an 8086 system that runs on 10 MHz frequency. Show the calculations. **(07 Marks)**

Module-4

7 a. With a neat circuit diagram, explain minimum mode configuration of 8086 system. **(08 Marks)**

b. Draw the timing diagram for read and write operation of maximum mode. **(08 Marks)**

OR

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

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

Module-5

9 a. Write an 8086 ALP to rotate the stepper motor in clockwise direction by 360° and then in anti clockwise direction by 180°. Assume 1–8 deg stepper and proc 'DELAY', **(08 Marks)**

b. Explain the following INT 21h DOS function calls.
i) Function 01h ii) function 02h iii) function 09h iv) function 0Ah. **(08 Marks)**

OR

10 a. Explain 8087 architecture with a neat diagram. **(08 Marks)**

b. Explain von-neumann and Harvard CPU architecture and CISC and RISC CPU architecture. **(08 Marks)**

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CBCS Scheme

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

Fourth Semester B.E. Degree Examination, June/July 2018
Control Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Write the differential equations for the mechanical system shown in Fig.Q1(a) and obtain F-V analogy. **(06 Marks)**

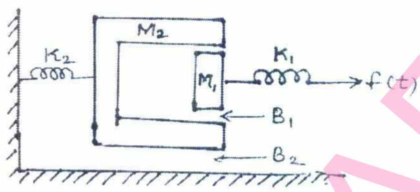

Fig.Q1(a)

b. Differentiate between open loop control system and closed-loop control system. **(06 Marks)**

c. For the rotational system shown in Fig.Q1(c). Draw torque-voltage analogous circuit. **(04 Marks)**

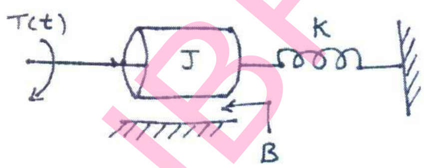

Fig.Q1(c)

OR

2 a. Reduce the following block diagram of the system shown on Fig.Q2(a) into a single equivalent block diagram by block diagram reduction rules. **(06 Marks)**

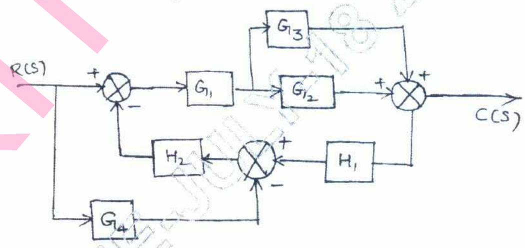

Fig.Q2(a)

b. Find $\frac{C(s)}{R(s)}$ for the following signal flow graph. [Refer Fig.Q2(b)] **(06 Marks)**

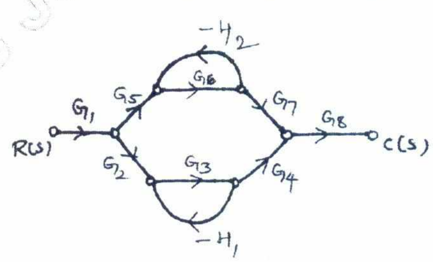

Fig.Q2(b)

c. For the following circuit write the signal flow graph. [Refer Fig.Q2(c)] **(04 Marks)**

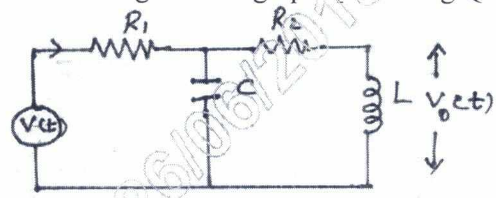

Fig.Q2(c)

Module-2

3 a. For the system shown in Fig.Q3(a). Find the : i) system type ii) static error constants k_p, k_v and k_a and iii) the steady state error for an input r(t) = 3 + 2t. **(06 Marks)**

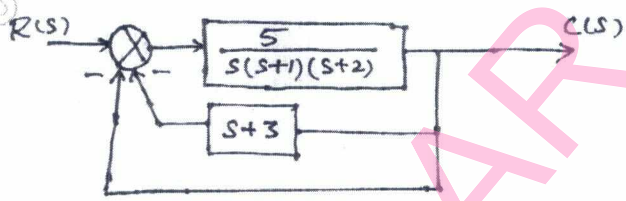

Fig.Q3(a)

b. Find the step-response, C(t) for the system described by $\frac{C(s)}{R(s)} = \frac{4}{S+4}$. Also find the time constant, rise time and settling time. **(05 Marks)**

c. Derive the equation for steady state error of simple closed loop system. **(05 Marks)**

OR

4 a. A second order system is represented by the transfer function.

$$\frac{Q(s)}{I(s)} = \frac{1}{JS^2 + fS + K}$$

A step input of 10 Nm is applied to the system and the test results are :

i) maximum overshoot = 6%
ii) time at peak overshoot = 1sec
iii) the steady state value of the output is 0.5 radian.

Determine the values of J, f and K. **(06 Marks)**

b. A system has 30% overshoot and settling time of 5 seconds for on unit step input. Determine: i) The transfer function ii) peak time 't_p' iii) output response (assume e_{ss} as 2%). **(06 Marks)**

c. Write the general block diagrams of the following :

i) PD type of controller
ii) PI type of controller. **(04 Marks)**

Module-3

5 a. Determine the ranges of 'K' such that the characteristic equation :

$S^3 + 3(K+1)S^2 + (7K+5)S + (4K+7) = 0$ has roots more negative than S = –1. **(06 Marks)**

b. Check the stability of the given characteristic equation using Routh's method.

$S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$. **(06 Marks)**

c. Mention few limitations of Routh's criterion. **(04 Marks)**

OR

6 a. Sketch the complete root locus of system having, $G(s)H(s) = \dfrac{K}{S(S+1)(S+2)(S+3)}$. **(12 Marks)**

b. Consider the system with $G(S)H(s) = \dfrac{K}{S(S+1)(S+4)}$. Find whether S = –2 point is on root locus or not using angle condition. **(04 Marks)**

Module-4

7 a. The open loop transfer function of a system is $G(s) = \dfrac{K}{s(1+s)(1+0.1s)}$. Determine the values of K such that i) gain margin = 10 dB ii) phase margin = 24°. Use Bode plot. **(10 Marks)**

b. Derive the expression for resonant peak 'M_r' and corresponding resonant frequency 'W_r' for a second–order underdamped system in frequency response analysis. **(06 Marks)**

OR

8 a. Sketch the Nyquist plot for a system with the open-loop transfer function :

$$G(s)H(s) = \frac{k(1+0.5s)(1+s)}{(1+10s)(s-1)}$$

Determine the range of values of 'k' for which the system is stable. **(08 Marks)**

b. Write the polar plot for the following open-loop transfer function :

$$G(S)H(s) = \frac{1}{1+0.1s}.$$ **(04 Marks)**

c. Explain Nyquist stability criteria. **(04 Marks)**

Module-5

9 a. Explain spectrum analysis of sampling process. **(06 Marks)**

b. Explain how zero–order hold is used for signal reconstruction. **(04 Marks)**

c. Find the state–transition matrix for $A = \begin{bmatrix} 0 & -1 \\ +2 & -3 \end{bmatrix}$. **(06 Marks)**

OR

10 a. Obtain an appropriate state model for a system represented by an electric circuit as shown in Fig.Q10(a).

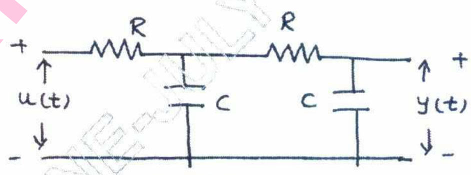

Fig.Q10(a) **(06 Marks)**

b. A linear time invariant system is characterized by the homogeneous state equation :

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

Compute the solution of homogeneous equation, assume the initial state vector.

$$X_0 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}.$$ **(06 Marks)**

c. State the properties of state transition matrix. **(04 Marks)**

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CBCS SCHEME

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15EC44

Fourth Semester B.E. Degree Examination, June/July 2018
Signals and Systems

Time: 3 hrs. Max. Marks: 80

Note: ***Answer 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)-(i) and Fig. Q1 (a)-(ii) **(08 Marks)**

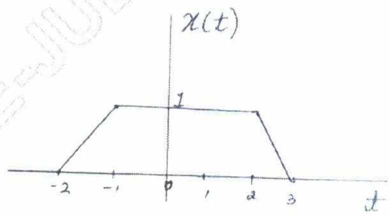

Fig. Q1 (a)-(i)

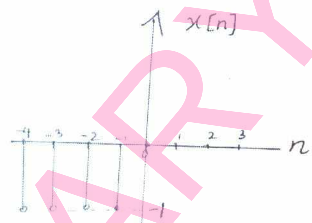

Fig. Q1 (a)-(ii)

b. The trapezoidal pulse x(t) shown in Fig. Q1 (b) is applied to a differentiator defined by,

$$y(t) = \frac{d}{dt}x(t)$$

Determine the resulting output y(t) and the total energy of y(t). **(08 Marks)**

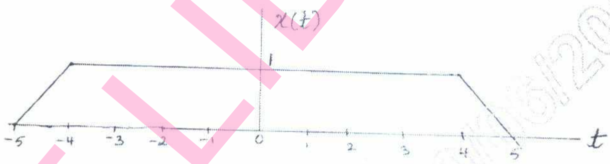

Fig. Q1 (b)

OR

2 a. Two systems are described by, (i) $y(n) = (n+1)x(n)$ (ii) $y(t) = x(t) + 10$. Test the systems for (i) Memory (ii) Causality (iii) Linearity (iv) Time-invariance and (v) Stability **(08 Marks)**

b. Let x(t) and y(t) be given in Fig. Q2 (b) respectively. Sketch the following signals, (i) $x(t)y(-t-1)$ (ii) $x(4-t)y(t)$ **(05 Marks)**

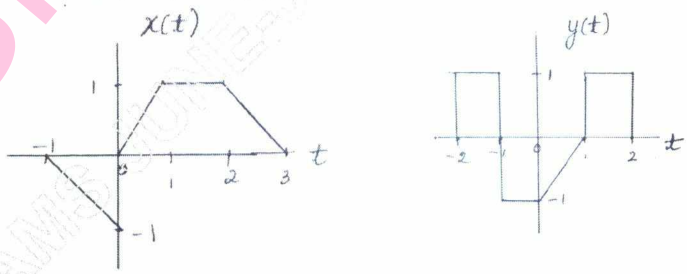

Fig. Q2 (b)

c. 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)**

Module-2

3 a. Show that, (i) $x(t) * \delta(t - t_0) = x(t - t_0)$ (ii) $x(n) = \sum_{K=-\infty}^{\infty} x(k)\delta(n - K)$

(iii) $x(t) * u(t) = \int_{-\infty}^{t} x(z)dz$ **(08 Marks)**

b. Determine graphically, the output of a LTI system whose impulse response is $h(t) = \begin{cases} 4 & \text{for } 0 \le t \le 2 \\ 0 & \text{elsewhere} \end{cases}$

for the input $x(t) = \begin{cases} 2 & \text{for } -2 \le t \le 2 \\ 0 & \text{elsewhere} \end{cases}$ **(08 Marks)**

OR

4 a. Use the definition of the convolution sum to prove the following properties:

(i) $x(n) * (h_1(n) + h_2(n)) = (x(n) * h_1(n)) + (x(n) * h_2(n))$

(ii) $x(n) * h(n) = h(n) * x(n)$ **(08 Marks)**

b. Compute the convolution sum of,

$x(n) = \alpha^n [U(n) - U(n-8)]$, $|\alpha| < 1$ and

$h(n) = U(n) - U(n-5)$ **(08 Marks)**

Module-3

5 a. Determine the overall impulse response h(t) in terms of impulse response of each subsystem shown in Fig. Q5 (a). **(04 Marks)**

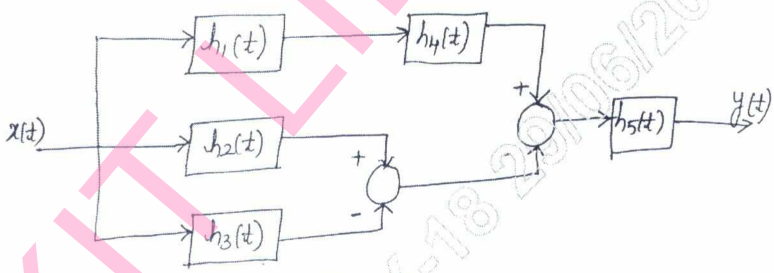

Fig. Q5 (a)

b. Determine whether the systems described by the following impulse responses are stable, causal and memoryless:

(i) $h(n) = \left(\frac{1}{2}\right)^n U(n)$ (ii) $h(t) = e^t u(-1-t)$ **(06 Marks)**

c. Find the DTFS coefficients of the signal shown in Fig. Q5 (c). **(06 Marks)**

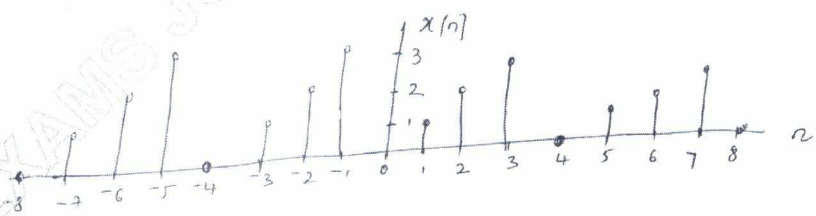

Fig. Q5 (c)

OR

6 a. Find the unit step response for the LTI systems represented by the following responses:

(i) $h(n) = \left(\frac{1}{2}\right)^n U(n-2)$ (ii) $h(t) = e^{-|t|}$ **(08 Marks)**

b. Find the Fourier series of the signal shown in Fig. Q6 (b), T = 2 **(08 Marks)**

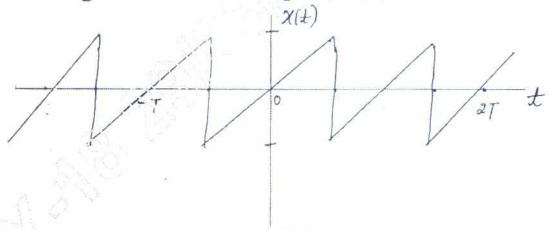

Fig. Q6 (b)

Module-4

7 a. State and prove the following properties of Discrete time Fourier transform:
(i) Frequency shift property (ii) Time differentiation property **(06 Marks)**

b. Find the Discrete time Fourier Transform of the following signals,
(i) $x(n) = a^{|n|}\ |a| < 1$ (ii) $x(n) = 2^n U(-n)$ **(10 Marks)**

OR

8 a. Determine the Nyquist sampling rate and Nyquist sampling interval for,
(i) $x(t) = 1 + \cos 2000\pi t + \sin 4000\pi t$ (ii) $x(t) = 25e^{j500\pi t}$ **(05 Marks)**

b. Determine the Fourier transform of the following signals,
(i) $x(t) = e^{-3t}u(t-1)$ (ii) $x(t) = e^{-a|t|}$ $a > 0$ **(06 Marks)**

c. Determine the time domain expression of $X(j\omega) = \frac{j\omega + 1}{(j\omega + 2)^2}$. **(05 Marks)**

Module-5

9 a. Determine the z-transform x(z), the ROC for the signals. Draw the ROC

(i) $x(n) = -\left(\frac{1}{2}\right)^n U[-n-1] - \left(-\frac{1}{3}\right)^n U[-n-1]$ (ii) $x(n) = -\left(\frac{3}{4}\right)^n U[-n-1] + \left(-\frac{1}{3}\right)^n U[n]$ **(08 Marks)**

b. State and prove the following properties of Z-transform:
(i) Time shift (ii) Convolution property. **(08 Marks)**

OR

10 a. The Z-transform of a sequence x(n) is given by, $x(z) = \frac{z(z^2 - 4z + 5)}{(z-3)(z-2)(z-1)}$.

find x(n) for the following ROCs
(i) $2 < |z| < 3$ (ii) $|z| > 3$ **(08 Marks)**

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

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

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

Find the output of the system if the input is, $\left(\frac{1}{2}\right)^n U(n)$. **(08 Marks)**

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CBCS SCHEME

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

Fourth Semester B.E. Degree Examination, June/July 2018
Principles of Communication Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define Amplitude modulation. Explain the generation of AM wave using switching modulator. **(06 Marks)**

b. What is coherent detection? With a neat block diagram, explain the demodulation of DSB-SC signals using Costas receiver. **(05 Marks)**

c. Obtain the expression for a spectrum of single tone AM signal. Show that the total power in the sidebands is one third of the total power in the modulated wave with 100% modulation. **(05 Marks)**

OR

2 a. What are the modified forms of amplitude modulation? With a neat circuit diagram and waveform, explain the operation of ring modulator. **(06 Marks)**

b. With the help of an amplitude response of VSB filter. Explain the VSB modulation and demodulation process. **(06 Marks)**

c. Consider a square law detector using a nonlinear device whose output defined by $v_2(t) = a_1 v_1(t) + a_2\ v_1^2(t)$, where a_1, a_2 are constants and $v_1(t) = A_c\ [\ 1+k_a u(t)]\ \text{Cos}\ 2\pi f_c t$.

i) Evaluate the output $v_2(t)$

ii) How the message signal can be recovered from $v_2(t)$? **(04 Marks)**

Module-2

3 a. Derive the expression for narrow band FM and compare it with the AM signal using phasor diagrams. **(06 Marks)**

b. Describe the frequency response of an ideal slope circuit used for the demodulation of FM signals and explain the balanced frequency discriminator. **(08 Marks)**

c. A commercial FM radio broadcasting uses modulation frequency w = 15KHz with the maximum value of frequency deviation 75KHz. Find the deviation ratio and transmission bandwidth. **(02 Marks)**

OR

4 a. With a neat block diagram, explain the generation of wideband FM signals. How the frequency stability is achieved. **(06 Marks)**

b. With the help of linear model of phase locked loop, obtain the output expression for demodulation of FM signals. **(07 Marks)**

c. An FM signal with a frequency deviation of 10KHz at a modulation frequency of 5KHz is applied to two frequency multipliers connected in cascade. The first multiplier doubles the frequency and the second multiplier triples it. Determine the frequency deviation and modulation index at the output. What is the frequency separation of adjacent side frequencies of this FM signal? **(03 Marks)**

Module-3

5 a. Define a random variable. Illustrate the relationship between sample space, random variable and probability. **(04 Marks)**

b. Define the autocorrelation and cross correlation functions. State the properties of auto correlation function. **(05 Marks)**

c. Explain the shot noise and thermal noise with the relevant expressions. **(07 Marks)**

OR

6 a. What is binary symmetric channel? Obtain a posteriori probabilities for the binary symmetric channel using transition probability diagram. **(06 Marks)**

b. Define mean, correlation and covariance function of a random process. compute the cross correlation for a pair of quadrature modulated stationary processes $x_1(t) = \text{Cos } 2\pi f_c t$ and $x_2(t) = \text{Sin } 2\pi f_c t$ **(05 Marks)**

c. What is white noise? Explain the power spectral density and autocorrelation function. **(05 Marks)**

Module-4

7 a. Explain the noise analysis of coherent detection of DSB – SC receiver. **(06 Marks)**

b. Explain the need of pre emphasis and de-emphasis in FM. Describe the transfer functions and circuit diagram of these filters. **(06 Marks)**

c. Compare the noise performance of AM and FM signals with reference to sinusoidal modulating signal and figure of merit. **(04 Marks)**

OR

8 a. Obtain the figure of merit of an AM receiver using envelope detector. **(08 Marks)**

b. With a neat block diagram, explain FMFB demodulator. **(04 Marks)**

c. Explain the following term with respect to FM i) Threshold effect ii) Capture effect. **(04 Marks)**

Module-5

9 a. State the sampling theorem. Obtain the expression for the spectrum of an ideally sampled signal and plot the spectrum for an arbitrary signal. **(06 Marks)**

b. What is multiplexing? What are the different types of multiplexing? Explain TDM with a neat block diagram. **(06 Marks)**

c. For a sinusoidal modulating signal, show that the signal to quantization noise ratio is 1.8 + 6R dB, where R is the number of bits per sample. **(04 Marks)**

OR

10 a. Define pulse amplitude modulation. Obtain the expression for the Fourier transform of PAM signal. **(07 Marks)**

b. What is quantization process? Explain the different types of Quantization with their input output characteristics. **(05 Marks)**

c. Represent the binary data: 10011101 in polar NRZ and bipolar RZ formatting. **(04 Marks)**

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CBCS SCHEME

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

15EC46

Fourth Semester B.E. Degree Examination, June/July 2018
Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer FIVE full questions, choosing one full question from each module.*
2. *Use of standard resistor value and standard capacitor value table is allowed.*

Module-1

1 a. With neat circuit diagram, explain basic op-amp circuit. **(06 Marks)**
b. Sketch an op-amp difference amplifier circuit. Derive an equation for output voltage and explain the operation. **(05 Marks)**
c. A non inverting amplifier is to amplify a 100 mV signal to a level of 3 V. Using 741 op-amp design a suitable circuit. **(05 Marks)**

OR

2 a. Define following terms with respect to op-amp and mention their typical values:
(i) PSRR (ii) CMRR (iii) Slew rate. **(06 Marks)**
b. With neat circuit diagram, explain the operation of a direct coupled inverting amplifier with necessary design steps. **(04 Marks)**
c. Obtain the expression for the three input inverting summing amplifier circuit and show how it can be converted into averaging circuit. **(06 Marks)**

Module-2

3 a. Sketch and explain high zin capacitor coupled voltage follower with necessary design steps and show that the input impedance is very high as compared to capacitor coupled voltage follower. **(08 Marks)**
b. What are the advantages of precision rectifier over ordinary rectifier? Discuss the operation of precision full wave rectifier circuit using bipolar op-amp. **(08 Marks)**

OR

4 a. Draw the circuit diagram of instrumentation amplifier and explain its operation. Also show how voltage gain can be varied. **(08 Marks)**
b. A capacitor coupled non-inverting amplifier is to have $A_V = 100$ and $V_0 = 5$ V with $R_L = 10\ K\Omega$ and $f_1 = 100$ Hz. Design a suitable circuit using 741 op-amp. **(08 Marks)**

Module-3

5 a. Draw and explain the operation of sample and hold circuit with signal, control and output waveforms. **(08 Marks)**
b. Using 741 op-amp with a supply of $\pm 12V$, design a phase shift oscillator to have an output frequency of 3.5 kHz and voltage gain of 29. ($A_V = 29$) **(08 Marks)**

OR

6 a. With neat circuit diagram explain the working of precision clipping circuit, with necessary waveforms. **(08 Marks)**
b. With neat circuit diagram, explain the operation of inverting Schmitt trigger circuit. Draw the output waveforms and discuss the design procedure. **(08 Marks)**

Module-4

7 a. Draw the internal schematic for 723 IC low voltage regulator and explain its working and also mention the advantages of IC voltage regulators. **(08 Marks)**

b. Design and explain the operation of second order active low pass filter. Using 741 op-amp to have a cut-off frequency of 2 kHz. **(08 Marks)**

OR

8 a. Show how a band pass filter can be constructed by the use of a low pass filter and a high pass filter. Sketch the expected frequency response and explain the operation of a single stage Band Pass Filter. **(08 Marks)**

b. Discuss the important characteristics of a three terminal IC regulator and design a 7805 IC regulator to get the output voltage of 7.5 V (Choose $I_Q = 4.2$ mA, $I_{R_1} = 25$ mA) **(08 Marks)**

Module-5

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

b. Explain the working of successive approximation Analog-to Digital Converter (ADC). **(08 Marks)**

OR

10 a. Draw the internal schematic of 555 timer IC and configure it for monostable operation and explain its working with necessary equations. **(08 Marks)**

b. Explain the working of R-2R network D-A converter and derive expression for output voltage. **(08 Marks)**

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CBCS Scheme

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15MATDIP41

Fourth Semester B.E. Degree Examination, June/July 2018
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Find the rank of the matrix $\begin{bmatrix} 5 & 3 & 14 & 4 \\ 0 & 1 & 2 & 1 \\ 1 & -1 & 2 & 0 \end{bmatrix}$ by reducing to echelon form. **(06 Marks)**

b. Use Cayley-Hamilton theorem to find the inverse of the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$. **(05 Marks)**

c. Apply Gauss elimination method to solve the equations $x+4y-z=-5$; $x+y-6z=-12$; $3x-y-z=4$ **(05 Marks)**

OR

2 a. Find all the eigen values and eigen vector corresponding to the largest eigen value of $\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$. **(06 Marks)**

b. Find the rank of the matrix by elementary row transformations $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix}$. **(05 Marks)**

c. Solve the system of linear equations $x+y+z=6$; $2x-3y+4z=8$; $x-y+2z=5$ by Gauss elimination method. **(05 Marks)**

Module-2

3 a. Solve $\frac{d^2y}{dx^2}+4y=\tan 2x$ by the method of variation of parameters. **(06 Marks)**

b. Solve $\frac{d^2x}{dt^2}+5\frac{dx}{dt}+6x=0$, given $x(0)=0$, $\frac{dx}{dt}(0)=15$. **(05 Marks)**

c. Solve $(D^2+5D+6)y=e^x$. **(05 Marks)**

OR

4 a. Solve by the method of undetermined coefficients $(D^2-2D+5)y=25x^2+12$. **(06 Marks)**

b. Solve $(D^2+3D+2)y=\sin 2x$. **(05 Marks)**

c. Solve $(D^2-2D-1)y=e^x\cos x$. **(05 Marks)**

Module-3

5 a. Find the Laplace transforms of, (i) $t\cos^2 t$ (ii) $\frac{1-e^{-t}}{t}$ **(06 Marks)**

b. Find the Laplace transforms of, (i) $e^{-2t}(2\cos 5t-\sin 5t)$ (ii) $3\sqrt{t}+\frac{4}{\sqrt{t}}$. **(05 Marks)**

c. Express the function, $f(t)=\begin{cases} t, & 0<t<4 \\ 5, & t>4 \end{cases}$ in terms of unit step function and hence find its Laplace transform. **(05 Marks)**

OR

6 a. Find the Laplace transform of the periodic function defined by $f(t) = E\sin\omega t$, $0 < t < \frac{\pi}{\omega}$ having period $\frac{\pi}{\omega}$. **(06 Marks)**

b. Find the Laplace transform of $2^t + t\sin t$. **(05 Marks)**

c. Find the Laplace transform of $\frac{2\sin t \sin 5t}{t}$. **(05 Marks)**

Module-4

7 a. Using laplace transforms method, solve $y'' - 6y' + 9 = t^2e^{3t}$, $y(0) = 2$, $y'(0) = 6$. **(06 Marks)**

b. Find the inverse Laplace transforms of, (i) $\frac{s^2 - 3s + 4}{s^3}$ (ii) $\frac{s+3}{s^2 - 4s + 13}$ **(05 Marks)**

c. Find the inverse Laplace transforms of, (i) $\log\left(\frac{s+1}{s-1}\right)$ (ii) $\frac{s^2}{(s-2)^3}$ **(05 Marks)**

OR

8 a. Solve the simultaneous equations $\frac{dx}{dt} + 5x - 2y = t$, $\frac{dy}{dt} + 2x + y = 0$ being given $x = y = 0$ when $t = 0$. **(06 Marks)**

b. Find the inverse Laplace transforms of $\cot^{-1}\left(\frac{s}{2}\right)$. **(05 Marks)**

c. Find the inverse Laplace transforms of $\frac{2s^2 - 6s + 5}{s^3 - 6s^2 + 11s - 6}$. **(05 Marks)**

Module-5

9 a. For any three arbitrary events A, B, C prove that,
$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C \cap A) + P(A \cap B \cap C)$ **(04 Marks)**

b. A class has 10 boys and 5 girls. Three students are selected at random, one after the other. Find probability that, (i) first two are boys and third is girl (ii) first and third boys and second is girl. (iii) first and third of same sex and the second is of opposite sex. **(06 Marks)**

c. In a certain college 25% of boys and 10% of girls are studying mathematics. The girls constitute 60% of the student body. (i) what is the probability that mathematics is being studied ? (ii) If a student is selected at random and is found to be studying mathematics, find the probability that the student is a girl? (iii) a boy? **(06 Marks)**

OR

10 a. State and prove Bayes theorem. **(04 Marks)**

b. A problem in mathematics is given to three students A, B and C whose chances of solving it are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved? **(06 Marks)**

c. A pair of dice is tossed twice. Find the probability of scoring 7 points. (i) Once, (ii) at least once (iii) twice. **(06 Marks)**

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