CBCS SCHEME

USN

15MAT41

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Engineering Mathematics – IV

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. Using Taylor's series method solve $\frac{dy}{dx} = x^2 + y^2$ with y(0) = 1 and hence find y(0.1) and consider upto 3[rd] degree. **(06 Marks)**

b. Using modified Euler's method solve $\frac{dy}{dx} = 1 + \frac{y}{x}$ with y(1) = 2 then find y(1.2) in two steps. **(05 Marks)**

c. Given $\frac{dy}{dx} = \frac{x+y}{2}$, give that y(0) = 2, y(0.5) = 2.636, y(1) = 3.595 and y(1.5) = 4.968 then find value of y at x = 2 using Milne's predictor and corrector formulae. **(05 Marks)**

OR

2 a. Using modified Euler's method solve $\frac{dy}{dx} = x + \sqrt{y}$, with y(0) = 1 then find y(0.2) with h = 0.2. **(06 Marks)**

b. Solve $\frac{dy}{dx} = \frac{y-x}{y+x}$, with y(0) = 1 and hence find y(0.1) by taking one steps using Runge-Kutta method of fourth order. **(05 Marks)**

c. Given $\frac{dy}{dx} = \frac{(1+x^2)y^2}{2}$, given that y(0) = 1, y(0.1) = 1.06. y(0.2) = 1.12 and y(0.3) = 1.21 then evaluate y(0.4) using Adam's – Bash forth method. **(05 Marks)**

Module-2

3 a. Given $\frac{d^2y}{dx^2} = \frac{2dy}{dx} - y$, y(0) = 1, y′(0) = 2, evaluate y(0.1) and y′(0.1) using Runge-Kutta method of fourth order. **(06 Marks)**

b. Solve the Bessel's differential equation : $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - n^2)y = 0$ leading to $J_n(x)$. **(05 Marks)**

c. Express $x^3 + 2x^2 - 4x + 5$ in terms of Legendre polynomials. **(05 Marks)**

OR

4 a. Using Milne's method. obtain an approximate solution at the point x = 0.8 of the problem $\dfrac{d^2y}{dx^2} = 1 - 2y\dfrac{dy}{dx}$ using the following data :

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. If α and β are two distinct roots of $J_n(x) = 0$ then P-T $\int_0^1 x\, J_n(\alpha x)\, J_n(\beta x)\, dx = \{0$ if $\alpha \neq \beta$. **(05 Marks)**

c. With usual notation, prove that $J_{+\frac{1}{2}}(x) = \sqrt{\dfrac{2}{\pi x}} \sin x$. **(05 Marks)**

Module-3

5 a. State and prove Cauchy-Riemann equation in Cartesian form. **(06 Marks)**

b. Find analytic function f(z) whose imaginary part is $v = \left(r - \frac{1}{r}\right)\sin\theta$. **(05 Marks)**

c. Discuss the transformation of $\omega = e^z$. **(05 Marks)**

OR

6 a. State and prove Cauchy's integral formula. **(06 Marks)**

b. Emulate $\oint_c \dfrac{e^{2z}}{(z+1)(z-2)} dz$ where c is |z| = 3 using Cauchy's residue theorem. **(05 Marks)**

c. Find the bilinear transformation which maps z = –1, 0, 1 into ω = 0, i, 3i. **(05 Marks)**

Module-4

7 a. Derive mean and variance of the binomial distribution. **(06 Marks)**

b. A random variable x has the following probability mass function.

x	0	1	2	3	4	5
P(x)	k	3k	5k	7k	9k	11k

i) find k ii) find p(x < 3) iii) find p(3 < x ≤ 5). **(05 Marks)**

c. The joint distribution of two random variable x and y as follows :

x \ y	–4	2	7
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
5	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$

Compute : i) E(x) and E(y) ii) E(xy) iii) cov(xy). **(05 Marks)**

OR

8 a. 2% of the fuses manufactured by a firm are found defective. Find the probability that a box containing 200 fuses contains. i) no defective fuses ii) 3 or more defective fuses. **(06 Marks)**

b. In a test on 2000 electric bulbs. It was found that the life of a particular brand was distributed normally with an average life of 2040 hours and S.D 60 hours. Estimate the number of bulbs likely to burn ($P(0 < z < 1.83) = 0.4664$ $P(1.33) = 0.4082$, $P(2) = 0.4772$) i) more than 2150 ii) less than 1960 iii) more than 1920 but less than 2160 hours. **(05 Marks)**

c. The joint probability distribution of two random variable X and Y given by the following table:

X \ Y	1	3	9
2	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$
4	$\frac{1}{4}$	$\frac{1}{4}$	0
6	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$

Find marginal distribution of X and Y and evaluate cov(XY). **(05 Marks)**

Module-5

9 a. Define: i) Null hypothesis ii) significance level iii) Type–I and Type–II error. **(06 Marks)**

b. Ten individual are chosen at random from a population and their height in inches are found to be 63, 63, 66, 67, 68, 69, 70, 70, 71, 71. Test the hypothesis that mean height of the universe is 66 inches. Given that ($t_{0.05} = 2.262$ for 9d.f) **(05 Marks)**

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

$$A = \begin{bmatrix} \frac{1}{2} & \frac{1}{4} & \frac{1}{4} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & 1 & 0 \end{bmatrix}.$$

(05 Marks)

OR

10 a. A coin is tossed 1000 times and head turns up 540 times. Decide on the hypothesis that the coin is unbiased. **(06 Marks)**

b. Four coins are tossed 100 times and following results were obtained :

No. of heads	0	1	2	3	4
Frequency	5	29	36	25	5

Fit a binomial distribution for the data and test the goodness of fit $\left(\chi^2_{0.05} = 9.49\right)$. **(05 Marks)**

c. A student's study habit 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? **(05 Marks)**

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CBCS SCHEME

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

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Microprocessors

Time: 3 hrs.   Max. Marks: 80

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

Module-1

1 a. Explain the flag register of 8086 in detail with neat diagram. **(08 Marks)**
b. Explain in detail with examples any 4 addressing modes of 8086. **(06 Marks)**
c. Opcode for MOV instruction is "100010", explain the formation of opcode for MOV AX, BX. **(02 Marks)**

OR

2 a. With a neat block diagram explain the internal architecture of 8086. **(08 Marks)**
b. Write an 8086 assembly language program to sort a block of 20 eight bit numbers at LOC1 into even and odd numbers, save them at EVN and ODD. **(06 Marks)**
c. Explain the working of following 8086 instructions:
(i) MOV AX, [SI]   (ii) ADD BYTE PTR [DI], 3 **(02 Marks)**

Module-2

3 a. Write an ALP to add two ASCII numbers N1 and N2 and save the result at RES as a hexadecimal number. **(08 Marks)**
b. Write an ALP to replace the "##" in a given string of 50 characters with "**". **(08 Marks)**

OR

4 a. What are assembler directives? Explain the following assembler directives :
(i) DQ   (ii) ASSUME   (iii) DUP. **(04 Marks)**
b. Write an ALP to copy a 100 Byte block of data from LOC1 to LOC2 using the MOVS instruction. **(06 Marks)**
c. A two digit BCD number is typed using a keyboard. Write an ALP to read the value, save it as BCD number at LOC as packed BCD. **(06 Marks)**

Module-3

5 a. Describe the purpose of the interrupt vector table of 8086 processor and conditions which cause the following interrupts Type 0; Type 2; Type 4. **(08 Marks)**
b. What are the differences between MACRO and PROCEDURE? **(04 Marks)**
c. Write a procedure DELAY which performs 10 msec delay with 8086 processor @ 10MHz. Show the calculations of the delay. **(04 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 MACRO to create a DELAY where the delay parameter is passed on to the macro. **(04 Marks)**

Module-4

7 a. With a neat diagram explain the control register of 8255 in detail. **(06 Marks)**

b. Write ALP to setup 8255 so that port A is input port B is output and PC0-3 are input, PC4-7 are output ports. Assume 8255 is mapped as IO at 40H. Show with neat diagram the hardware connection of 8086 to 8255 using 74LS138 decoder to generate $\overline{CS}$ logic. **(10 Marks)**

OR

8 a. With neat diagram explain maximum mode of operation of 8086. **(06 Marks)**

b. 8086 is interfaced through a 8255 to a 4 by 4 keypad where Port C4-7 is connected to column and PC0-3 to row. 8255 is in isolated IO mode at location 40H. Write ALP to setup 8255 and read the key pressed to display on screen as "ROW#: __" and "COLUMN#:__". Assume a 50 msec delay routine DELAY50 is available to you. **(10 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 working of DOS21H interrupt when AH = 09h and AH = 02h. **(04 Marks)**

OR

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

b. Explain the control register of 8253/54 in detail. **(06 Marks)**

c. Explain the difference between CISC and RISC Architecture. **(02 Marks)**

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CBCS SCHEME

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

15EC43

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. Define control system. Write the differences between open loop control system and closed loop control system. **(08 Marks)**

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

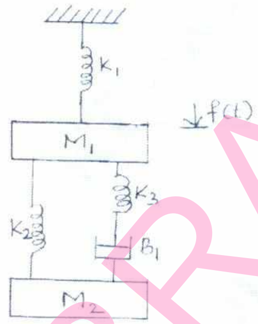

Fig.Q1(b)

OR

2 a. Define transfer function. derive an expression for the transfer function of a closed loop, negative feedback system. **(04 Marks)**

b. Reduce the block diagram shown in Fig.Q2(b) using block diagram reduction rules and obtain C(S)/R(S). **(06 Marks)**

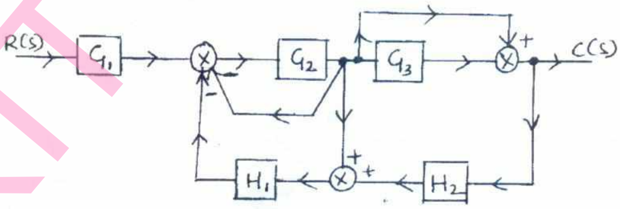

Fig.Q2(b)

c. Find $\dfrac{C(S)}{R(S)}$ using Mason's gain formula. **(06 Marks)**

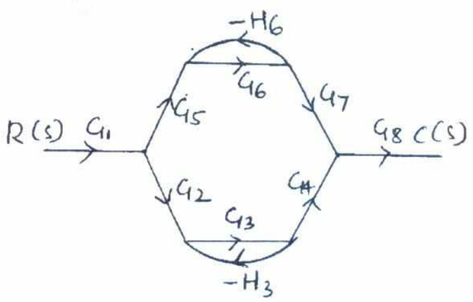

Fig.Q2(c)

Module-2

3 a. With the help of graphical representation and mathematical expression, explain the following test signals.
i) Step signal ii) Ramp signal iii) Impulse signal iv) Parabolic signal. **(08 Marks)**

b. Derive an expression for the underdamped response of a second order feedback control system for step input. **(08 Marks)**

OR

4 a. Define the following terms with respect to an underdamped second order system :
i) Peak time (T_p) ii) settling time (T_S) iii) Delay Time (T_d). **(06 Marks)**

b. A unity feedback system has $G(S) = \dfrac{40(s+2)}{s(s+1)(s+4)}$.
Determine : All error co-efficient ii) Error for ramp input with magnitude of 4. **(06 Marks)**

c. Derive the expression for rise time(T_r). **(04 Marks)**

Module-3

5 a. A feedback control system has a characteristic equation :
$s^6 + 2s^5 + 9s^4 + 16s^3 + 24s^2 + 32s + 16 = 0$.
How many poles are : i) in the left half of s-plane ii) on the imaginary axis iii) on the right half of the s-plane. **(06 Marks)**

b. For a unity feedback system, $G(s) = \dfrac{k}{s(1+0.4s)(1+0.25s)}$. Find the range of values of 'k', marginal value of 'K' and frequency of sustained oscillations. **(06 Marks)**

c. Explain the Routh's stability criterion for assessing the stability of a system. **(04 Marks**

OR

6 a. Explain the angle condition and magnitude condition. **(04 Marks)**

b. Sketch the complete root locus for the system having $G(s)H(s) = \dfrac{k}{s(s+1)(s+2)(s+3)}$. **(12 Marks)**

Module-4

7 a. Sketch the bode plot for the transfer function :
$$G(s) = \frac{ks^2}{(1+0.2s)(1+0.02s)}$$
Determine the value of k for the gain cross-over frequency to be 5 rad/sec. **(10 Marks)**

b. Define : i) Gain margin ii) Phase margin iii) Gain cross-over frequency. **(06 Marks)**

OR

8 a. For a certain control system :
$$G(s)H(s) = \frac{k}{s(s+2)(s+10)}$$
Sketch the Nyquist plot and hence calculate the range of values of k for system stability. **(10 Marks)**

b. State and explain the Nyquist stability criterion. **(06 Marks)**

Module-5

9 a. Explain a typical system with digital controller. **(06 Marks)**
b. Explain the spectrum analysis of sampling process. **(10 Marks)**

OR

10 a. Obtain the state transition matrix for
$$A = \begin{bmatrix} 0 & -1 \\ 2 & -3 \end{bmatrix}.$$
(08 Marks)
b. List the properties of state transition matrix. **(04 Marks)**
c. Define : i) state ii) state variables. **(04 Marks)**

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CBCS SCHEME

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

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. Define a signal and a system. Explain any two properties of a system. **(06 Marks)**

b. A continuous signal x(t) is shown in Fig Q1(b). sketch and label each of the following :

i) $x(t)\cdot u(1-t)$

ii) $x(t)\cdot[u(t)-u(t-1)]$

iii) $x(t)\cdot \sigma(t-3/2)$

iv) $x(t)\cdot[u(t+1)-u(t)]$

v) $x(t)\cdot u(t-1)$

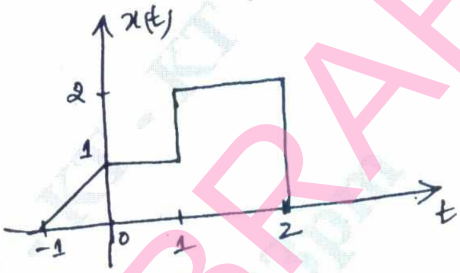

Fig Q1(b) **(10 Marks)**

OR

2 a. Distinguish between :

i) Energy and power signal

ii) Even and odd signal **(04 Marks)**

b. Determine whether the continuous – time signal $x(t) = x_1(t) + x_2(t) + x_3(t)$ is periodic or not. If periodic find the fundamental period. Where $x_1(t)$, $x_2(t)$ and $x_3(t)$ have periods of 8/3, 1.26 and $\sqrt{2}$ respectively. **(06 Marks)**

c. For the following system, determine whether the system is

(i) Linear (ii) Time – invariant (iii) Memory less and (iv) Causal.

$y(t) = e^{x(t)}$ **(06 Marks)**

Module-2

3 a. Determine the convolution sum of the given sequence

$x(n) = \left\{ \underset{\uparrow}{1}, 2, 3, 1 \right\}$ and $h(n) = \left\{ 1, \underset{\uparrow}{2}, 1, -1 \right\}$ **(04 Marks)**

b. Evaluate the discrete time convolution sum given and also plot the output y(n)

$y(n) = \left(\frac{1}{2}\right)^n \cdot u(n-2) * u(n)$ **(06 Marks)**

c. For the system with impulse response shown, determine whether the system in stable, memory less and causal $h(t) = e^{-2|t|}$. **(06 Marks)**

OR

4 a. Compute the o/p y(t) for an continuous time LTI system whose impulse response h(t) and its input x(t) are given by

$h(t) = e^{-t} \cdot u(t)$

$x(t) = u(t) - u(t-2)$ **(10 Marks)**

b. Prove the following convolution properties of impulse function

i) $x(t) * \sigma(t) = x(t)$

ii) $x(t) * \sigma(t - t_0) = x(t - t_0)$

iii) $x(t) * \sigma(t + t_0) = x(t + t_0)$ **(06 Marks)**

Module-3

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

b. Find the unit step response of the following system given by their impulse response

$$h(n) = \left(\frac{1}{2}\right)^n \cdot u(n)$$ **(04 Marks)**

c. State the condition for the Fourier series to exist. Also prove the convergence condition (Absolute Integrability) **(06 Marks)**

OR

6 a. Prove the following properties of Fourier series:

i) Convolution property

ii) Parasevals relationship **(04 Marks)**

b. Determine the Fourier – series of the signal $x(t) = 3\,\mathrm{Cos}\left(\frac{\pi}{2}t + \frac{\pi}{3}\right)$. Plot the magnitude and phase spectra. **(06 Marks)**

c. Show that if x(n) is real and even, its Fourier coefficient are real. Hence find the DTFS coefficients for the signal

$$x[n] = \sum_{p=-\infty}^{\infty} \sigma[n - 2p]$$ **(06 Marks)**

Module-4

7 a. State and prove the following properties of Fourier transform :

i) Frequency shift property

ii) Differentiation in time property **(04 Marks)**

b. Find the Fourier transform of

$x(t) = e^{-at} \cdot u(t)$. Also plot magnitude and phase spectra. **(06 Marks)**

c. For the rectangular pulse shown in Fig Q7(c), Evaluate the Fourier Transform and draw its spectrum. **(06 Marks)**

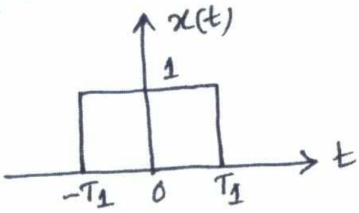

Fig Q7(c)

OR

8 a. Determine the DTFT of the following signal and draw its spectrum.

$$x(n) = \left(\frac{1}{2}\right)^n \cdot u(n-4)$$ **(06 Marks)**

b. Define the DTFT of a signal. Establish the relation between DTFT and z-transform. **(05 Marks)**

c. Find the NyQuist rate and Nyquist interval for the following signal.
$x(t) = 5\,\text{Cos}1000\,\pi t + 2\text{Sin}\,500\pi t$. **(05 Marks)**

Module-5

9 a. Describe the properties of Region of convergence and sketch the ROC of two sided, right sided and left sided sequence. **(08 Marks)**

b. Determine the z-transfer of

(i) $x[n] = -u[-n-1] + \left(\frac{1}{2}\right)^n \cdot u(n)$

(ii) $x[n] = \left(\frac{1}{2}\right)^{|n|}$

Find the ROC and pole zero locations of x(z). **(08 Marks)**

OR

10 a. Find the inverse z – transform of

$$x(z) = \frac{z(z^2-4z+5)}{(z-3)(z-1)(z-2)}$$ with : i) $|z| > 3$ ii) $|z| < 1$. **(08 Marks)**

b. A discrete LTI system is characterized by the difference equation
$y(n) = y(n-1) + y(n-2) + x(n-1)$
i) Find the system function H(z)
ii) Plot poles and zeros of H(z)
iii) Indicate the ROC of system is stable and causal
iv) Determine the impulse response of the stable system. **(08 Marks)**

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CBCS SCHEME

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

15EC45

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019

Principles of Communication Systems

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. Define amplitude modulation. Derive the expression on AM by both time domain and frequency domain representation with necessary waveforms. **(08 Marks)**

b. Explain how RING modulator can be used to generate DSB-SC modulation. **(08 Marks)**

OR

2 a. An audio frequency signal 5 sin $2\pi(1000t)$ is used to amplitude modulate a carrier of 100 sin $2\pi(10^6t)$. Assume modulation index of 0.4.
Find :
i) Sideband frequencies
ii) Bandwidth required. **(02 Marks)**

b. Explain the scheme for generation and demodulation of VSB modulated wave, with relevant spectrum of signals in the demodulation scheme. Give relevant mathematical expressions. **(08 Marks)**

c. With a neat block diagram, explain the operation of FDM technique. **(06 Marks)**

Module-2

3 a. Describe with necessary equations and phasor diagram, the generation of Narrow Band FM(NBFM). **(08 Marks)**

b. Explain the direct method of generating FM waves. **(06 Marks)**

c. A FM signal has sinusoidal modulation with W = 15KHz and modulation index $\beta = 2$. Using Carson's rule, find the transmission bandwidth and deviation ratio. Assume $\Delta f = 75$ KHz. **(02 Marks)**

OR

4 a. Explain with relevant block diagram and mathematical expression, the demodulation of a FM signal using non-linear and linear model of the PLL. **(10 Marks)**

b. Draw the block diagram of a super heterodyne receiver and explain the function of each section. **(06 Marks)**

Module-3

5 a. Define probability theory. Explain conditional probability. **(06 Marks)**

b. Describe mean, auto correlation and co-variance functions with respect to random process. **(04 Marks)**

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

OR

6 a. A random variable has probability function :

$$f(x) = \begin{cases} \dfrac{5(1-x^4)}{4} & ; \quad 0 \le x \le 1 \\ 0 & ; \quad \text{elsewhere} \end{cases}$$

Find : i)E(x) ii) E(4x + 2) iii) E(x^2). **(06 Marks)**

b. Explain the following :
i) Short Noise ii) Thermal Noise iii) White Nose iv) Noise Figure v) Noise Equivalent Bandwidth. **(10 Marks)**

Module-4

7 a. Derive the expression for the FOM of DSB – SC receiver. **(08 Marks)**
b. Derive the expression for the FOM of an AM receiver. **(08 Marks)**

OR

8 a. In AM receiver, find the Figure of Merit (FOM) when the depth of modulation is :
i) 50% ii) 100%. **(02 Marks)**
b. Explain the working of pre-emphasis and de-emphasis in FM. **(06 Marks)**
c. Derive the expression for the FOM of an FM receiver. **(08 Marks)**

Module-5

9 a. Mention the advantages of digital communication system. **(04 Marks)**
b. State and prove sampling theorem and reconstruction of lowpass signal using Nyquist Criterion. **(12 Marks)**

OR

10 a. With a neat block diagram, explain the operation of TDM. **(06 Marks)**
b. With a neat block diagram, explain the concept of PCM. **(10 Marks)**

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CBCS SCHEME

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

15EC46

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Missing data may be assumed with necessary justification.

Module-1

1 a. List the ideal electrical characteristics of operational amplifier and mention the practical values for each. **(05 Marks)**

b. Explain the operation of direct coupled non-investing summing amplifier and show that output voltage $V_0 = V_1 + V_2$ with necessary proof. **(05 Marks)**

c. Design an direct coupled inverting amplifier using op-amp 741 with voltage gain 100 and output voltage required is 5V. **(06 Marks)**

OR

2 a. Explain the following terms : i) input offset voltage ii) slew rate iii) output voltage swing iv) CMRR v) PSRR.
Mention the typical values of each terms for 741 op-amp. **(05 Marks)**

b. Discuss the ideal voltage transfer curve of op-amp and also draw the equivalent circuit of op-amp and discuss it significance. **(05 Marks)**

c. Sketch the direct coupled difference amplifier circuit. Derive an equation for output voltage (ie $V_0 = \frac{R_2}{R_1}(V_2 - V_1)$) and explain the operation. **(06 Marks)**

Module-2

3 a. Sketch the circuit of a high Z_{in} capacitor coupled voltage follower. Briefly explain its operation and show that the input impedance is very high compared to the capacitor coupled voltage follower. **(05 Marks)**

b. Design capacitor coupled non-inverting amplifier to have voltage gain of 66. The signal amplitude is of 25mV. The load resistor is 2.2kΩ and lower cut-off frequency is to be 120Hz. Sketch the circuit. **(05 Marks)**

c. Design a capacitor coupled inverting amplifier to operate with a +20V supply. The minimum input signal level is 50mV, the voltage is to be 68, the load resistance is 500 ohms, the lowest cutoff frequency is to be 200Hz. Use 741 op-amp with maximum input bias current $I_{B(max)} = 500nA$. **(06 Marks)**

OR

4 a. Sketch the circuit of 3-op-amp instrumentation amplifier and explain its operation and with necessary proof show that $V_0 = \frac{R_2}{R_1}\left[1 + \frac{2R_f}{R_G}\right](V_2 - V_1)$. And also list the requirements of instrumentation amplifier. **(10 Marks)**

b. Sketch the precision full wave rectifier and explain the operation with necessary mathematical equations and waveforms. **(06 Marks)**

Module-3

5 a. Draw the circuit diagram of inverting Schmitt trigger with different UTP and LTP adjustments. Sketch I/O transfer curve and waveform and the operation. **(10 Marks)**

b. Using 741 op-amp with supply of ±12V, design a RC phase shift oscillator to have an output frequency of oscillation 5KHz. Choose $I_1 = 50\ \mu A$. **(06 Marks)**

OR

6 a. Draw the detailed circuit diagram of sample and hold circuit and explain the operation with necessary waveforms. **(05 Marks)**

b. Sketch the circuit and explain the operation of voltage to current converter with grounded load and show that load current is independent of R_L. **(05 Marks)**

c. Design the capacitor coupled zero- crossing detector using op-amp 741 having $I_{B(max)} = 500nA$ and minimum signal frequency is 500Hz. The supply voltages are ±12V. **(06 Marks)**

Module-4

7 a. Design a first order high pass filter with $f_L = 10KHz$ with passband gain of 1.5 and also plot the frequency response of designed filter. **(06 Marks)**

b. Show how ban stop filter circuit can be constructed by using LPF and HPF. Sketch the block diagram and explain with necessary waveform. **(06 Marks)**

c. Draw the ideal response curves for all types of filters and briefly explain. **(04 Marks)**

OR

8 a. List the performance parameters of power supply and explain. **(05 Marks)**

b. With necessary functional block diagram of 3-terminal IC voltage regulator explain its operation. **(05 Marks)**

c. Draw the circuit of wide band pass filter and explain its operation. Sketch the necessary wave forms also. **(06 Marks)**

Module-5

9 a. Draw the block diagram of PLL and explain its operation, list the application of PLL. **(05 Marks)**

b. Explain the operation of analog to digital conversion using successive approximation technique. **(05 Marks)**

c. Design astable multivibration using 555 timer for the frequency of oscillation 2KHz with 25% duty cycle. Sketch the circuit after design. **(06 Marks)**

OR

10 a. With necessary circuit, explain how PLL can be used as frequency multiplier and divider. **(05 Marks)**

b. Explain how 4-bit digital information converted to analoge using R-2R ladder N/w DAC. **(05 Marks)**

c. List the specification parameters of ADC and briefly discuss on same (min 4 parameters). **(06 Marks)**

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CBCS SCHEME

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15MATDIP41

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
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 matrix $A = \begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$ **(05 Marks)**

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

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

OR

2 a. Find the values of K, such that the matrix A may have the rank equal to 3:
$A = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 2 & 4 & K \\ 1 & 4 & 10 & K^2 \end{bmatrix}$ **(05 Marks)**

b. Solve by Gauss elimination method
$x_1-2x_2+3x_3=2 \qquad 3x_1-x_2+4x_3=4 \qquad 2x_1+x_2-2x_3=5$ **(05 Marks)**

c. Find all the eigen values and corresponding eigen vectors of the matrix
$A = \begin{bmatrix} -19 & 7 \\ -42 & 16 \end{bmatrix}$ **(06 Marks)**

Module-2

3 a. Find C.F of $(4D^4-8D^3-7D^2+11D+6)y=0$. **(05 Marks)**

b. Solve the initial value problem $\dfrac{d^2x}{dt^2}+4\dfrac{dx}{dt}+29x=0$
Subject to the conditions $x(0)=0$, $\dfrac{dx}{dt}(0)=15$. **(05 Marks)**

c. Using the method of undetermined coefficients, solve $(D^2-4D+3)y=20\cos x$ **(06 Marks)**

OR

4 a. Solve $(D^2-2D+4)y=e^x\cos x$. **(05 Marks)**

b. Solve $(D^2+4)y=x^2+2^{-x}$. **(05 Marks)**

c. Using the method of variation of parameters, find the solution of $(D^2-2D+1)y=e^x/x$. **(06 Marks)**

Module-3

5 a. Find the Laplace transform of $\dfrac{\cos 3t - \cos 4t}{t}$. **(05 Marks)**

b. Find $L\{t \sin^2 t\}$ **(05 Marks)**

c. Express the following function interms of Heaviside unit step function and hence find the Laplace transform where

$$f(t) = \begin{cases} t^2 & 0 < t \le 2 \\ 4t & t > 2 \end{cases}$$ **(06 Marks)**

OR

6 a. Find $L\left[\dfrac{e^{-t}.\sin t}{t}\right]$. **(05 Marks)**

b. Using Laplace transform evaluate $\int_0^\infty e^{-t} t \sin^2 3t dt$. **(05 Marks)**

c. If $f(t) = \begin{cases} t & 0 \le t \le a \\ 2a - t & a \le t \le 2a \end{cases}$ $f(t+2a) = f(t)$, show that $L[f(t)] = \dfrac{1}{s^2} \tan h\left(\dfrac{as}{2}\right)$. **(06 Marks)**

Module-4

7 a. Find inverse Laplace transform of $\dfrac{s+5}{s^2 - 6s + 13}$. **(05 Marks)**

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

c. Solve by using Laplace transform method $y''(t) + 4y(t) = 0$, given that $y(0) = 2$, $y'(0) = 0$. **(06 Marks)**

OR

8 a. Find $L^{-1}\left[\dfrac{s^2}{(s^2+1)(s^2+4)}\right]$. **(05 Marks)**

b. Find $L^{-1}\left[\dfrac{(s+2)e^{-s}}{(s+1)^4}\right]$ **(05 Marks)**

c. Solve by using Laplace transform method $y'' + 5y' + 6y = 5e^{2x}$, $y(0) = 2$, $y'(0) = 1$. **(06 Marks)**

Module-5

9 a. There are 10 students of which three are graduates. If a committee of five is to be formed, what is the probability that there are (i) only 2 graduates (ii) atleast 2 graduates? **(05 Marks)**

b. In a school 25% of the students failed in the first language, 15% of the students failed in second language and 10% of the students failed in both. If a student is selected at random find the probability that :

i) He failed in first language if he had failed in the second language.

ii) He failed in second language if he had failed in the first language. **(05 Marks)**

c. In a bolt factory there are four machines A, B, C and D manufacturing respectively 20%, 15%, 25%, 40% of the total production. Out of these 5%, 4%, 3% and 2% are defective. If a bolt drawn at random was found defective what is the probability that it was manufactured by A or D. **(06 Marks)**

OR

10 a. From 6 positive and 8 negative numbers, 4 numbers are chosen at random (without replacement) and multiplied. What is the probability that the product is a positive number? **(05 Marks)**

b. Three students A, B, C write an entrance examination. Their chances of passing are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively. Find the probability that (i) atleast one of them passes (ii) all of them passes. **(05 Marks)**

c. Three major parties A, B, C are contending for power in the elections of a state and the chance of their winning the election is in the ratio 1:3:5. The parties A, B, C respectively have probability of banning the online lottery $\frac{2}{3}$, $\frac{1}{3}$, $\frac{3}{5}$. What is the probability that there will be a ban on the online lottery in the state? What is the probability that the ban is from the party 'C'? **(06 Marks)**

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