IV EC, EE

CBCS Scheme

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

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.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. Employ Taylor's series method to find y at x = 0.1. Correct to four decimal places given $\frac{dy}{dx} = 2y + 3e^x$; $y(0) = 0$. **(05 Marks)**

b. Using Runge Kutta method of order 4, find y(0.2) for $\frac{dy}{dx} = \frac{y-x}{y+x}$; y(0) = 1, taking h = 0.2. **(05 Marks)**

c. If $y' = 2e^x - y$; y(0) = 2, y(0.1) = 2.010, y(0.2) = 2.040 and y(0.3) = 2.090. Find y(0.4) using Milne's predictor corrector formula. Apply corrector formula twice. **(06 Marks)**

OR

2 a. Use Taylor's series method to find y(4.1) given that $(x^2 + y)y' = 1$ and y(4) = 4. **(05 Marks)**

b. Using modified Euler's method find y at x = 0.1, given $y' = 3x + \frac{y}{2}$ with y(0) = 1, h = 0.1. Perform two iterations. **(05 Marks)**

c. Find y at x = 0.4 given $y' + y + xy^2 = 0$ and $y_0 = 1$, $y_1 = 0.9008$, $y_2 = 0.8066$, $y_3 = 0.722$ taking h = 0.1 using Adams-Bashforth method. Apply corrector formula twice. **(06 Marks)**

Module-2

3 a. Given $y'' = xy'^2 - y^2$ find y at x = 0.2 correct to four decimal places, given y = 1 and y′ = 0 when x = 0, using R-K method. **(05 Marks)**

b. If α and β are two distinct roots of $J_n(x) = 0$, then prove that $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$ if $\alpha \neq \beta$. **(05 Marks)**

c. If $x^3 + 2x^2 - x + 1 = ap_0(x) + bp_1(x) + cp_2(x) + dp_3(x)$ then, find the values of a, b, c, d. **(06 Marks)**

OR

4 a. Apply Milne's method to compute y(0.8) given that $y'' = 1 - 2yy'$ and the table.

x	0	0.2	0.4	0.6
y	0	0.02	0.0795	0.1762
y′	0	0.1996	0.3937	0.5689

Apply corrector formula twice. **(05 Marks)**

b. Show that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$. **(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. Define analytic function and obtain Cauchy Riemann equation in Cartesian form. **(05 Marks)**

b. Evaluate $\int_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2(z-2)} dz$; c is the circle $|z| = 3$ by using theorem Cauchy's residue. **(05 Marks)**

c. Discuss the transformation $w = e^z$ with respect to straight line parallel to x and y axis. **(06 Marks)**

OR

6 a. Find the analytic function whose real part is $u = \frac{x^4y^4 - 2x}{x^2 + y^2}$. **(05 Marks)**

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

c. Find the bilinear transformation which maps the points $z = 1, i, -1$ into $w = 2, i, -2$. **(06 Marks)**

Module-4

7 a. Find the constant c, such that the function $f(x) = \begin{cases} cx^2, & 0 < x < 3 \\ 0, & \text{otherwise} \end{cases}$ is a p.d.f. Also compute $p(1 < x < 2)$, $p(x \le 1)$, $p(x > 1)$. **(05 Marks)**

b. If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals, more than two will get a bad reaction. **(05 Marks)**

c. x and y are independent random variables, x take the values 1, 2 with probability 0.7; 0.3 and y take the values -2, 5, 8 with probabilities 0.3, 0.5, 0.2. Find the joint distribution of x and y hence find cov(x, y). **(06 Marks)**

OR

8 a. Obtain mean and variance of binomial distribution. **(05 Marks)**

b. The length of telephone conservation in a booth has been an exponential distribution and found on an average to be 5 minutes. Find the probability that a random call made from this booth (i) ends less than 5 minutes, (ii) between 5 and 10 minutes. **(05 Marks)**

c. The joint distribution of two discrete variables x and y is $f(x, y) = k(2x + y)$ where x and y are integers such that $0 \le x \le 2$; $0 \le y \le 3$. Find: (i) The value of k; (ii) Marginal distributions of x and y; (iii) Are x and y independent? **(06 Marks)**

Module-5

9 a. Explain the terms: (i) Null hypothesis; (ii) Type I and type II errors; (iii) Significance level. **(05 Marks)**

b. A die thrown 9000 times and a throw of 3 or 4 was observed 3240 times. Is it reasonable to think that the die is an unbiased one? **(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. A certain stimulus administered to each of the 12 patients resulted in the following change in blood pressure 5, 2, 8, −1, 3, 0, 6, −2, 1, 5, 0, 4. Can it be concluded that the stimulus will increase the blood pressure. ($t_{0.05}$ for 11 d.f = 2.201) **(05 Marks)**

b. It has been found that the mean breaking strength of a particular brand of thread is 275.6 gms with $\sigma = 39.7$ gms. A sample of 36 pieces of thread showed a mean breaking strength of 253.2 gms. Test the claim at 1+.. and 5–l. level of significance. **(05 Marks)**

c. A man's smoking habits are as follows. If he smokes filter cigarettes one week, he switches to non filter cigarettes the next week with probability 0.2. One the other hand, if he smokes non filter cigarettes one week there is a probability of 0.7 that he will smoke non filter cigarettes the next week as well. In the long run how often does he smoke filter cigarettes? **(06 Marks)**

CBCS Scheme

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

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Microprocessor

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define Microprocessor. Describe architecture of 8086, with neat block diagram. **(10 Marks)**

b. Explain the significance of following pins of 8086 :
i) ALE ii) RESET iii) $\overline{TEST}$ iv) $M/\overline{IO}$. **(04 Marks)**

c. Explain the physical Address formation in 8086. **(02 Marks)**

OR

2 a. Explain the following addressing modes of 8086 :
i) Register Addressing mode ii) Based Indexed Addressing mode
iii) Immediate Addressing mode iv) Direct Addressing mode. **(08 Marks)**

b. Explain the significance of following 1 bit indicators in opcodes of 8086 processor. **(04 Marks)**

c. The Opcode for MOV instructions is "100010". Determine machine language code for the following instructions. i) MOV.AL.[BX] ii) MOV 56[SI], CL. **(04 Marks)**

Module-2

3 a. Explain the following instruction with examples :
i) LEA ii) IDIV iii) XLAT. **(06 Marks)**

b. Write a ALP to convert a 4 digit BCD No. into hexadecimal number. **(06 Marks)**

c. Differentiate between the following instructions :
i) AND & TEST ii) SHIFT & ROTATE. **(04 Marks)**

OR

4 a. What are assembler directives? Explain the following assembles directives with examples :
i) ASSUME ii) DUP iii) DB iv) LABEL. **(08 Marks)**

b. Write a ALP to find whether the given number is 2 out of 5 code. **(04 Marks)**

c. Explain the string instructions of 8086. **(04 Marks)**

Module-3

5 a. Explain the stack structure of 8086 in detail. **(06 Marks)**

b. Differentiate between procedure and Macro's. **(06 Marks)**

c. Write a ALP to find factorial of Number. **(04 Marks)**

OR

6 a. Write a programme to generate a delay of 100 m sec using 8086 microprocessor operating on 10MHz frequency. Show calculation for the delay. **(06 Marks)**

b. Explain the Interrupt Acknowledge sequence of 8086 with timing diagram. **(06 Marks)**

c. Explain interrupt response structure of 8086. **(04 Marks)**

Module-4

7 a. Draw and discuss typical maximum mode of 8086. **(08 Marks)**

b. Explain different modes of operation of 8255. **(08 Marks)**

OR

8 a. Interface two 4k × 8 EPROMS and two 4k × 8 RAM chips with 8086. **(06 Marks)**
b. Interface eight seven segment display using 8255 with 8086. **(06 Marks)**
c. Draw the timing diagram for $\overline{RQ}$ / $\overline{GT}$ for maximum mode. **(04 Marks)**

Module-5

9 a. Draw and discuss the interface between 8086 and 8087. **(08 Marks)**
b. Explain the following keyboard handling INT21 DOS function :
i) Function 01h ii) Function 08h. **(03 Marks)**
c. Write an ALP to interface stepper molar to 8086. **(05 Marks)**

OR

10 a. Differentiate between :
i) Harvard and Von Neuman Architecture ii) RISC and CISC Architecture. **(06 Marks)**
b. Explain the significance of different bits of control word. Register format of 8253/54. **(06 Marks)**
c. Write a program to generate triangular wave using DAC 0800. **(04 Marks)**

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CBCS Scheme

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

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.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. Define control system. Distinguish between open loop and closed loop systems with examples. **(05 Marks)**

b. Write the differential equations for the mechanical system shown in Fig.Q1(b) and obtain F-V and F-I analogous electrical networks. **(05 Marks)**

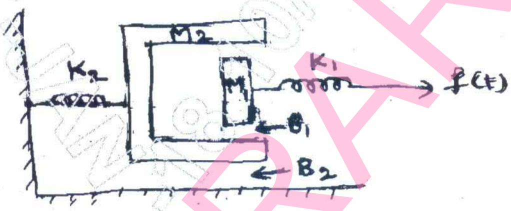

Fig.Q1(b)

c. Using Mason's gain formula, find the gain of the system shown in Fig.Q1(c). **(06 Marks)**

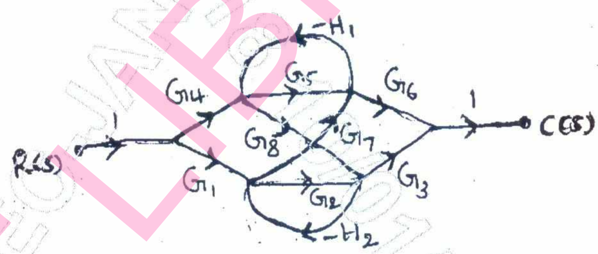

Fig.Q1(c)

OR

2 a. Write the Mason's gain formula for signal flow graph. Indicate what each term represents. **(04 Marks)**

b. Show that two systems shown in Fig.Q2(a) are analogous systems, by comparing their functions. **(06 Marks)**

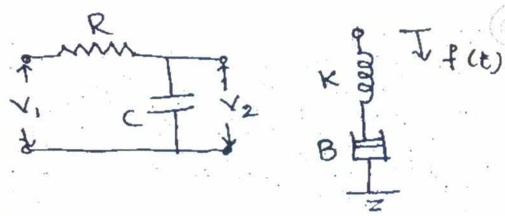

Fig.Q2(b)

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

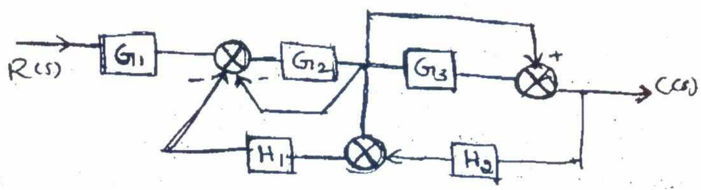

Fig.Q2(c)

Module-2

3 a. Obtain an expression for time response of the first order system subjected to unit step input. **(04 Marks)**

b. Explain proportional + integral + differential controller and their effect on stability. **(06 Marks)**

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

Determine the gain K so that system will have a damping ratio of 0.5. For this value of K, find settling time (2% criterion), peak overshoot and time to peak overshoot for a unit step input. **(06 Marks)**

OR

4 a. With a neat sketch explain all the time domain specifications. **(10 Marks)**

b. For the system shown in Fig.Q4(b). Determine the value of 'a' which gives damping factor 0.7. What is the steady state error to unit ramp input for value of 'a'. **(06 Marks)**

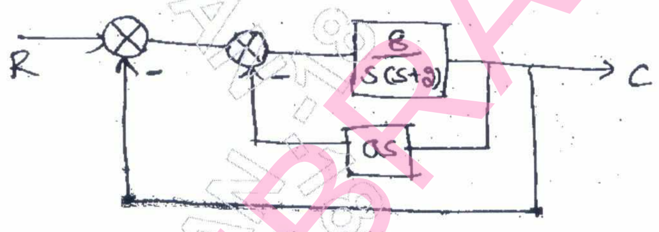

Fig.4Q(b)

Module-3

5 a. State and explain Routh-Hurwitz criterion. **(05 Marks)**

b. List the advantages of Root Locus method. **(05 Marks)**

c. Using RH criterion determine the stability of the system having the characteristic equation : $s^6 + 2s^5 + 5s^4 + 8s^3 + 8s^2 + 8s + 4 = 0$. **(06 Marks)**

OR

6 a. By applying Routh criterion, discuss the stability of the closed loop system as a function of K for the following open loop transfer function :

$$G(s)H(s) = \frac{K(s+1)}{s(s-1)(s^2+4s+16)}.$$ **(06 Marks)**

b. The open loop transfer function of a control system is given by $G(s) = \dfrac{k}{s(s+2)(s^2+6s+2s)}$.

Sketch the complete root locus as k is varied from zero to infinity. **(10 Marks)**

Module-4

7 a. The open loop transfer function of a system is $G(s) = \dfrac{K}{s(1+0.5s)(1+0.2s)}$ using Bode plot.

Find K so that : i) Gain margin is 6dB ii) Phase margin is 25°. **(12 Marks)**

b. What is Nyquist plot? State the Nyquist stability criterion. **(04 Marks)**

OR

8 a. The open loop transfer function of a control system is $G(s)H(s) = \frac{1}{s^2(s+2)}$. Sketch the Nyquist plot, path and ascertain the stability. **(10 Marks)**

b. Write a note on lead compensator. **(06 Marks)**

Module-5

9 a. What is signal reconstruction? Explain it with sample and hold circuit. **(08 Marks)**

b. Consider the circuit of Fig.Q9(b). Identify suitable state variables and write its state vector matrix equation. Note that there are two inputs. **(08 Marks)**

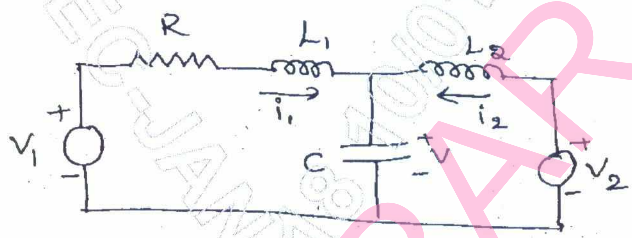

Fig.Q9(b)

OR

10 a. List the properties of state transition matrix. **(06 Marks)**

b. A single input single output system has the state and output equations :

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -6 & -5 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} r$$

$$y = [5 \quad 0]x$$

i) Determine its transfer function

ii) Find its state transition matrix. **(08 Marks)**

c. What is sampled data control system? **(02 Marks)**

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CBCS Scheme

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

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Signals and 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. Find odd and even components of the following signals.
i) $x(t) = 1 + t\cos t + t^2 \sin t + t^3 \cos^2 t \sin t$
ii) $x(t) = 1 + t^2 \cos^2 t + t^3 \sin^3 t + t^4 \cos t$. **(08 Marks)**

b. For the signal x(t) shown in Fig.Q1(b) find and plot.
i) $x(-2t-4)$ ii) $x(-3t+2)$ iii) $x(2(-t-1))$. **(08 Marks)**

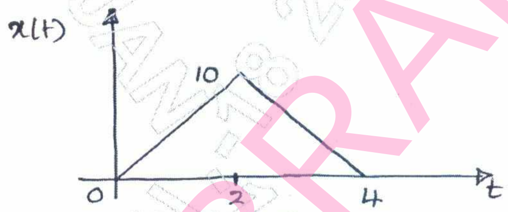

Fig.Q1(b)

OR

2 a. Determine whether the system described by the following input/output relationship is memoryless, causal, time – invariant or linear.

i) $y(n) = e^{x(n)}$ ii) $y(t) = \frac{1}{C}\int_{-\infty}^{t} x(\tau)d\tau$. **(08 Marks)**

b. Given the signal $x(n) = (8-n)[u(n) - u(n-8)]$. Find and sketch
i) $y_1(n) = x[4-n]$ ii) $y_2(n) = x[2n-3]$. **(08 Marks)**

Module-2

3 a. Find the convolution integral of $x_1(t) = e^{-2t}u(t)$ and $x_2(t) = u(t+2)$. **(08 Marks)**

b. Find $y(n) = \beta^n u(n) * \alpha^n u(n)$. Given : $|\beta| < 1$ and $|\alpha| < 1$. **(04 Marks)**

c. Find $y(n) = x_1(n) * x_2(n)$

Where $x_1(n) = \{\underset{\uparrow}{1}, 2, 3\}$ and

$x_2(n) = \{1, 2, \underset{\uparrow}{3}, 4\}$. **(04 Marks)**

OR

4 a. Convolute the two continuous time signals $x_1(t)$ and $x_2(t)$ given below :
$x_1(t) = \cos\pi t[u(t+1) - u(t-3)]$ and $x_2(t) = u(t)$. **(08 Marks)**

b. Evaluate $y(n) = \beta^n u(n) * u(n-3)$ given: $|\beta| < 1$. **(04 Marks)**

c. Show that : i) $x(n) * \delta(n) = x(n)$ ii) $x(n) * \delta(n-n_0) = x(n-n_0)$. **(04 Marks)**

Module-3

5 a. Check the following systems for memory less, causality and stability :
i) $h(n) = (-0.25)^{|n|}$ ii) $h(t) = e^{2t}\,u(t-1)$. **(06 Marks)**

b. Find the step response of an LTI system whose impulse response is defined by $h(n) = \frac{1}{3}\sum_{k=0}^{2} \delta(n-k)$. **(04 Marks)**

c. Evaluate the DTFS representation for the signal $x(n) = \sin\left(\frac{4\pi}{21}n\right) + \cos\left(\frac{10\pi}{21}n\right) + 1$. Also draw its magnitude and phase spectra. **(06 Marks)**

OR

6 a. Find the step response of an LTI system whose impulse response is given by
i) $h(t) = e^{-|t|}$ ii) $h(t) = t^2 u(t)$. **(06 Marks)**

b. State any six properties of DTFS. **(06 Marks)**

c. Determine DTFS of the signal $x(n) = \cos\left(\frac{\pi}{3}n\right)$. Also draw its spectra. **(04 Marks)**

Module-4

7 a. Obtain the Fourier transform of the signal $x(t) = e^{-at}u(t);\ a > 0$. Also draw its magnitude and phase spectra. **(06 Marks)**

b. Find the DTFT of the signal $x(n) = \alpha^n u(n);\ |\alpha| < 1$. Also draw its magnitude spectra. **(04 Marks)**

c. Find the FT representation for the periodic signal $x(t) = \cos \omega_0 t$ and also draw its spectrum. **(06 Marks)**

OR

8 a. Find the FT of the signignum function $x(t) = s_g n(t)$. Draw the magnitude and phase spectra. **(06 Marks)**

b. Find the DTFT of $\delta(n)$ and draw the spectrum. **(04 Marks)**

c. Find the FT of the periodic impulse train $\delta_{T_0}(t) = \sum_{k=-\infty}^{\infty} \delta(t - kT_0)$ and draw the spectrum. **(06 Marks)**

Module-5

9 a. Find Z.T of the following sequences and als sketch their RoC :
i) $x(n) = \sin\Omega_0 n\, u(n)$ ii) $x(n) = (\frac{1}{2})^n u(n) + (-2)^n u(-n-1)$. **(08 Marks)**

b. Find IZT of the following sequence $x(z) = \dfrac{\left(\frac{1}{4}\right)z^{-1}}{\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)}$ with RoC $\frac{1}{4} < |z| < \frac{1}{2}$. **(08 Marks)**

OR

10 a. State and prove the following properties of ZT
i) Time reversal property ii) differentiation property. **(08 Marks)**

b. Find IZT of the following sequence using partial fraction expansion method :

$$x(z) = \frac{z\left[2z - \frac{3}{2}\right]}{z^2 - \frac{3}{2}z + \frac{1}{2}}$$

Given : i) RoC : $|z| < \frac{1}{2}$; ii) RoC : $|z| > 1$; iii) RoC : $\frac{1}{2} < |z| < 1$. **(08 Marks)**

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CBCS Scheme

USN

15EC45

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Principles of Communication System

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain in detail the working of switching modulator with suitable block diagram and necessary derivations. **(07 Marks)**

b. An audio frequency signal 5cos (2π 1000t) is used to amplitude modulate a carrier of 100 cos ($2\pi\ 10^6$t). If modulation index is 0.4, find i) Sideband frequencies ii) Amplitude of each sideband iii) Bandwidth required iv) Total power delivered to a load of 100Ω. **(04 Marks)**

c. Explain the generation of DSB – SC – modulated waves using ring modulator. **(05 Marks)**

OR

2 a. Give the comparison of various amplitude modulation techniques. **(05 Marks)**

b. With relevant block diagram, explain the working of FDM system. **(06 Marks)**

c. Consider a two stage product modulator with a band pass filter after each product modulator as shown in fig. Q2(c). The filter characteristics is such that its pass band is exactly the same as the upper sideband of the preceding product modulators output. The input signal consists of a voice signal occupying the frequency band of 0.3 to 3.4 KHz. The two oscillator frequencies have values f_1 = 100KHz and f_2 = 10MHz. Specify the following : **(05 Marks)**

i) Output of two product modulator, mentioning the frequency values.

ii) Output of two bandpass filters, mentioning the frequency values.

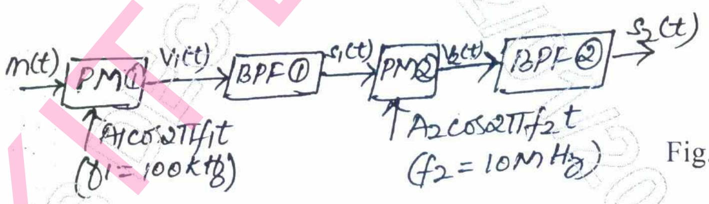

Fig.Q2(c)

Module-2

3 a. Explain the important properties of angle modulated waves. **(05 Marks)**

b. Explain the generation of wideband frequency modulated wave by direct method. **(07 Marks)**

c. A FM wave is represented by the following equation :

s(t) = 10 sin [5×10^8t + 4sin 1250t]. find i) Carrier frequency ii) Modulation index and frequency deviation iii) Power dissipated by this FM wave across a 5Ω resistor. **(04 Marks)**

OR

4 a. With the help of block diagram, explain the working of FM stereo multiplexing. **(06 Marks)**

b. Explain the non linear model of PLL, with relevant block diagram and derivations. **(05 Marks)**

c. Explain the working of super heterodyne receiver. **(05 Marks)**

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

Module-3

5 a. Explain the following terms and find the relation between them : (06 Marks)
i) Joint probability of events A & B ii) Conditional probability of events A & B.
b. Define Autocorrelation function. Explain its important properties. (06 Marks)
c. Describe Mean and Covariance function with respect to stationary random process. (04 Marks)

OR

6 a. Define Shot noise, White noise and Thermal noise. (06 Marks)
b. Define Noise equivalent bandwidth and derive the expression for the same. (06 Marks)
c. Suppose amplifier 1 has a noise figure of 9dB and power gain of 15dB. It is connected in cascade to the other amplifier 2 with noise figure of 20dB. Calculate the overall noise figure for this cascade connection in decibel units. (04 Marks)

Module-4

7 a. Discuss the noise in DSBSC receiver with a model receiver using coherent detection. Prove that the figure of merit for such a receiver is unity. (08 Marks)
b. An AM receiver operating with a sinusoidal wave and 80% modulation has an output signal to noise ratio of 30dB. Calculate the corresponding carrier to noise ratio. Prove the formula used. (08 Marks)

OR

8 a. Explain about the FM threshold effect and its reduction method. (06 Marks)
b. Why pre – emphasis and de – emphasis are required? Explain how they are implemented. (06 Marks)
c. An FM signal with Δf = 75KHz is applied to and FM demodulator. When channel SNR is 15dB, fm is 10KHz. Find output SNR at demodulator. (04 Marks)

Module-5

9 a. What are the advantages of digital signals over analog signals? (04 Marks)
b. State and prove sampling theorem for band limited signals. (06 Marks)
c. Explain the working of TDM system with necessary block diagram. (06 Marks)

OR

10 a. Explain the generation and reconstruction of a PCM signal. (08 Marks)
b. What is Quantization noise? Derive the output signal to ratio of a uniform quantizer. (08 Marks)

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CBCS Scheme

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

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define following terms with respect to opamp and mention the typical values of opamp 741: (i) PSRR, (ii) CMRR, (iii) Slew rate, (iv) input voltage range and output voltage range. **(08 Marks)**

b. Compare emitter follower with voltage follower. **(04 Marks)**

c. A voltage follower using 741 opamp is connected to signal source with resistance of R_s = 47 KΩ. Calculate suitable value of resistor R_i and also maximum voltage drop across each resistor and maximum input offset voltage produced by input offset current.

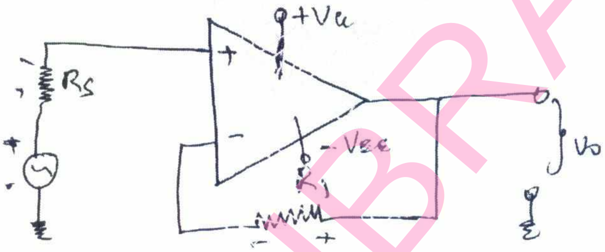

Fig.Q1(c) **(04 Marks)**

OR

2 a. Derive output voltage equation of 3 input non inverting summing circuit and show how it can be converted into averaging circuit. **(08 Marks)**

b. An operational amplifier circuit with closed loop gain is 100 and common mode output voltage is 5 mV and common mode input is 5 mV, determine common mode rejection ratio. **(02 Marks)**

c. Explain the operation of a basic op-amp circuit. **(06 Marks)**

Module-2

3 a. Explain capacitor coupled voltage follower circuit. **(08 Marks)**

b. Design a precision voltage source to provide an output of 9 V the available supply is ±12V allow approximately ±10% tolerance on Zener diode voltage. **(08 Marks)**

OR

4 a. Design an instrumentation amplifier to have an overall gain of 900. The input signal amplitude of 15 mV, 741 opamp is to be used. Supply is ±15V. **(08 Marks)**

b. Explain high Zin capacitor coupled non inverting amplifier with design steps. **(08 Marks)**

Module-3

5 a. Explain precision clipping circuit. **(08 Marks)**

b. Explain log amplifier and derive its output voltage equation. **(08 Marks)**

OR

6 a. Using 741 opamp with supply voltage of ±12V design Schmitt trigger to have trigger points ±2V. **(06 Marks)**

b. Explain sample and hold circuit using of opamp. **(10 Marks)**

Module-4

7 a. Explain second order active low pass filter and also write design equations. **(08 Marks)**

b. Explain the function diagram of 723 general purpose regulator IC. **(08 Marks)**

OR

8 a. Design a second order active high pass filter using 741 opamp with cutoff frequency of 12 kHz. **(06 Marks)**

b. What is meant by line regulation and load regulator with respect to IC regulators and mention the characteristics of 3 terminal IC voltage regulators. **(06 Marks)**

c. Design a first order active low pass filter to have cutoff frequency of 1 kHz. Use 741 opamp. **(04 Marks)**

Module-5

9 a. Explain the operation of a Astable multivibrater using 555 timer. **(08 Marks)**

b. Explain operation of PLL with block diagram. **(08 Marks)**

OR

10 a. Explain the operation of a VCO. **(08 Marks)**

b. Explain analog to digital conversion using successive approximation method. **(08 Marks)**

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CBCS Scheme

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15MATDIP41

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.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 $A = \begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$ by applying elimentary row transformations. **(06 Marks)**

b. Solve the following system of equations by Gauss-elimination method: $x+y+z=9$, $x-2y+3z=8$ and $2x+y-z=3$. **(05 Marks)**

c. Find the inverse of the matrix $\begin{bmatrix} 5 & -2 \\ 3 & 1 \end{bmatrix}$ using Cayley-Hamilton theorem. **(05 Marks)**

OR

2 a. Find the rank of the matrix $\begin{bmatrix} 1 & 3 & -1 & 2 \\ 0 & 11 & -5 & 3 \\ 2 & -5 & 3 & 1 \\ 4 & 1 & 1 & 5 \end{bmatrix}$ by reducing it to echelon form. **(06 Marks)**

b. Solve the following system of equations by Gauss-elimination method: $x+y+z=9$, $2x-3y+4z=13$ and $3x+4y+5z=40$. **(05 Marks)**

c. Find the eigen values of $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$. **(05 Marks)**

Module-2

3 a. Solve $(D^4 - 2D^3 + 5D^2 - 8D + 4)y = 0$. **(05 Marks)**

b. Solve $\frac{d^2y}{dx^2} - 4y = \cosh(2x-1) + 3^x$. **(05 Marks)**

c. Solve by the method of variation of parameters $y'' + a^2y = \sec ax$. **(06 Marks)**

OR

4 a. Solve $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 2y = e^x$. **(05 Marks)**

b. Solve $(D^2 + 5D + 6)y = \sin x$. **(05 Marks)**

c. Solve by the method of undetermined coefficients $y'' + 2y' + y = x^2 + 2x$ **(06 Marks)**

Module-3

5 a. Find the Laplace transform of $\cos t.\cos 2t.\cos 3t$. **(06 Marks)**

b. Find the Laplace transform $f(t) = \frac{Kt}{T}$, $0 < t < \pi$, $f(t+T) = f(t)$. **(05 Marks)**

c. Express $f(t) = \begin{cases} \cos t, & 0 < t < \pi \\ \sin t, & t > \pi \end{cases}$ in terms of unit step function, and hence find $L[f(t)]$. **(05 Marks)**

OR

6 a. Find the Laplace transform of (i) $t\cos at$, (ii) $\dfrac{1-e^{-at}}{t}$. **(06 Marks)**

b. Find the Laplace transform of a periodic function a period 2a, given that
$f(t) = \begin{cases} t, & 0 \le t < a \\ 2a - t, & a \le t < 2a \end{cases}$ $f(t+2a) = f(t)$. **(05 Marks)**

c. Express $f(t) = \begin{cases} 1, & 0 < t < 1 \\ t, & 1 < t \le 2 \\ t^2, & t > 2 \end{cases}$ in terms of unit step function and hence find its Laplace transform. **(05 Marks)**

Module-4

7 a. Find the inverse Laplace transform of (i) $\dfrac{(s+2)^3}{s^6}$, (ii) $\dfrac{s+5}{s^2 - 6s + 13}$. **(06 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 transforms $\dfrac{d^2y}{dt^2} + k^2 y = 0$, given that y(0) = 2, y′(0) = 0. **(05 Marks)**

OR

8 a. Find the inverse Laplace transform of $\dfrac{4s+5}{(s+1)^2(s+2)}$. **(06 Marks)**

b. Find the inverse Laplace transform of $\cot^{-1}\left(\dfrac{s+a}{b}\right)$. **(05 Marks)**

c. Using Laplace transforms solve the differential equation $y'' + 4y' + 3y = e^{-t}$ with y(0) = 1, y′(0) = 1. **(05 Marks)**

Module-5

9 a. If A and B are any two events of S, which are not mutually exclusive then $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. **(05 Marks)**

b. The probability that 3 students A, B, C, solve a problem are ½, ⅓, ¼ respectively. If the problem is simultaneously assigned to all of them, what is the probability that the problem is solved? **(05 Marks)**

c. In a class 70% are boys and 30% are girls. 5% of boys, 3% of girls are irregular to the classes. What is the probability of a student selected at random is irregular to the classes and what is the probability that the irregular student is a girl? **(06 Marks)**

OR

10 a. If A and B are independent events then prove that $\overline{A}$ and $\overline{B}$ are also independent events. **(05 Marks)**

b. State and prove Baye's theorem. **(05 Marks)**

c. A Shooter can hit a target in 3 out of 4 shots and another shooter can hit the target in 2 out or 3 shoots. Find the probability that the target is being hit:
(i) when both of them try (ii) by only one shooter. **(06 Marks)**

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