CBCS SCHEME

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17MAT41

Fourth Semester B.E. Degree Examination, July/August 2021
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Use Taylor's series method to find $y(1.5)$ from $y' = xy^{\frac{1}{3}}$, $y(1) = 1$, consider upto third order derivative term. **(06 Marks)**

b. Find $y(0.2)$ by using modified Euler's method given that $y' = x + |\sqrt{y}|$, $y(0) = 1$. Take $h = 0.2$ and carry out two modifications at each step. **(07 Marks)**

c. If $5xy' + y^2 = 2$, $y(4) = 1$, $y(4.1) = 1.0049$, $y(4.2) = 1.0097$, $y(4.3) = 1.0143$ then find $y(4.4)$ by using Milne's method. **(07 Marks)**

2 a. Use Taylor's series method to find $y(1.02)$ from $y' = xy - 1$, $y(1) = 2$ consider upto fourth order derivative term. **(06 Marks)**

b. Use Runge-Kutta method to find $y(0.2)$ from $y' = \frac{y^2 - x^2}{y^2 + x^2}$, $y(0) = 1$ taking $h = 0.2$. **(07 Marks)**

c. Use Adam Bashforth method to find $y(0.4)$ from $y' = x + y^2$, $y(0) = 1$, $y(0.1) = 1.1$, $y(0.2) = 1.231$, $y(0.3) = 1.402$ **(07 Marks)**

3 a. Express $2x^3 - x^2 - 3x + 2$ in terms of Legendre polynomials. **(06 Marks)**

b. Find $y(0.1)$ by using Runge-Kutta method given that $y'' = x^3(y + y')$, $y(0) = 1$, $y'(0) = 0.5$ taking step length $h = 0.1$. **(07 Marks)**

c. If α and β are the roots of $J_n(\alpha) = 0$ then show that $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$ if $\alpha \neq \beta$. **(07 Marks)**

4 a. Prove that $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}}\cos x$. **(06 Marks)**

b. Find $y(0.4)$ by using Milne's method given $y'' + y' = 2e^x$, $y(0) = 2$, $y'(0) = 0$, $y(0.1) = 2.01$, $y'(0.1) = 0.2$, $y(0.2) = 2.04$, $y'(0.2) = 0.4$, $y(0.3) = 2.09$, $y'(0.3) = 0.6$. **(07 Marks)**

c. State and prove Rodrigue's formula. **(07 Marks)**

5 a. Derive Cauchy-Riemann equation in Cartesian form. **(06 Marks)**

b. Find the analytic function $f(z) = u + iv$ in terms of z given that $U = \frac{2\sin 2x}{e^{2y} + e^{-2y} - 2\cos 2x}$. **(07 Marks)**

c. Evaluate $\int_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2(z-2)}$ where C is the circle $|z| = 3$. **(07 Marks)**

6 a. If $f(z)$ is analytic function then prove that, $\left[\frac{\partial|f(z)|}{\partial x}\right]^2 + \left[\frac{\partial|f(z)|}{\partial y}\right]^2 = |f'(z)|^2$. **(06 Marks)**

b. Discuss the transformation $W = e^z$. **(07 Marks)**

c. Find the bilinear transformation that maps the points $z = -1, i, 1$ onto the points $W = 1, i, -1$. Also find the invariant points. **(07 Marks)**

7 a. Find the value of K such that the following distribution represents a finite probability distribution. Hence find its mean and standard deviation. Also find

(i) $P(x \leq 1)$ (ii) $P(x > 1)$ (iii) $P(-1 < x \leq 2)$

x	−3	−2	−1	0	1	2	3
P(x)	K	2K	3K	4K	3K	2K	K

(06 Marks)

b. The marks of 1000 students in an examination follows a normal distribution with mean 70 and standard deviation 5. Find the number of students where marks will be

(i) Less than 65 (ii) More than 75 (iii) Between 65 and 75 (A(1) = 0.3413)

(07 Marks)

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

X \ Y	−2	−1	4	6
1	0.1	0.2	0	0.3
2	0.2	0.1	0.1	0

Find : (i) E(X)E(Y) (ii) E(XY)

(iii) Covariance of (XY) (iv) Correlation of X and Y. **(07 Marks)**

8 a. Derive mean and variance of the exponential distribution. **(06 Marks)**

b. The joint probability distribution for two random variables X and Y as follows: **(07 Marks)**

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

Find (i) E(X) and E(Y)

(ii) E(XY)

(iii) Covariance (X, Y)

(iv) Correlation of X and Y.

c. In a certain factory turning out razor blades there is a small chance of 0.002 for any blade to the defective. The blades are supplied in packets of 10. Using Poisson distribution find the approximate number of packets containing (i) No defective blade (ii) One defecting blade (iii) Two defective blades in a consignment of 10000 packets. **(07 Marks)**

9 a. A coin was tossed 400 times and the head turned up 216 times. Test the hypothesis that the coin is unbiased at 5% level of significance. **(06 Marks)**

b. A certain stimulus administered to each of 12 patients resulted in the following increases of blood pressure 5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4, 6. Can it be concluded that the stimulus will in general be accompanied by an increase in blood pressure. $(t(11)_{00.05} = 2.2)$ **(07 Marks)**

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

$$\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1/2 & 1/2 & 0 \end{bmatrix}.$$

(07 Marks)

10 a. Define the terms : (i) Null hypothesis (ii) Type – I and Type II error.

(iii) Tests of significance. **(06 Marks)**

b. In experiments on pea breeding the following frequencies of seeds were obtained:

Round and Yellow	Wrinkled and Yellow	Round and Green	Wrinkled and Green	Total
315	101	108	32	556

Theory Predicts that the frequencies should be in proportions 9:3:3:1. Examine the correspondence between theory and experiment $\left(\psi^2_{0.05} = 7.815\right)$. **(07 Marks)**

c. A students study habits are as follows. If he studies one night, he is 30% sure 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 as well. Find the transition matrix for the chain of his study. In the long run how often does he study? **(07 Marks)**

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CBCS SCHEME

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17EC42

Fourth Semester B.E. Degree Examination, July/August 2021
Signals and Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Distinguish between :
i) Periodic and non-periodic signals
ii) Even and odd signals. **(04 Marks)**

b. Determine whether the following systems are linear, causal, dynamic, time-variants and stable. i) $y(n) = 3x(n-1)$ ii) $y(t) = x(t^2)$. **(08 Marks)**

c. Given the signal x(t) as shown, sketch the following : i) $x(-2t+3)$ ii) $x(t/2-2)$.

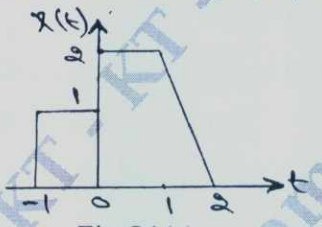

Fig.Q1(c) **(08 Marks)**

2 a. Check whether the following signals are periodic or not. If periodic, determine their fundamental period. i) $x(t) = \cos 2t + \sin 3t$ ii) $x(n) = \cos\left(\frac{\pi n}{5}\right)\sin\left(\frac{\pi n}{3}\right)$. **(06 Marks)**

b. Sketch the even and odd parts of the following signal, $x(t) = u(t+2) + u(t) - 2u(t-1)$. **(08 Marks)**

c. Express : x(t) interms of g(t), if x(t) and g(t) are as shown in Fig.Q2(c).

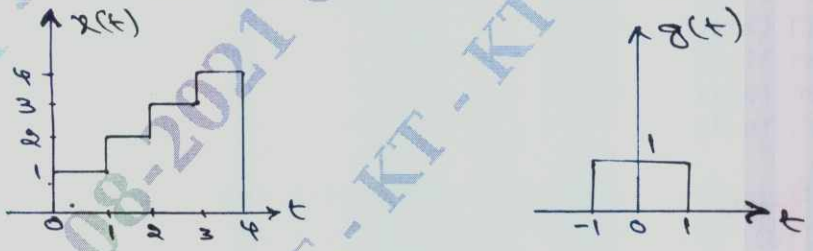

Fig.Q2(c) **(06 Marks)**

3 a. Prove the following :
i) $x(t) * \delta(t-t_0) = x(t-t_0)$
ii) $x(n) * h(n) = h(n) * x(n)$. **(04 Marks)**

b. Compute the convolution integral of $x(t) = e^{-3t}[u(t) - u(t-2)]$ and $h(t) = e^{-t}u(t)$. **(08 Marks)**

c. Evaluate $y(t) = x(t) * h(t)$. x(t) and h(t) are shown in Fig.Q3(c).

Fig.Q3(c) **(08 Marks)**

4 a. Evaluate $y(n) = x(n) * h(n)$. If $x(n)$ and $h(n)$ are given as :
$x(n) = \{2, \underset{\uparrow}{4}, -2, 1, 7\}$ and $h(n) = \{2, 3, \underset{\uparrow}{1}, 4\}$. **(05 Marks)**

b. Compute the convolution sum of $x(n) = a^n u(n)$ and $h(n) = b^n u(n)$. **(07 Marks)**
i) when $a > b$ ii) when $a < b$ iii) when $a = b$.

c. Determine the response of an LTI system with input $x(n) = (1/3)^n u(n)$ and impulse response $h(n) = u(n) - u(n-5)$. **(08 Marks)**

5 a. Calculate the step response of the LTI systems represented by following impulse responses.
i) $h(n) = (1/2)^n u(n-3)$ ii) $h(t) = \begin{cases} 1, & -2 \le t \le 0 \\ 0, & \text{elsewhere} \end{cases}$. **(06 Marks)**

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

c. Determine the DTFS coefficients of $x(n) = \sin\left(\frac{4\pi n}{21}\right) + \cos\left(\frac{10\pi n}{21}\right) + 1$. Also sketch its magnitude and phase spectrum. **(08 Marks)**

6 a. Check the following LTI system for memoryless, causality and stability :
i) $h(t) = e^{t}u(-1,-t)$ ii) $h(n) = \{\underset{\uparrow}{2}, 3, -1, 4\}$. **(06 Marks)**

b. Determine the Fourier series coefficients of the signal shown in Fig.6(b) and also plot $|X \times (k)|$ and $< X(k)$.

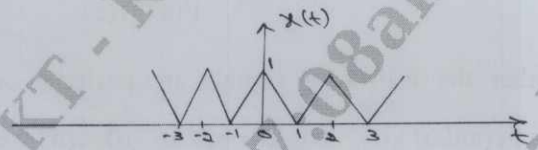

Fig.Q6(b) **(08 Marks)**

c. State the following properties DTFS :
i) Time shifting
ii) Frequency shifting
iii) Convolution
iv) Modulation
v) Parseval's theorem
vi) Duality. **(06 Marks)**

7 a. Determine the Fourier transforms of the following :
i) $x(t) = e^{at}u(-t)$ ii) $x(t) = e^{-a|t|}$, $a > 0$. **(08 Marks)**

b. State and prove the following properties of DTFT :
i) Convolution in time ii) Parseval's theorem. **(06 Marks)**

c. Determine the Nyquist sampling rate and Nyquist sampling interval for the following signals:
i) $x(t) = \frac{1}{2\pi}[\cos(4000\pi t)\cos(1000\pi t)]$ ii) $y(t) = \sin C^2(200t)$. **(06 Marks)**

8 a. State and prove the following properties of CTFT :
i) Time shifting ii) Frequency differentiation. **(08 Marks)**

b. Determine the DTFTs of the following :
i) $x(n) = (1/2)^n u(n-4)$ ii) $x(n) = -a^n u(-n-1)$. **(08 Marks)**

c. State the sampling theorem and briefly explain how to practically reconstruct the signal. **(04 Marks)**

9 a. Define region of convergence. Mention its properties. (04 Marks)

b. Using appropriate properties, find the z – transforms of the following signals :

i) $x(n) = n(n + 1)\, u(n)$ ii) $x(n) = n(1/3)^{n+3}\, u(n + 3)$. (08 Marks)

c. Evaluate the inverse Z – transform of the following for all possible ROCs.

$$X(z) = \frac{z(z^2 - 4z + 5)}{(z-3)(z^2 - 3z + 2)}.$$ (08 Marks)

10 a. State and prove the following properties of Z-transform :

i) Time Reversal ii) Scaling in Z–domain. (06 Marks)

b. Find the Z–transform of $x(n) = 2^n u(n) + 3^n u(-n - 1)$ and draw its pole – zero plot. (04 Marks)

c. Compute the response of the system : $y(n) = 0.7y(n - 1) - 0.12y(n - 2) + x(n - 1) + x(n - 2)$ to the input $x(n) = n\, u(n)$. Also check whether the system is stable. (10 Marks)

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17EC43

Fourth Semester B.E. Degree Examination, July/August 2021
Control Systems

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Write the difference between open loop and closed loop control system. **(04 Marks)**

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

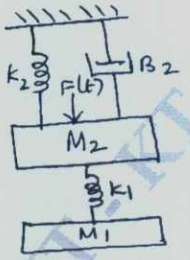

Fig. Q1 (b)

c. Obtain the overall transfer function of the block diagram, shown in Fig. Q1 (c) by block diagram reduction technique. **(08 Marks)**

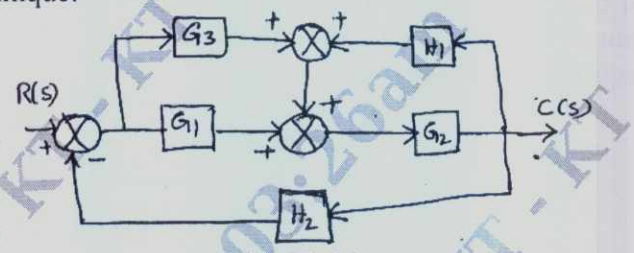

Fig. Q1 (c)

2 a. For the rotational system shown in Fig. Q2 (a), draw the torque voltage analogous circuit. **(08 Marks)**

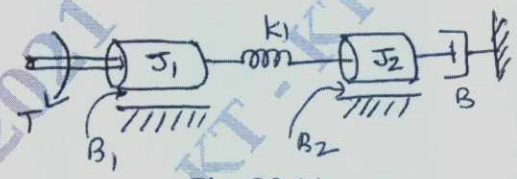

Fig. Q2 (a)

b. Explain Mason's gain formula for determining the transfer function from signal flow graph. **(04 Marks)**

c. For the system described by the signal flow graph shown in Fig. Q2 (c), obtain the closed loop transfer function $\frac{C(s)}{R(s)}$ using Mason's Gain formula. **(08 Marks)**

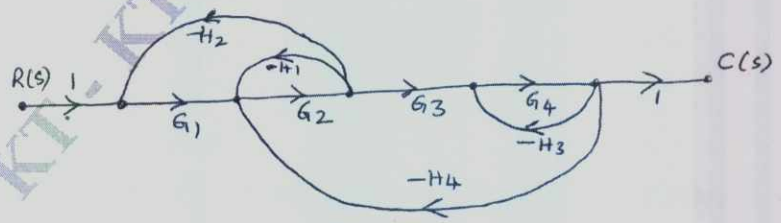

Fig. Q2 (c)

3 a. Derive an expression for rise time in a second order underdamped system subjected to unit step input. **(04 Marks)**

b. The transfer function of a second order system subjected to a unit step input, given by

$$\frac{C(s)}{R(s)} = \frac{16}{s^2 + 2s + 16}$$

Calculate the rise time, peak time, peak overshoot and settling time. **(08 Marks)**

c. For a negative unity feed back control system with $G(s) = \frac{100}{s^2(s+4)(s+12)}$. Determine

(i) Type of the system (ii) Error co-efficients (iii) Steady state error when the input $r(t) = 2t^2 + 5t + 10$ **(08 Marks)**

4 a. With general block diagram, explain PD controller and PI controller. **(06 Marks)**

b. In PD controller system shown in Fig. Q4 (b), determine the value of T_d, so that the system will be critically damped, calculate its settling time. **(06 Marks)**

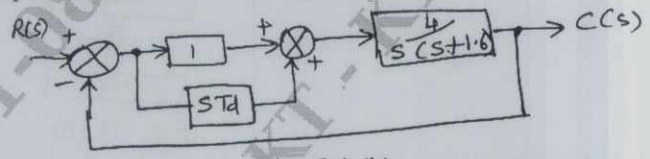

Fig. Q4 (b)

c. For the system shown in Fig. Q4 (c), obtain the closed loop transfer function, damping ratio, natural frequence, damping frequency and the expression for the output response if subjected to unit step input. **(08 Marks)**

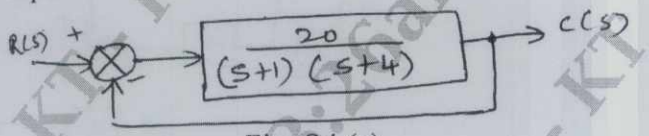

Fig. Q4 (c)

5 a. Investigate the stability of a closed loop system whose characteristic equation is given by,

$s^5 + s^4 + 2s^3 + 3s + 5 = 0$

using R–H criteria. **(06 Marks)**

b. The open loop transfer function of a unity feedback system is given by, $G(s) = \frac{K}{s(s+3)(s^2+s+1)}$, using RH criteria find the value of 'K' that will cause sustained oscillation, hence find the oscillation frequency. **(06 Marks)**

c. Consider the characteristic equation,

$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$, using RH criteria investigate the stability of the system. **(08 Marks)**

6 a. Determine the value of 'K' and 'a' so that the system shown in Fig. Q6 (a) oscillates with frequency of 2 rad/sec. **(06 Marks)**

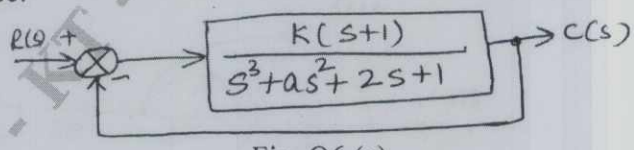

Fig. Q6 (a)

b. Sketch the Root locus for a unity feedback system with $G(s) = \frac{K}{s(s^2+8s+17)}$. From root locus determine the value of K for a damping factor of 0.5. **(14 Marks)**

7 a. Construct the Bode plot for a unity feedback control system having $G(s) = \frac{K}{s(1+s)(1+0.1s)}$, find the (i) Value of K for a gain margin of 10 dB. (ii) Value of K to give a phase margin of 24°. **(12 Marks)**

b. Find the transfer function of the system whose Bode plot is given in Fig. Q7 (b). **(08 Marks)**

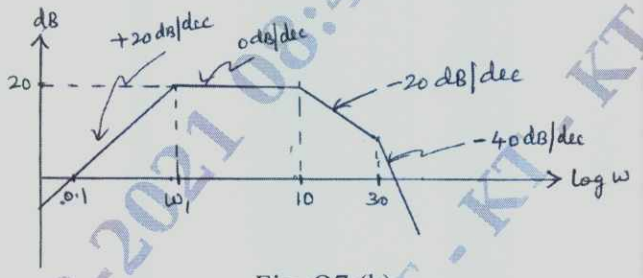

Fig. Q7 (b)

8 a. Plot the polar plot for the open loop transfer function, $G(s)H(s) = \frac{1}{1+0.1s}$. **(06 Marks)**

b. A unity feedback system has $G(s) = \frac{10}{s(s+1)(s+2)}$. Draw Nyquist plot and comment on closed loop stability. **(14 Marks)**

9 a. With a block diagram, explain a system with digital controller. **(06 Marks)**

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

c. State the properties of state transition matrix. **(06 Marks)**

10 a. Explain signal reconstruction using sampler and zero order hold. **(06 Marks)**

b. Obtain the state model for the system represented by a differential equation,

$$\frac{d^3y}{dt^3} + 3\frac{d^2y}{dt^2} + 6\frac{dy}{dt} + 7y(t) = 2u(t)$$ **(06 Marks)**

c. For the electrical network shown in Fig. Q10 (c), find the state space representation if the output is the current through the resistor. **(08 Marks)**

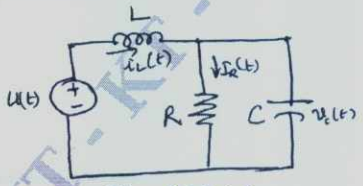

Fig. Q10 (c)

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17EC44

Fourth Semester B.E. Degree Examination, July/August 2021
Principles of Communication Systems

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Explain the operation of the switching modulator with circuit diagram, waveforms and relevant expressions. **(08 Marks)**

b. Explain the operation of the costas receiver for detection of DSB-SC waves. **(06 Marks)**

c. Explain the importance of vestigial sideband modulation in communication system. Describe the frequency domain description with message spectrum and VSB modulated wave spectrum. **(06 Marks)**

2 a. Explain the operation of the envelope detector with circuit diagram, waveforms and relevant mathematical expressions. **(08 Marks)**

b. Explain the principle of operation of the Quadrature-carrier-Multiplexing with block diagram approach. **(06 Marks)**

c. Explain the principle of operation of the frequency-division-multiplexing with suitable block-diagram. **(06 Marks)**

3 a. Explain the narrow band frequency modulation, with block diagram approach. Explain the generation of narrowband FM using DSB-SC modulator. **(07 Marks)**

b. An FM wave with a frequency deviation of 10kHz at a modulation frequency of 5kHz is applied to two frequency doublers connected in cascade. Determine the frequency deviation and the modulation index of the FM wave at the output of second frequency multiplier. What is the frequency of the adjacent side-frequencies of this FM wave? **(05 Marks)**

c. Explain the operation of the superhetero dyne receiver. Mention the function of each block with suitable diagram. **(08 Marks)**

4 a. Explain the Demodulation of FM signals using circuit diagram and relevant graphs (Any one of the method). **(07 Marks)**

b. Briefly explain about FM stereo multiplexing with multiplexer of FM stereo transmitter and Demultiplexer of FM stereo receiver. **(08 Marks)**

c. Derive an expression for linear model of phase locked loop in FM system. **(05 Marks)**

5 a. Explain the conditional probability with mathematical expressions. State and prove Baye's rule. **(07 Marks)**

b. Define and write the expressions for mean, correlation and covariance function. **(07 Marks)**

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

6 a. Briefly explain the noises such as shot noise, thermal noise and white noise. **(09 Marks)**

b. Derive an expression for noise equivalent Bandwidth, with relevant circuit and equations. **(07 Marks)**

c. Briefly explain the Noise factor and noise figure with equations. **(04 Marks)**

7 a. Derive an expression for noise in DSBSC receivers with model and relevant expressions. **(08 Marks)**
b. Find the figure of merit when the depth of modulation is i) 100% ii) 50% iii) 30% **(04 Marks)**
c. Explain the FM threshold effect with phasor diagram, graph and relevant expressions. **(08 Marks)**

8 a. 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 (optional). **(04 Marks)**
b. Explain the FM threshold reduction process with graph representing the extending threshold effect and block diagram of FM feedback demodulator. **(08 Marks)**
c. Explain the significance of Pre-emphasis and De-emphasis in FM system. **(08 Marks)**

9 a. Why we digitize Analog sources? Explain the sampling process with graph showing CT and its DT signal. **(08 Marks)**
b. Explain the pulse width modulation with generation circuit, waveforms. Mention the advantages, disadvantages and applications of PWM. **(08 Marks)**
c. Explain the Digital Multiplexing with diagram. Mention the number of inputs and rates. **(04 Marks)**

10 a. Explain the generation of pulse amplitude modulation with block diagram and waveforms. Mention the importance of flat-top sampling with waveform. **(08 Marks)**
b. For a pulse-amplitude modulation transmission of noise signal with W = 3kHz. Calculate Bandwidth B_T, if f_s = 8kHz and τ = 0.1Ts. **(04 Marks)**
c. Explain the Application to vocoders such as voice model and vocoder with relevant block-diagrams. **(08 Marks)**

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17EC45

Fourth Semester B.E. Degree Examination, July/August 2021
Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions.

1 a. With a neat circuit diagram and relevant equations, explain the basic op-amp circuit. **(07 Marks)**

b. Define the following terms as applied to an op-amp and mention their typical values for IC741: (i) CMRR (ii) Slew rate (iii) PSRR (iv) Input offset voltage **(08 Marks)**

c. Show that $V_{O_{CM}} = \frac{V_{i_{CM}}}{CMRR} \times A_V$ **(05 Marks)**

2 a. Explain the operation of direct coupled non inverting amplifier. Mention the design steps. **(07 Marks)**

b. Explain the working of a three input inverting summer amplifier and show how it can be modified into averaging circuit. **(08 Marks)**

c. For the op-amp circuit shown in Fig.Q2(c), calculate the gain.

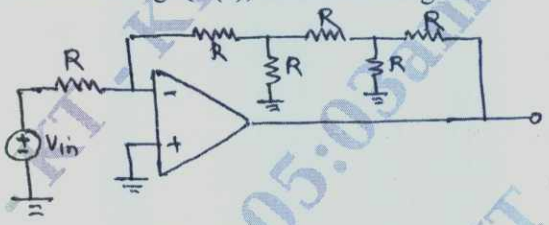

Fig.Q2(c) **(05 Marks)**

3 a. With a neat circuit diagram, explain the operation of high input impedance capacitor coupled non inverting amplifier. **(09 Marks)**

b. A capacitor coupled voltage follower circuit is to be designed to have a lower cut-off frequency of 120 Hz. The load resistance is 8.2 KΩ and the op-amp used has a maximum bias current of 600 nA. Design a suitable circuit. Calculate the new cut-off frequency when the load resistance is changed to 4.7 KΩ. **(06 Marks)**

c. Explain the operation of capacitor coupled inverting amplifier using single polarity supply. **(05 Marks)**

4 a. With a neat circuit diagram, explain the operation of instrumentation amplifier. **(09 Marks)**

b. Design a low resistance voltage source to provide an output of 8V using 741 op-amp with ±15V supply and maximum output current is to be 60 mA. Use a suitable Zener diode. For 741 op-amp $I_{B(max)} = 500$ nA. **(06 Marks)**

c. Explain how a fullwave precision rectifier is implemented using Halfwave rectifier and a summer. **(05 Marks)**

5 a. With a neat circuit diagram, explain the operation of inverting Schmitt trigger circuit. **(08 Marks)**

b. Explain the working of Wien bridge oscillator using op-amp. **(06 Marks)**

c. Design a capacitor coupled Zero Cross Detector (ZCD) using 741 op-amp having $I_{B(max)} = 500$ nA and minimum signal frequency of 500 Hz. the supply voltage are ± 12V. **(06 Marks)**

6 a. Draw an op-amp sample and hold circuit. Sketch the signal, control and output waveforms and explain the operation of the circuit. **(08 Marks)**

b. Explain the operation of logarithmic amplifier using op-amp. **(06 Marks)**

c. Design a RC phase shift oscillator to have an output frequency of 3.5 kHz using 741 op-amp with a supply voltage of ±12V. **(06 Marks)**

7 a. List the advantages and limitations of Active filters. **(06 Marks)**

b. Explain the operation of First order low pass filter using op-amp and mention the design steps. **(08 Marks)**

c. A single stage band pass filter is to be designed using 715 op-amp. The center frequency is to be 3.3 kHz with a passband approximately 50 Hz on each side. Determine the suitable component values. For 715 op-amp choose $I_{B_{(max)}} = 1.5\ \mu A$. **(06 Marks)**

8 a. With a neat circuit diagram, explain the working of voltage follower series regulator. **(06 Marks)**

b. Explain the functional block of 723 general purpose regulator. **(08 Marks)**

c. Design an adjustable regulator using IC7810 regulator to get an output voltage of 15 V and 25 mA. Given Quiscent current = 4.2 mA. **(06 Marks)**

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

b. Explain the working of 3-bit R-2R Ladder types DAC. **(06 Marks)**

c. What output voltage is produced by a DAC whose output range is 0 to 10V and whose input binary is :
(i) 10 (for a 2 bit DAC)
(ii) 0110 (for a 4 bit DAC)
(iii) 10111100 (for a 8 bit DAC) **(06 Marks)**

10 a. With a neat functional diagram, explain the operation of monostable multivibrator using 555 timer and obtain the expression for its pulse width. **(08 Marks)**

b. With a neat block diagram, explain the working of successive approximation type ADC. **(06 Marks)**

c. A 555 timer Astable multivibrator has $R_A = 2.2\ K\Omega$, $R_B = 6.8\ K\Omega$ and $C = 0.01\ \mu F$. Calculate T_{high}, T_{Low}, free running frequency and duty cycle. Draw the circuit. **(06 Marks)**

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CBCS SCHEME

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17EC46

Fourth Semester B.E. Degree Examination, July/August 2021
Microprocessors

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. What advantage does 8086 processor have by having two independent units Bust Interface Units (BIU) and Execution Unit (EU)? **(04 Marks)**

b. With suitable examples, explain various addressing modes of 8086 processor. **(08 Marks)**

c. The machine code of an instruction is 8907H, explain how these two bytes are interpreted? What is the Instruction? Given, Opcode of MOV instruction '100010'. **(08 Marks)**

2 a. Explain the following :
i) Offset address ii) Physical address
iii) Paragraph Boundary iv) Memory relocation. **(04 Marks)**

b. Explain the (MOD – REG – R/M) byte of an 8086 instructions. **(08 Marks)**

c. At a certain instant during the execution of a program the 8086 processor has the following data in the registers AX = 1234H , BX = 5678H , SI = 1200H , DI = ABCDH , CS = AB00H and IP = 789AH , DS = ES = 4567H.
State the addressing modes and find physical addresses of source and destination of data, when each of the following instruction is executed.
i) MOV BX , AX ii) MOV [BX + DI + 120FH] , AB46H
iii) MOV AX, [1200H] iv) LODSW. **(08 Marks)**

3 a. Use appropriate logical instruction which performs :
i) Set higher nibble of AL register ii) Clear AX register
iii) Invert even bits of BX register iv) Clear 5^{th} and 6^{th} bits of CH register. **(04 Marks)**

b. Write an 8086 ALP to transfer a block of data stored at SRC to another memory area DST. The length of the block is specified at location BLK – LEN. **(08 Marks)**

c. Consider the registers of 8086 loaded with the following data :
ES = 1234H , DS = 1224H , DI = 200H , SI = 100H , CX = 10H , DFlag = '1'.
If now, the instruction REP MOVSW is completely executed workout the contents of above defined registers after the execution of the REP MOVSW instruction. **(08 Marks)**

4 a. What are Assembler directives? With examples, explain the data definition directives DB, DW and DD. **(04 Marks)**

b. Write an 8086 ALP to arrange an array of 'N' bytes in ascending order. **(08 Marks)**

c. Explain five string primitives of 8086. Also specify necessary initializations to be done before using the string instructions. **(08 Marks)**

5 a. Distinguish between MACROS and Procedures. **(04 Marks)**

b. Explain working of Interrupt and Trap flags of 8086 processor. Write a procedure to set trap flag and procedure to reset trap flag. **(08 Marks)**

c. With neat schematic, explain generation of NMI interrupt during power failure. **(08 Marks)**

6 a. Explain how the 8086 processor finds the address of interrupt service subroutine for particular interrupt. **(04 Marks)**

b. Explain Interrupt system of 8086 processor. Write the sequence of events takes place when an interrupt occurs. **(08 Marks)**

c. What is meant by Modular Programming? Also write a procedure to generate a delay of 2 msec, for the 8086 operated at 5 MHz. **(08 Marks)**

7 a. Compare memory mapped I/O and I/O mapped I/O interfacing schemes. **(04 Marks)**

b. Why the address demultiplexing is required in 8086 processor? Explain how it is done for minimum mode of operation. **(08 Marks)**

c. What is Wait State? How do you introduce it? Explain with necessary timing diagram with respect to 8086 processor. **(08 Marks)**

8 a. Explain the function of following 8086 pins :
i) $\overline{BHE}$ ii) ALE iii) INTR iv) $DT/\overline{R}$. **(04 Marks)**

b. Sketch memory read bus cycle of 8086 and explain. **(08 Marks)**

c. Explain 8255 modes of operations. **(08 Marks)**

9 a. Write 8255 control word to set PC_5. **(04 Marks)**

b. Interface a stepper motor to 8086 processor using 8255 and write an ALP to it for 180^0 in clock wise direction. **(08 Marks)**

c. Explain Mode - 0 and Mode – 3 operations of 8254. **(08 Marks)**

10 a. Bring out the differences between CICS and RISC processors. **(04 Marks)**

b. Describe any five DOS functions related with INT21H. **(08 Marks)**

c. Using DOS functions write an 8086 ALP to read a two digit hexadecimal number and display the same on the console. **(08 Marks)**

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17MATDIP41

Fourth Semester B.E. Degree Examination, July/August 2021
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions.

1 a. Find the rank of the matrix

$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ -2 & -3 & 1 & 2 \\ -3 & -4 & 3 & 8 \\ 1 & 3 & 10 & 14 \end{bmatrix}$$

by using elementary row operations. **(06 Marks)**

b. Solve the following system of equations by Gauss elimination method:
$x + y + z = 9;\quad x - 2y + 3z = 8;\quad 2x + y - z = 3$ **(07 Marks)**

c. Find the inverse of the matrix $A = \begin{bmatrix} 3 & -2 \\ 2 & -1 \end{bmatrix}$ using Cayley-Hamilton theorem. **(07 Marks)**

2 a. Show that eigen values of matrix $A = \begin{bmatrix} 1 & -6 & -4 \\ 0 & 4 & 2 \\ 0 & -6 & -3 \end{bmatrix}$ are 0, 1, 1 and find eigen vector corresponding to the eigen value '0'. **(06 Marks)**

b. Test the following system for consistency and solve the system if the system is consistent
$x + 2y + 3z = 1,\quad 2x + 3y + 8z = 2,\quad x + y + z = 3.$ **(07 Marks)**

c. Using Cayley-Hamilton theorem, find the inverse of the matrix, $A = \begin{bmatrix} 1 & 1 & 2 \\ 0 & -2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ **(07 Marks)**

3 a. Solve $\frac{d^3y}{dx^3} - 4\frac{d^2y}{dx^2} + 5\frac{dy}{dx} - 2y = 0.$ **(06 Marks)**

b. Solve $(D^2 - 13D + 12)y = e^{2x} + 5e^x$ **(07 Marks)**

c. Solve by using the method of undetermined coefficients: $\frac{d^2y}{dx^2} + y = 2\cos x.$ **(07 Marks)**

4 a. Solve $\frac{d^2x}{dt^2} - 3\frac{dx}{dt} + 2x = 0$ given $x = 0$ and $\frac{dx}{dt} = 1$ when $t = 0.$ **(06 Marks)**

b. Solve $y'' - 4y' + 4y = x^2 + \cos 2x$ **(07 Marks)**

c. Solve by the method of variation of parameters $y'' + y = \operatorname{cosec} x$ **(07 Marks)**

5 a. Find $L\{\sin t . \sin 2t . \sin 3t\}$. **(06 Marks)**

b. Find (i) $L\{e^{-3t}\cos 4t\}$ (ii) $L\left\{\frac{e^{at}-e^{bt}}{t}\right\}$ **(07 Marks)**

c. Find $L\{f(t)\}$ where $f(t)=\begin{cases}3t, & 0<t<2\\ 6, & 2<t<4\end{cases}$, given f(t) is the periodic function with the period 4. **(07 Marks)**

6 a. Find $L\{4+4^t+4\sin^2 t\}$ **(06 Marks)**

b. Find $L\{t^2 e^{3t}\sin t\}$ **(07 Marks)**

c. Express $f(t)=\begin{cases}\sin t, & 0<t<\pi\\ \cos t, & t>\pi\end{cases}$ interms of unit step function and hence find $L\{f(t)\}$. **(07 Marks)**

7 a. Find $L^{-1}\left\{\frac{1}{(s+1)(s+2)(s+3)}\right\}$. **(06 Marks)**

b. Find the inverse Laplace transform of $\log\left(\frac{s+a}{s+b}\right)$ **(07 Marks)**

c. Solve $y''+4y'+3y=0$ given $y(0)=0, y'(0)=1$ using Laplace transform. **(07 Marks)**

8 a. Find $L^{-1}\left\{\frac{s+1}{s^2+6s+9}\right\}$. **(06 Marks)**

b. Find inverse Laplace transform of $\cot^{-1}(s-a)$. **(07 Marks)**

c. Solve $y''+2y'+y=6te^{-1}$ under the conditions $y(0)=0$, $y'(0)=0$ by using Laplace transformation. **(07 Marks)**

9 a. Define conditional probability. Given for the events A and B, $P(A)=\frac{3}{4}$, $P(B)=\frac{1}{5}$ and $P(A\cap B)=\frac{1}{20}$, find $P\left(\frac{A}{B}\right)$, $P\left(\frac{B}{A}\right)$, $P\left(\frac{\overline{A}}{\overline{B}}\right)$, $P\left(\frac{\overline{B}}{\overline{A}}\right)$. **(06 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
(iii) atleast two of them passes. **(07 Marks)**

c. Three machines A, B, C produce 50%, 30% and 20% of the items in a factory. The percentage of defective outputs of these machines are 3, 4 and 5 respectively. If an item is selected at random, what is the probability that is defective? If a selected item is defective, what is the probability that is from machine A? **(07 Marks)**

10 a. State and prove Baye's theorem. **(06 Marks)**

b. A box contains three white balls and two red balls. If two balls are drawn in succession, find the probability that the first removed ball is white and the second is red. **(07 Marks)**

c. If a pair of dice is thrown what is the probability that

(i) the sum of numbers is divisible by 4
(ii) the number on the first is greater than that on the second. **(07 Marks)**

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