CBCS SCHEME

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17MAT41

Fourth Semester B.E. Degree Examination, Jan./Feb.2021
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Using Taylor's series method, compute the solution of $\frac{dy}{dx} = x - y^2$ with $y(0) = 1$ at $x = 0.1$, correct to fourth decimal place. **(06 Marks)**

b. Using modified Euler's formula, solve the $\frac{dy}{dx} = x + |\sqrt{y}|$ with $y(0.2) = 1.23$ at $x = 0.4$ by taking $h = 0.2$. **(07 Marks)**

c. The following table gives the solution of $\frac{dy}{dx} = x^2 + \frac{y}{2}$. Find the value of y at $x = 1.4$ by using Milne's Predictor-Corrector method.

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514

(07 Marks)

OR

2 a. Using modified Euler's method, solve $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with $y(20) = 5$ at $x = 20.2$ by taking $h = 0.2$. **(06 Marks)**

b. Employ the Range-Kutta method of fourth order to solve $\frac{dy}{dx} = 3x + \frac{y}{2}$, with $y(0) = 1$ at $x = 0.1$ by taking $h = 0.1$. **(07 Marks)**

c. Using Adams-Bashforth method, find y when $x = 1.4$ given $\frac{dy}{dx} = x^2(1 + y)$, with $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$, $y(1.3) = 1.979$ **(07 Marks)**

Module-2

3 a. Using Runge-Kutta method of fourth order solve the differential equation, $\frac{d^2y}{dx^2} = x^3\left(y + \frac{dy}{dx}\right)$ for $x = 0.1$. Correct to four decimal places with initial conditions $y(0) = 1$, $y'(0) = 0.5$. **(06 Marks)**

b. Obtain the series solution of Legendre Differential equation leading to Pn(x). **(07 Marks)**

c. With usual notation, show that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}}\sin x$. **(07 Marks)**

OR

4 a. Apply Milne's method to compute y(1.4) given that $2\frac{d^2y}{dx^2} = 4x + \frac{dy}{dx}$ and

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

(06 Marks)

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

c. Express $f(x) = 3x^3 - x^2 + 5x - 2$ in terms of Legendre's polynomials. **(07 Marks)**

Module-3

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

b. If $V = e^{-2y} \sin 2x$, find the analytic function f(z). **(07 Marks)**

c. Find the bilinear transformation that maps the points 0, i, ∞ onto the points 1, $-i$, -1. **(07 Marks)**

OR

6 a. State and prove Cauchy's theorem on complex integration. **(06 Marks)**

b. Evaluate $\oint_C \frac{z^2+5}{(z-2)(z-3)} dz$, where $C : |z| = \frac{5}{2}$. **(07 Marks)**

c. Discuss the transformation $W = Z + \frac{1}{Z}$. **(07 Marks)**

Module-4

7 a. A box contains 100 transistors, 20 of which are defective and 10 are selected at random, find the probability that (i) all are defective (ii) at least one is defective (iii) all are good (iv) at most three are defective. **(06 Marks)**

b. Show that mean and standard deviation of exponential distribution are equal. **(07 Marks)**

c. The joint probability is,

X \ Y	0	1	2	3
0	0	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	0

(i) Find marginal distributions of X and Y.

(ii) Also find E(X), E(Y) and E(XY). **(07 Marks)**

OR

8 a. Find the mean and variance of binomial distribution. **(06 Marks)**

b. In an examination taken by 500 candidates the average and the standard deviation of marks obtained (normally distributed) are 40% and 10%. Find approximately,

(i) How many will pass, if 50% is fixed as a minimum?

(ii) What should be the minimum if 350 candidates are to pass?

(iii) How many have scored marks above 60%? **(07 Marks)**

c. Suppose X and Y are independent random variables with the following distributions:

x_i	1	2
$f(x_i)$	0.7	0.3

y_j	-2	5	8
$g(y_j)$	0.3	0.5	0.2

Find the joint distribution of X and Y. Also find the expectations of X and Y and covariance of X and Y. **(07 Marks)**

Module-5

9 a. The average income of persons was Rs.210 with a standard deviation of Rs.10 in sample of 100 people of a city. For another sample of 150 persons, the average income was Rs.220 with standard deviation of Rs.12. The standard deviation of the incomes of the people of the city was Rs.11. Test whether there is any significant difference between the average incomes of the localities. (Use $Z_{0.05} = 1.96$) **(06 Marks)**

b. 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). **(07 Marks)**

c. Define stochastic matrix. Find a unique fixed probability vector for the matrix $\begin{bmatrix} 0 & 1 & 0 \\ \frac{1}{6} & \frac{1}{2} & \frac{1}{3} \\ 0 & \frac{2}{3} & \frac{1}{3} \end{bmatrix}$. **(07 Marks)**

OR

10 a. Explain the following terms:
(i) Type I and Type II errors.
(ii) Null hypothesis.
(iii) Level of significance.
(iv) Confidence limits. **(06 Marks)**

b. Eleven school boys were given a test in mathematics carrying a maximum of 25 marks. They were given a month's extra coaching and a second test of equal difficulty was held thereafter. The following table gives the marks in two tests.

Boy	1	2	3	4	5	6	7	8	9	10	11
Marks (I test)	23	20	21	18	18	20	18	17	23	16	19
Marks (II test)	24	19	18	20	20	22	20	20	23	20	17

Do the marks give evidence that the students have benefitted by extra coaching? (Given $t_{0.05} = 2.228$ for 10 d.f) **(07 Marks)**

c. Three boys A, B and C are throwing ball to each other. A always throws the ball to B and B always throws the ball to C. C is just as likely to throw the ball to B as to A. If C was the first person to throw the ball, find the probabilities that after three throws (i) A has the ball, (ii) B has the ball, (iii) C has the ball. **(07 Marks)**

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17EC42

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Signals and Systems

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define a signal. List the elementary signals. Differentiate between even and odd signals, energy and power signals. **(08 Marks)**

b. Sketch the signal $x(t) = r(t+1) - r(t) + r(t-1)$. **(04 Marks)**

c. Check whether the following signals are periodic or not. If periodic, determine the fundamental period:

i) $x(n) = \cos\left(\frac{\pi n}{2}\right) + \sin\left(\frac{\pi n}{4}\right)$ ii) $x(t) = \cos(2\pi t)\ \sin\ 4\pi t$ **(08 Marks)**

OR

2 a. Determine and sketch the even and odd components of the signal x(t) shown in Fig.Q.2(a). **(08 Marks)**

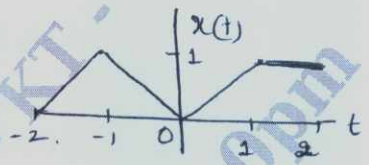

Fig.Q.2(a)

b. Find and sketch the derivatives of the following signals: $x(t) = u(t) - u(t-a)$, $a > 0$. **(04 Marks)**

c. Check whether the following system is
i) Static or dynamic
ii) Linear or nonlinear
iii) Time invariant or time variant
iv) Causal or non causal
v) Stable or unstable
vi) Invertible or non invertible. $y(n) = \log[x(n)]$. **(08 Marks)**

Module-2

3 a. Derive the expression for convolution integral. **(07 Marks)**

b. Prove the following: i) $x(n) * \delta(n) = x(n)$ ii) $x(n) * u(n) = \sum_{k=-\infty}^{n} x(k)$ **(06 Marks)**

c. Consider a LTI system with unit impulse response $h(t) = e^{-t}u(t)$. If the input applied to this system is $x(t) = e^{-3t}\ (u(t) - u(t-2))$. Find the output y(t) of the system. **(07 Marks)**

OR

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

b. The impulse response of LTI system is $h(n) = \{1, \underset{\uparrow}{2}\}$. Determine the response of the system to input signal $x(n) = \{1, \underset{\uparrow}{3}, 1\}$ using graphical method. **(06 Marks)**

c. Find the discrete time convolution sum given below:
$y(n) = \beta^n u(n) * \alpha^n u(n)$, $|B| < 1$, $|\alpha| < 1$ **(06 Marks)**

Module-3

5 a. The LTI systems are connected as shown in Fig.Q.5(a). If $h_1(n) = u(n-2)$, $h_2(n) = nu(n)$ and $h_3(n) = \delta(n-2)$. Find the overall response. **(10 Marks)**

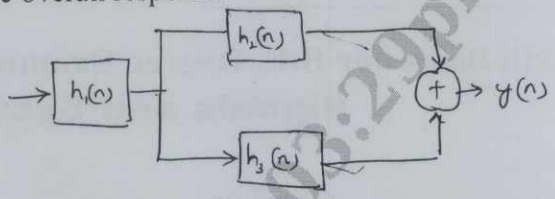

Fig.Q.5(a)

b. Evaluate the DTFS representation for the signal

$$x(n) = \sin\left(\frac{4\pi}{21}n\right) + \cos\left(\frac{10\pi}{21}n\right) + 1$$

Sketch the magnitude and phase spectra. **(10 Marks)**

OR

6 a. State and explain following continuous time Fourier series properties:
i) Time shift ii) Convolution iii) Parseval's Theorem. **(06 Marks)**

b. Check whether the system whose impulse response is
i) $h(n) = (1/2)^n u(-n)$ ii) $h(t) = e^{2t} u(t-1)$ stable, causal and memory less. **(09 Marks)**

c. Evaluate the step response for the LTI system represented by the following impulse response. $h(t) = t^2 u(t)$. **(05 Marks)**

Module-4

7 a. State the following properties of DTFT: i) Linearity ii) Frequency shift iii) Frequency differentiation iv) Modulation v) Convolution. **(10 Marks)**

b. Obtain the FT of the signal $x(t) = e^{-at} u(t)$; $a > 0$. **(10 Marks)**

OR

8 a. Find DTFT of the signal $x(n) = \{1, 3, \underset{\uparrow}{5}, 3, 1\}$ and evaluate $X(e^{j\Omega})$ at $\Omega = 0$ **(06 Marks)**

b. With neat diagrams, state and explain sampling theorem. **(08 Marks)**

c. Determine the Nyquist sampling rate and Nyquist sampling interval for
i) $x_1(t) = \text{Cos}(5\pi t) + 0.5\cos(10\pi t)$ ii) $x_2(t) = \text{Sinc}^2(200t)$ **(06 Marks)**

Module-5

9 a. Define Z-transform. Mention the properties of Region of Convergence (ROC). **(06 Marks)**

b. Determine the Z transform of these signals

i) $x_1(n) = n\left(\frac{5}{8}\right)^n u(n)$ ii) $x_2(n) = (0.9)^n u(n) * (0.6)^n u(n)$ **(08 Marks)**

c. Find Inverse Z transform, if $X(z) = \frac{\left(\frac{1}{4}\right)z^{-1}}{\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)}$ for all possible ROCs. **(06 Marks)**

OR

10 a. Prove the following properties of Z-transform: i) Linearity ii) Time Reversal. **(08 Marks)**

b. A system has impulse response $h(n) = \left(\frac{1}{2}\right)^n u(n)$. Determine the input to the system if the output is given by $y(n) = \frac{1}{3}u(n) + \frac{2}{3}\left(-\frac{1}{2}\right)^n u(n)$. **(12 Marks)**

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17EC43

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Control Systems

Time: 3 hrs. Max. Marks: 100

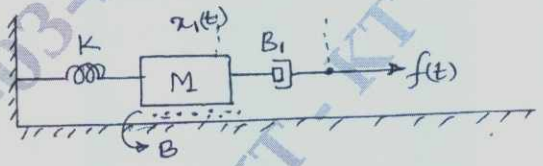
Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Differentiate between Open loop control system and Closed loop control system. **(06 Marks)**

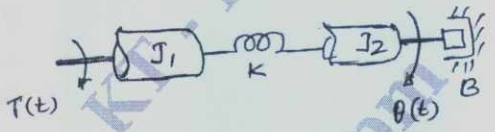
b. For the mechanical system, shown in fig. Q1(b), write the i) Mechanical network ;
ii) Differential equations of performance. **(06 Marks)**

Fig.Q1(b)



c. Obtain the transfer function of the system shown in fig. Q1(c).

Fig.Q1(c)



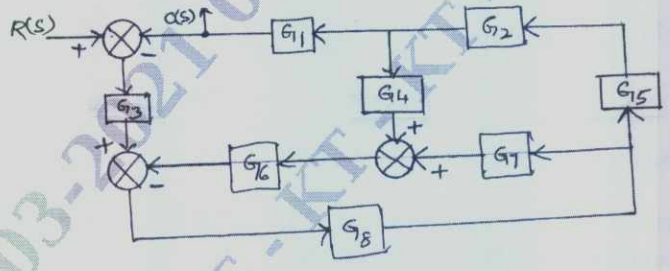
(08 Marks)

OR

2 a. Explain the block diagram rule regarding : i) Combining blocks in cascade
ii) Moving a take off point beyond a block. **(04 Marks)**

b. Determine the transfer function C(s)/R(s) for the block diagram shown in fig. Q2(b), using block diagram reduction techniques.

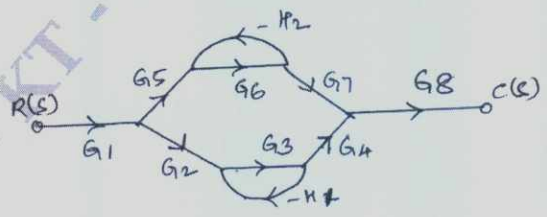
Fig.Q2(b)



(08 Marks)

c. Find $\frac{C(s)}{R(s)}$ for the following signal flow graph of fig. Q2(c).

Fig.Q2(c)



(08 Marks)

Module-2

3 a. With usual notation, derive an expression for the Peak time (t_p) and Rise time (t_r) of a response of second order system to a unit step input. **(06 Marks)**

b. Explain PI and PID controllers of a control system. **(06 Marks)**

c. A second order control system is represented by a transfer function given below :

$\frac{Q(s)}{T(s)} = \frac{1}{Js^2 + Bs + K}$, where Q(s) is the proportional output and T(s) is the input torque.

A step unit of 10N-mt is applied to the system and test results are given below :

i) Maximum overshoot is 6% ii) Peak time is 1 sec iii) Steady static value of the output is 0.5 radian. Determine the values of J , F and K. **(08 Marks)**

OR

4 a. Define Steady state error and Static error coefficients with respect to step input, velocity input and acceleration inputs. **(06 Marks)**

b. For a unity feedback system $G(s) = \frac{s(s+1)}{s^2(s+3)(s+10)}$. Determine the type of system, error coefficients and steady state error for input $\gamma(t) = 1 + 3t$. **(06 Marks)**

c. A signal is represented by the equation $\frac{d^2\theta}{dt^2} + 10.\frac{d\theta}{dt} = 150.e$. Where $e = (r-\theta)$ is the actuating signal. Calculate the value of damping ratio, undamped and damped frequency of oscillation. Also determine Open loop transfer function. **(08 Marks)**

Module-3

5 a. State R – H criterion and discuss its limitation. **(06 Marks)**

b. State the different rules for the construction Root locus. **(06 Marks)**

c. The open loop transfer function of a unity feedback system is given by

$G(s) = \frac{K}{s(s+3)(s^2+s+1)}$. Determine the value of K that will cause sustained oscillations in the closed loop system. Also find the frequency of sustained oscillations. **(08 Marks)**

OR

6 a. A unity feedback control system has $G(s) = \frac{K}{s(s+2)(s+5)}$. Sketch the root locus and show clearly i) Break away points ii) The frequency at which root locus crosses imaginary axis and corresponding value of K. **(12 Marks)**

b. The open loop transfer function of a unity feedback system is given by

$G(s) = \frac{K(s+1)}{s^3 + as^2 + 2s + 1}$. Determine the value of K and a, so that the system oscillates at a frequency of 2 rad/sec^2. **(08 Marks)**

Module-4

7 a. With figure, define the frequency domain specifications. **(06 Marks)**

b. Construct the Bode plot for a unity feedback control system with

$G(s) = \frac{10(s+10)}{s(s+2)(s+5)}$. Find the Gain margin and Phase margin. Comment on the stability. **(14 Marks)**

OR

8 a. Explain Lag – lead compensating networks. **(06 Marks)**

b. Given $G(s)H(s) = \frac{12}{s[s+1][s+2]}$. Draw the Polar plot and hence determine if system is stable? **(06 Marks)**

c. 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 asertain the stability. **(08 Marks)**

Module-5

9 a. What is Signal Reconstruction? Explain it with SAMPLE and HOLD circuit. **(06 Marks)**

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

c. Consider the system given by $\dddot{y} + 9\ddot{y} + 26\dot{y} + 24y = 6\,U$. Obtain its state model. **(08 Marks)**

OR

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

b. Explain Spectrum analysis of Sampling process. **(06 Marks)**

c. Obtain the transition matrix Q(t) of the following system

$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$. Also obtain the inverse of the transition matrix $\phi^{i}(t)$. **(08 Marks)**

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17EC44

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Principles of Communication Systems

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Illustrate the amplitude modulation process. What is envelope distortion? **(10 Marks)**

b. With the aid of neat block diagram, describe coherent detection of DSB-SC modulated wave. What is quadrature null effect? **(07 Marks)**

c. A single of 5KHz frequency signal is modulated on a carrier wave of a frequency 2 MHz. What are the frequencies of the resultant signal? **(03 Marks)**

OR

2 a. Describe ring modulator. Why the ring modulator is referred as a double balanced modulator? **(10 Marks)**

b. Describe quadrature carrier multiplexing. **(06 Marks)**

c. What are the factors influencing the choice of VSB modulation for the transmission of analog TV signals? **(04 Marks)**

Module-2

3 a. Derive an expression for FM signal. **(08 Marks)**

b. With the aid of neat block diagram, explain AM super heterodyne receiver. **(08 Marks)**

c. The resulting FM signal is $10 \cos[(2\pi\ 10^5 t) + 15 \sin(2\pi\ 100t)]$. Find the approximate bandwidth of the FM signal. **(04 Marks)**

OR

4 a. Describe the PLL working. **(08 Marks)**

b. With the aid of neat circuit diagram balanced frequency discriminator. **(08 Marks)**

c. What are the RF frequency range and intermediate frequency for AM and FM ratio? **(04 Marks)**

Module-3

5 a. Define Mean, correlation and covariance Functions of a random process x(t). **(08 Marks)**

b. Discuss Gaussian process and its properties. **(08 Marks)**

c. Draw the characteristics of white noise. **(04 Marks)**

OR

6 a. Write the important properties of autocorrelation function. **(08 Marks)**

b. Discuss shot noise, and thermal noise. **(08 Marks)**

c. Define noise equivalent bandwidth. **(04 Marks)**

Module-4

7 a. Discuss noise in DSB-SC. Show that figure of merit for DSB-SC receiver is one. **(10 Marks)**

b. Discuss pre-emphasis and de-emphasis in FM. **(10 Marks)**

OR

8 a. Derive the expression for figure of merit for FM. **(14 Marks)**

b. Show that figure of merit for single tone AM modulation is equal to 1/3 for 100% modulation. **(06 Marks)**

Module-5

9 a. With the aid of block diagram, describe PPM Generation and detection. **(10 Marks)**

b. Design a PCM multiplexing system using 256 levels signal quantizer for the transmission of 3 signals: m_1 m_2 and m_3 band limited to 5KHz, 10KHz and 5KHz respectively. Assuming that each signal is sampled at its Nyquist rate and 8 bits are transmitted simultaneously. Compute :

i) Maximum bit duration

ii) Channel Bandwidth required to pass PCM signal

iii) The commutator speed in RPM. **(10 Marks)**

OR

10 a. Describe the basic elements of a PCM system. **(10 Marks)**

b. State sampling theorem. Find the Nyquist sampling rate for the signal.
$g(t) = 10 \text{ Cos } (50\pi t) \text{ Cos}^2 (150\pi t)$ where t is in mscecs. **(06 Marks)**

c. Represent the binary data given below interms of i) unipolar NRZ signaling ii) Split phase.
Binary data : 0 1 1 0 1 0 0 1. **(04 Marks)**

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17EC45

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following terms with respect to op-amp and mention their typical values
(i) CMRR (ii) PSRR (iii) Slew Rate (iv) I/P Offset voltages (v) Input bias current **(10 Marks)**

b. Sketch the circuit of an op-amp difference amplifier. Discuss the working common mode nulling capability with necessary circuit modifications and equations. **(10 Marks)**

OR

2 a. With a neat circuit diagram, explain the basic operational amplifier circuit. **(06 Marks)**

b. A non-inverting amplifier is to amplify a 100 mV signal to a level 5V. Using 741 op-amp design a suitable circuit. Also calculate the input and output impedances. **(08 Marks)**

c. With a neat circuit diagram, explain inverting summing amplifier and derive for output voltage and show how it can be converted into averaging circuit. **(06 Marks)**

Module-2

3 a. Sketch the circuit of a High Z_{in} capacitor Coupled Non-inverting amplifier and explain its working with necessary design steps. Show that the input impedance is very high compared to capacitor coupled Non-Inverting amplifier. **(10 Marks)**

b. Design a capacitor coupled Inverting amplifier using op-amp 741 to have a voltage gain of 50 and an output voltage of 2.5 V. The input signal frequency ranges from 10 Hz to 1 kHz with a load resistance of 250 Ω. **(06 Marks)**

c. What are the advantages of precision rectifiers over ordinary rectifiers? **(04 Marks)**

OR

4 a. Draw the circuit of an instrumentation amplifier and explain. Also show the method of nulling common mode outputs and how dc output voltage can be level shifted and list the features of instrumentation amplifier. **(10 Marks)**

b. With a neat sketch, explain the working of a precision voltage source with zener diode and op-amp. **(05 Marks)**

c. Explain how upper cutoff frequency can be set in Non-Inverting and Inverting capacitor coupled circuits. **(05 Marks)**

Module-3

5 a. Draw and explain an op-amp sample and hold circuit with necessary waveforms. **(08 Marks)**

b. Explain the working of Weinbridge oscillator using op-amp with a neat sketch of circuit, waveforms and equations. Design the same to get output frequency of 15 kHz with +/– 12 power supply using IC 741. **(08 Marks)**

c. With a neat circuit diagram, explain a multiplier using op-amp. **(04 Marks)**

OR

6 a. With a neat sketch, explain Inverting Schmitt trigger circuit with necessary waveforms and equations. Also design the same using IC741 op-amp to have UTP = 0V and LTP = – 2V with +/– 12V power supply. **(10 Marks)**

b. Sketch the circuit of fundamental log amplifier. Explain its working and derive for output voltage. What is the drawback of fundamental log amplifier and how it can be eliminated in temperature compensated log amplifier. **(10 Marks)**

Module-4

7 a. Sketch the circuit of second order active high pass filter using bipolor op-amp and explain its working. Design the same for a cutoff frequency of 7 kHz. **(08 Marks)**

b. Show how a bandpass filter can be constructed by the use of lowpass and high pass filters. Draw the circuit of a single stage band pass filter and explain the operation with necessary design equations. **(08 Marks)**

c. List the advantages of active filters over passive filters. **(04 Marks)**

OR

8 a. With a neat diagram, explain the operation of IC 723 as high voltage regulator. Design the same to have $V_0 = 12V$ and $I_0 = 2A$. **(08 Marks)**

b. Discuss the performance parameters of a three terminal IC regulator can be used as a current source. **(08 Marks)**

c. List the important characteristics of a three terminal IC regulator. **(04 Marks)**

Module-5

9 a. With a neat circuit diagram, explain the working of IC 566 voltage controlled oscillator with necessary waveforms. Also derive for output frequency. **(08 Marks)**

b. With a neat circuit diagram and waveforms explain the working of R-2R network D-A converter and derive the expression for output voltage. **(08 Marks)**

c. What is the output voltage produced by a DAC with output range of 0V to 10V for the given binary input number is (i) 0110 (for 4 bit DAC) (ii) 10111011 (for 8 bit DAC). **(04 Marks)**

OR

10 a. Draw the internal schematic of IC 555, configure it for astable operation and explain with necessary equations and waveforms. **(10 Marks)**

b. Explain the working of successive approximation Analog to Digital Converter (ADC). **(10 Marks)**

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17EC46

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Microprocessors

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Draw and explain the internal architecture of 8086 microprocessor. **(10 Marks)**

b. Explain the concept of segmented memory. What are its advantages? **(06 Marks)**

c. If (CS) = 2000H, (DS) = 1234H, (SS) = 5678H, (BP) = 09ABH, calculate the physical address generated by the microprocessor when the following instruction is executed: MOV AL, [BP + 55H]. **(04 Marks)**

OR

2 a. With one example for each, describe any five addressing modes of 8086, used to access the data present in memory. **(10 Marks)**

b. List out any six conditional branch instruction that work based on the condition of any one flag. Mention the flag corresponding to each instruction. **(06 Marks)**

c. With numerical examples, illustrate the use of CBW and CWD instructions. **(04 Marks)**

Module-2

3 a. List out the five string manipulation instructions of 8086 and explain the operation of each. **(10 Marks)**

b. Write an Assembly Language Program (ALP) to add the data word located at address 2000H : 0500H to another data word available at offset 0600H in the same segment, and store the result and carry starting at 0700H in the same segment. **(06 Marks)**

c. With numerical examples, bring out the difference between SAR and SHR instructions. **(04 Marks)**

OR

4 a. Write an ALP using assembler directives to convert a 4-digit packed BCD number into equivalent 16-bit binary number, and store the result in memory. Write comments in your program. **(10 Marks)**

b. Explain the following instructions with one example each: RCR, XOR, SAHF. **(06 Marks)**

c. State the difference between the following two instructions: AND, TEST. What is the use of these instructions? **(04 Marks)**

Module-3

5 a. Explain the structure of stack in 8086 microprocessor. What is the role of stack during CALL and RET instructions? Illustrate with example. **(10 Marks)**

b. Explain any three methods of passing the parameters to and from a procedure. **(06 Marks)**

c. What is a macro? Give any two differences between macro and procedure. **(04 Marks)**

OR

6 a. Draw the interrupt vector table of 8086 and explain how an interrupt request is serviced, taking the example of type N interrupt. **(10 Marks)**

b. Write an ALP to generate a time delay of 10 seconds using an 8086 system that runs on 10MHz frequency. **(06 Marks)**

c. Bring out any four differences between maskable and non-maskable interrupts. **(04 Marks)**

Module-4

7 a. With a neat diagram, explain the maximum mode 8086 system. **(10 Marks)**

b. Write the functions of the following signals of 8086 : i) ALE ii) $\overline{DEN}$ iii) $\overline{BHE}$. **(06 Marks)**

c. Draw the minimum mode read cycle timing diagram, and explain briefly. **(04 Marks)**

OR

8 a. Design an interface between 8086 and two ICs of 32KB RAM and two ICs of 16KB EPROM. The RAM address must start at 00000H, and the EPROM address must end at FFFFFH. **(10 Marks)**

b. Draw the internal architecture of 8255 PIO and explain in brief. **(06 Marks)**

c. Explain Mode-1 and BSR modes of 8255. **(04 Marks)**

Module-5

9 a. Interface ADC 0808 with 8086 CPU using 8255 ports. Use port A for transferring digital data of ADC to CPU, and port C for control signals. Assume that analog input is present at input-3 of ADC. Draw the schematic and write the required ALP. **(10 Marks)**

b. Interface DAC0800 with 8086 CPU using port B of 8255. Write an ALP to generate a triangular waveform of frequency 400Hz. Assume that the system operates at 8MHz and the amplitude of the wave is 5V. **(10 Marks)**

OR

10 a. Write an ALP to read a 2-digit hexadecimal number from keyboard, and display its 4-digit square value on the computer screen, using appropriate DOS function calls. Use assembler directives and comments in your program. **(12 Marks)**

b. Write short notes on Von-Neumann architecture and Harvard architecture of computers with neat block diagrams. **(08 Marks)**

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CBCS SCHEME

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17MATDIP41

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Find the rank of the matrix $\begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 16 & 8 & -6 & -2 \end{bmatrix}$ by elementary applying row transformation. **(06 Marks)**

b. Solve the following system of linear equation by Gauss Elimination method $x + 2y + z = 3$, $2x + 3y + 3z = 10$, $3x - y + 2z = 13$ **(07 Marks)**

c. Find the inverse of the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ using Cayley-Hamilton theorem. **(07 Marks)**

OR

2 a. Reduce the matrix $\begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{bmatrix}$ into its echelon form and hence find its rank. **(06 Marks)**

b. Find the Eigen values and Eigen vectors of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$. **(07 Marks)**

c. Solve the following system of linear equation by Gauss Elimination method $x + y + z = 9$, $x - 2y + 3z = 8$, $2x + y - z = 3$. **(07 Marks)**

Module-2

3 a. Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 6e^{3x}$ **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = \cos 3x$ **(07 Marks)**

c. Solve $\frac{d^2y}{dx^2} + y = \tan x$ by the method of variation of parameters. **(07 Marks)**

OR

4 a. Solve $\frac{d^2y}{dx^2} + 4y = x^2$ **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = \frac{e^x + e^{-x}}{2}$ **(07 Marks)**

c. Solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 4e^{3x}$ by the method of undetermined coefficients. **(07 Marks)**

Module-3

5 a. Prove that $L[\text{Cosh at}] = \frac{s}{s^2 - a^2}$ **(06 Marks)**

b. Find the Laplace transform of cost cos2t cos3t **(07 Marks)**

c. Find the Laplace transform of $f(t) = \begin{cases} t & 0 \le t \le a \\ 2a - t & a < t \le 2a \end{cases}$ where $f(t + 2a) = f(t)$ **(07 Marks)**

OR

6 a. Find the Laplace transform of sint sin2t sin3t. **(06 Marks)**

b. Find the Laplace transform of $t^2 \sin at$. **(07 Marks)**

c. Express $f(t) = \begin{cases} t^2 & 1 < t \le 2 \\ 4t & t > 2 \end{cases}$ interms of unit step function and hence find $L\{f(t)\}$. **(07 Marks)**

Module-4

7 a. Find the inverse Laplace transform of $\frac{1}{s(s+1)(s+2)}$ **(06 Marks)**

b. Find the inverse Laplace transform of $\log \frac{(s^2+1)}{s(s+1)}$ **(07 Marks)**

c. Using Laplace transform, solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 0$ under the initial condition $y(0) = 1$ $y'(0) = 0$. **(07 Marks)**

OR

8 a. Find the inverse Laplace transform of $\log\left(\frac{s+a}{s+b}\right)$. **(06 Marks)**

b. Find the inverse Laplace transform of $\frac{5s+3}{(s-1)(s^2+2s+5)}$. **(07 Marks)**

c. Solve by using Laplace transform $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}$ under the initial condition $y(0) = 0$, $y'(0) = 0$. **(07 Marks)**

Module-5

9 a. Prove that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. **(06 Marks)**

b. Find the probability that a leap year selected at random will contain 53 Sundays. **(07 Marks)**

c. An office has 4 secretaries handling 20%, 60%, 15%, 5% respectively of the files of certain reports. The probabilities that they misfile such reports are respectively 0.05, 0.1, 0.1 and 0.05. Find the probability that a misfiled report is caused by the first secretary. **(07 Marks)**

OR

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

b. A problem is given to four students A, B, C, D whose chances of solving it are 1/2, 1/3, 1/4, 1/5 respectively. Find the probability that the problem is solved. **(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 it is defective? If a selected item is defective, what is the probability that it is from machine A? **(07 Marks)**

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