CBCS SCHEME

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15MAT41

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

Time: 3 hrs. Max. Marks:80

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

1 a. Find y at x = 0.4 correct to 4 decimal places given $\frac{dy}{dx} = 2xy + 1$; y(0) = 0 applying Taylor's series method upto third degree term. **(05 Marks)**

b. Using modified Euler's method find y(0.2) correct to four decimal places solving the equation $y' = x - y^2$, y(0) = 1 taking h = 0.1. Use modified Euler's formula twice. **(05 Marks)**

c. Use fourth order Runge – Kutta method to solve $(x + y)\frac{dy}{dx} = 1$, y(0.4) = 1 at x = 0.5 correct to four decimal places. **(06 Marks)**

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

b. Apply Milne's method to find y at x = 1.4 correct to four decimal places given $\frac{dy}{dx} = x^2 + \frac{y}{2}$ and the following data y(1) = 2, y(1.1) = 2.2156, y(1.2) = 2.4649, y(1.3) = 2.7514. **(05 Marks)**

c. Find the value of y at x = 4.4 by applying Adams – Bashforth method given that $5x\frac{dy}{dx} + y^2 - 2 = 0$ with the initial values of y : $y_0 = 1$, $y_1 = 1.0049$, $y_2 = 1.0097$, $y_3 = 1.0142$ corresponding to the values of x : $x_0 = 4$, $x_1 = 4.1$m, $x_2 = 4.2$, $x_3 = 4.3$. **(06 Marks)**

3 a. Apply Milne's predictor – corrector method to compute y(0.4) given the differential equation $y'' + 3xy' - 6y = 0$ and the following table of initial values. **(05 Marks)**

x	0	0.1	0.2	0.3
y	1	1.03995	1.13803	1.29865
y′	0.1	0.6955	1.258	1.873

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

c. Express $f(x) = 4x^3 + 6x^2 + 7x + 2$ in terms of Legendre polynomials. **(06 Marks)**

4 a. Given $y'' - xy' - y = 0$ with the initial conditions y(0) = 1, y′(0) = 0, compute y(0.2) using fourth order Runge – Kutta method. **(05 Marks)**

b. Prove the Rodrigues formula $P_n(x) = \frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2 - 1)^n$. **(05 Marks)**

c. Obtain the series solution of Bessel's differential equation $x^2y'' + xy' + (x^2 + n^2)y = 0$. **(06 Marks)**

5 a. State and prove Cauchy's – Riemann equation in polar form. **(05 Marks)**

b. Discuss the transformation $W = Z^2$. **(05 Marks)**

c. Using Cauchy's residue theorem evaluate :

$$\int_C \frac{z\cos z}{(z - \frac{\pi}{2})^3} dz \quad \text{where} \quad C : |z - 1| = 1.$$ **(06 Marks)**

6 a. Find an analytical function whose real part is $e^{-x}\left[(x^2 - y^2)\cos y + 2xy\sin y\right]$. **(05 Marks)**

b. Evaluate : $\int_C \frac{e^{2z}}{(z+1)(z-2)}\,dz$ where C is the circle $|z| = 3$. **(05 Marks)**

c. Find the bilinear transformation which maps the points $Z = 1, i, -1$ into $w = 0, 1, \infty$. **(06 Marks)**

7 a. A random variate X has the following probability function for various values of x

x	0	1	2	3	4	5	6	7
P(x)	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2 + K$

Find : i) K ii) Evaluate $P(x < 6)$ $P(x \geq 6)$ and $P(0 < x < 5)$. **(05 Marks)**

b. Find the mean and standard deviation of the exponential distribution. **(05 Marks)**

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

X \ Y	−2	−1	4	5
1	0.1	0.2	0	0.3
2	0.2	0.1	0.1	0

Determine :
i) Marginal distribution of X and Y
ii) Expectation of X
iii) S.D of Y
iv) Covariance of X and Y
v) Correlation of X and Y. **(06 Marks)**

8 a. A random variable x has the following density function :

$$f(x) = \begin{cases} Kx^2, & 0 < x < 3 \\ 0, & \text{otherwise} \end{cases}$$

Evaluate : i) K ii) $P(1 < x < 2)$ iii) $P(x \leq 1)$ iv) $P(x > 1)$ v) Mean. **(05 Marks)**

b. In a quiz contest of answering 'Yes' or 'No' what is the probability of guessing atleast 6 answers correctly out of 10 questions asked? Also find the probability of the same if there are 4 options for a correct answer. **(05 Marks)**

c. In a normal distribution 31% of the items are under 45 and 8% of the items are over 64. Find the mean and S.D of the distribution. It is given that if :

$$P(Z) = \frac{1}{\sqrt{2\pi}} \int_0^z e^{-z^2/2}\,dz$$

then $A(-0.4958) = 0.19$ and $A(1.405) = 0.42$. **(06 Marks)**

9 a. The weights of 1500 ball bearings are normally distributed with a mean of 635gms and S.D of 1.36gms. If 300 random samples of size 36 are drawn from this population, determine the expected mean and S.D of the sampling distribution of means if sampling is done : i) with replacement ii) without replacement. **(05 Marks)**

b. Two athletes A and B were tested according to the time (in seconds) to run a particular race with the following results.

Athlete A	28	30	32	33	33	29	34
Athlete B	29	30	30	24	27	29	

Test whether you can discriminate between the two Athletes. ($t_{0.05} = 2.2$ and $t_{0.02} = 2.72$ for 11d.f). **(05 Marks)**

c. A student's study habits are as follows. If he studies one night, he is 70% sure not to study the next night. On the other hand if he does not study one night, he is 60% sure not to study the next night. In the long run how often does he study? **(06 Marks)**

10 a. The mean and S.D of the maximum loads supported by 60 cables are 11.09 tonnes and 0.73 tonnes respectively. Find : i) 95% ii) 99% confidence limits for mean of the maximum loads of all cables produced by the company. **(05 Marks)**

b. Fit a Poisson distribution for the following data and test the goodness of fit given that $\chi^2_{0.05} = 7.815$ for 3d.f.

x	0	1	2	3	4
f	122	60	15	2	1

(05 Marks)

c. Show that $P = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$ is a regular stochastic matrix. Also find the associated unique fixed probability vector. **(06 Marks)**

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CBCS SCHEME

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Fourth Semester B.E. Degree Examination, July/August 2021
Object Oriented Concepts

Time: 3 hrs. Max. Marks: 80

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

1 a. Define structure. Explain the syntax for structure definition and declaration. Write a C++ program to create new user-defined data type using structure. **(08 Marks)**
b. Difference between Procedure Oriented Programming (POP) and Object Oriented Programming (OOP). **(05 Marks)**
c. Explain how console Input/Output is achieved in C++ with an example. **(03 Marks)**

2 a. What is function overloading? Write a C++ program to implement function overloading. **(05 Marks)**
b. Define Namespace in C++. How do you resolve the name conflicts using namespace with an example? **(05 Marks)**
c. What is friend function? Write a C++ program to implement the friend function. **(06 Marks)**

3 a. Explain how Java program solve both security and portability problems. **(05 Marks)**
b. Describe type-conversion and casting in Java with an example program. **(06 Marks)**
c. Define short circuit logical operators. Write a Java program to implement the same operators. **(05 Marks)**

4 a. Explain the features / Buzzwords of Java. **(08 Marks)**
b. Define and represent the syntax for for-each version of for loop. Write a Java program to read elements of an array and compute sum of array elements by using for-each. **(08 Marks)**

5 a. Define class and object in Java with syntax. Write a Java Program to implement the class and object to compute sum and average of three integer input.
[Consider class-name as Demo with 2 method called sum( ) and average ( ) followed by an object called CS. Main classname is sample] **(08 Marks)**
b. Define constructor. List the different types of constructor. Explain any one constructor with an example. **(05 Marks)**
c. Define the following with syntax:
(i) this keyword
(ii) super keyword. **(03 Marks)**

6 a. Define inheritance in Java. Write a java program to implement multi-level inheritance for banking applications, consists of members like saving_account, fixed_deposit and account_number by the class-name Bank for main method and bank details. **(08 Marks)**
b. What is method overriding? Write a java program to implement method overriding. **(04 Marks)**
c. Define package and list the basic packages in Java. Explain the process of creating, accessing and using of user-defined package with an example. **(04 Marks)**

7 a. What is thread? Explain the creation of thread in Java by using runnable interface with an example. **(05 Marks)**

b. What is the need of synchronization? Explain with an example how synchronization is implemented in Java. **(06 Marks)**

c. What is meant by thread priority? How it is assigned? **(05 Marks)**

8 a. What is delegation model? Describe the significance of adaptor class with example. **(05 Marks)**

b. List different event Listener interfaces and explain any two with its method (syntax). **(05 Marks)**

c. Write a short note on :
   (i) ActionEvent Class and AdjustmentEvent Class.
   (ii) WindowListener and WindowAdaptor **(06 Marks)**

9 a. What is applet? What are the types of applet and explain the skeleton of applet. **(06 Marks)**

b. Explain HTML applet tag with example. **(05 Marks)**

c. Explain the various component and containers in swings. **(05 Marks)**

10 a. Write an applet program to create label called "JAVA" of text field with 4 check boxes consists of caption:
   (i) this
   (ii) super
   (iii) package.
   (iv) Exception **(06 Marks)**

b. Write the steps to create J-table. Write a program to create a table with column heading "User-name, id, age" and insert atleast 5 records in the table and display. **(05 Marks)**

c. Write swing program to demonstrate with two JButtons names CSI and ISI. When either of these button entered, it should display respective label with its icon. Image icons are "CS.JPG" and "IS.JPG". Set initial label as "enter the input". **(05 Marks)**

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15MATDIP41

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

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions.

1 a. Determine the rank of the matrix $A = \begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$ by applying elementary row transformations. **(05 Marks)**

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

c. Solve by Gauss elimination method

$2x + y + 4z = 12$
$4x + 11y - z = 33$
$8x - 3y + 2z = 20$ **(06 Marks)**

2 a. Find the eigen values of $A = \begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$ **(05 Marks)**

b. Solve the system of equations by Gauss elimination method.

$x + y + z = 9$
$x - 2y + 3z = 8$
$2x + y - z = 3$ **(06 Marks)**

c. Find the rank of the matrix by reducing it to echelon form.

$$\begin{bmatrix} -2 & -1 & -3 & -1 \\ 1 & 2 & 3 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 \end{bmatrix}$$ **(05 Marks)**

3 a. Solve $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 5y = 0$ subject to $\frac{dy}{dx} = 2$, $y = 1$ at $x = 0$. **(05 Marks)**

b. Solve $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$. **(05 Marks)**

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

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

b. Solve $y'' + 2y' + y = 2x + x^2$ **(05 Marks)**

c. Using the method of undetermined coefficients, solve $y'' - 5y' + 6y = e^{3x} + x$ **(06 Marks)**

5 a. Find the Laplace transform of (i) $\frac{e^{-at} - e^{-bt}}{t}$ (ii) $\sin 5t \cos 2t$ **(05 Marks)**

b. Find the Laplace transform of

$$f(t) = \begin{cases} E, & 0 < t < \frac{a}{2} \\ -E, & \frac{a}{2} < t < a \end{cases} \quad \text{where } f(t+a) = f(t)$$ **(06 Marks)**

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

6 a. Express $f(t) = \begin{cases} \cos t, & 0 < t < \pi \\ \cos 2t, & \pi < t < 2\pi \\ \cos 3t, & t > 2\pi \end{cases}$ in terms of unit step function and hence find its Laplace transform. **(06 Marks)**

b. Find the Laplace Transform of (i) $t \sin at$ (ii) $t^5 e^{4t}$ **(05 Marks)**

c. If $f(t) = t^2$, $0 < t < 2$ and $f(t+2) = f(t)$ for $t > 2$, find $L[f(t)]$. **(05 Marks)**

7 a. Find the inverse Laplace Transform of $\frac{2s-1}{s^2+4s+29}$. **(05 Marks)**

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

c. Solve by using Laplace Transforms $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}$; $y(0) = 0$, $y'(0) = 0$. **(06 Marks)**

8 a. Solve the initial value problem $y'' + 4y' + 3y = e^{-t}$ conditions with $y(0) = 1$, $y'(0) = 1$ using Laplace Transforms. **(06 Marks)**

b. Find the inverse Laplace Transform of $\frac{s+2}{s^2(s+3)}$ **(05 Marks)**

c. Find the inverse Laplace Transform of $\log\left[\frac{s^2+4}{s(s+4)(s-4)}\right]$ **(05 Marks)**

9 a. A box contains 3 white, 5 black and 6 red balls. If a ball is drawn at random, what is the probability that it is either red or white? **(05 Marks)**

b. The probability that a person A solves the problem is 1/3, that of B is 1/2 and that of C is 3/5. If the problem is simultaneously assigned to all of them what is the probability that the problem is solved? **(05 Marks)**

c. Three machines A, B and C produce respectively 60%, 30%, 10% of the total number of items of a factory. The percentages of defective output of these machines are respectively 2%, 3% and 4%. An item is selected at random and is found defective. Find the probability that the item was produced by machine C. **(06 Marks)**

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

b. If A and B are events with $P(A \cup B) = \frac{3}{4}$, $P(\overline{A}) = \frac{2}{3}$ and $P(A \cap B) = \frac{1}{4}$, find P(A), P(B) and $P(A \cap \overline{B})$. **(05 Marks)**

c. Three students A, B, C, write an entrance examination. Their chances of passing are 1/2, 1/3 and 1/4 respectively. Find the probability that
(i) atleast one of them passes (ii) all of them pass (iii) atleast two of them passes. **(06 Marks)**

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