CBCS SCHEME

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15MAT41

Fourth Semester B.E. Degree Examination, July/August 2022
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 statistical table is permitted.

Module-1

1 a. Using Taylor's series method, solve $dy = (xy - 1)dx$, $y(1) = 2$ at $x = 1.02$ considering upto 3rd degree term. **(05 Marks)**

b. Using Runge – Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ at the point $x = 0.2$ by taking step length $h = 0.2$. **(05 Marks)**

c. Given that $\frac{dy}{dx} = x - y^2$, $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$, $y(0.6) = 0.1762$. Compute y at $x = 0.8$ by Adams – Bashforth predictor – corrector method. **(06 Marks)**

OR

2 a. Using modified Euler's method, find an approximate value of y when $x = 0.1$ given that $\frac{dy}{dx} = x + y$ and $y = 1$ when $x = 0$. Take $h = 0.1$ and perform three iterations. **(05 Marks)**

b. Solve $\frac{dy}{dx} = 2y + 3e^x$ $y(0) = 0$ using Taylors series method an find $y(0.1)$. **(05 Marks)**

c. Apply Milne's method to compute $y(1.4)$ correct to four decimal places given $\frac{dy}{dx} = x^2 + \frac{y}{2}$ the data $y(1) = 2$, $y(1.1) = 2.2156$, $y(1.2) = 2.4649$, $y(1.3) = 2.7514$. **(06 Marks)**

Module-2

3 a. Given $\frac{d^2y}{dx^2} = x^3\left(y + \frac{dy}{dx}\right)$ $y(0) = 1$, $y'(0.1) = 0.5$, evaluate $y(0.1)$ using 4th order – Runge – Kutta method. **(05 Marks)**

b. Express $f(x) = x^3 + 2x^2 - 4x + 5$ interms of Legendre polynomials. **(05 Marks)**

c. If α and β are the roots of $J_n(x) = 0$ then prove that $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$ if $\alpha \neq \beta$. **(06 Marks)**

OR

4 a. Using the Milne's method obtain the approximate solution at the point $x = 0.4$ of the problem $\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} - 6y = 0$, $y(0) = 1$, $y'(0.1) = 0.1$. Given :

$y(0.1) = 1.03995$ $y'(0.1) = 0.6955$ $y(0.2) = 1.138036$
$y'(0.2) = 1.258$ $y(0.3) = 1.29865$ $y'(0.3) = 1.873$ **(05 Marks)**

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

c. State and prove Rodrigue's formula. **(06 Marks)**

Module-3

5 a. Derive Cauchy's Riemann equations in Cartesian form. **(05 Marks)**

b. Using Cauchy's residue theorem evaluate the integral $\int_C \frac{e^{2z}}{(z+1)^4} dz$ where C is the circle $|z| = 3$. **(05 Marks)**

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

OR

6 a. State and prove Cauchy's theorem. **(05 Marks)**

b. Given $u - v = (x - y)(x^2 + 4xy + y^2)$ find the analytic function $f(z) = u + iv$. **(05 Marks)**

c. Discuss the transformation $W = e^z$. **(06 Marks)**

Module-4

7 a. Derive mean and variance of the Binomial distribution. **(05 Marks)**

b. The probability that an individual suffers a bad reaction from an injection is 0.001. Find the probability that out of 2000 individuals more than 2 will get a bad reaction. **(05 Marks)**

c. The joint probability distribution of two random variable X and Y as follows :

x \ y	−2	−1	4	6
1	0.1	0.2	0.0	0.3
2	0.2	0.1	0.1	0.0

Determine :
i) Marginal distribution of X and Y
ii) Covariance of X and Y
iii) Correlation of X and Y. **(06 Marks)**

OR

8 a. Derive mean and standard deviation of exponential distribution. **(05 Marks)**

b. The life of an electric bulb is normally distributed with average life of 2000 hours and standard deviation of 60 hours. Out of 2500 bulbs find the number of bulbs that are likely to last between 1900 and 2100 hours. Given that $P(0 < z < 1.67) = 0.4525$. **(05 Marks)**

c. The joint probability distribution of two random variable X and Y as follows :

x \ y	−4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8

Determine :
i) Marginal distribution of X and Y
ii) Covariance of X and Y
iii) Correlation of X and Y. **(06 Marks)**

Module-5

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

b. Find he student 't' for the following variables values in a sample of eight – 4, –2, –2, 0, 2, 2, 3, 3 taking the mean of the universe to be zero. **(05 Marks)**

c. Find the fixed probability vector of the regular stochastic matrix :

$$A = \begin{bmatrix} \frac{1}{2} & \frac{1}{4} & \frac{1}{4} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & 1 & 0 \end{bmatrix}.$$ **(06 Marks)**

OR

10 a. A coin is tossed 1000 times and head turns up 540 times. Decide on the hypothesis that the coin is unbiased. **(05 Marks)**

b. A set of five similar coins is tossed 320 times and the result is

Number of heads	0	1	2	3	4	5
Frequency	6	27	72	112	71	32

Test the hypothesis that the data follow a binomial distribution for v = 5 we have $\chi^2_{0.05} = 11.07$. **(05 Marks)**

c. A students study habits are as follows. If he studies one night, he is 60% sure not study the next night. On the other hand if he does not study one night, he is 80% sure not to study the next night. In the long run how often does he study? **(06 Marks)**

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15MATDIP41

Fourth Semester B.E. Degree Examination, July/August 2022
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 by elementary row transformations: $A = \begin{bmatrix} 4 & 0 & 2 & 1 \\ 2 & 1 & 3 & 4 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix}$. **(05 Marks)**

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

c. Find all the eigen values and the corresponding eigen vectors for the matrix.
$A = \begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$. **(06 Marks)**

OR

2 a. Reduce the matrix to echelon form and find the rank of the matrix.
$A = \begin{bmatrix} 0 & 2 & 3 & 4 \\ 2 & 3 & 5 & 4 \\ 4 & 8 & 13 & 12 \end{bmatrix}$. **(05 Marks)**

b. Solve the following system of equations by Gauss elimination method:
$x_1 - 2x_2 + 3x_3 = 2$
$3x_1 - x_2 + 4x_3 = 4$
$2x_1 + x_2 - 2x_3 = 5$ **(05 Marks)**

c. Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$ Find A^{-1}. **(06 Marks)**

Module-2

3 a. Solve $\frac{d^2y}{dx^2} - 4y = \cosh(2x-1) + 3^x$. **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 0$ given that $y = 0$, $\frac{dy}{dx} = -1$ at $x = 1$. **(05 Marks)**

c. Solve by the method of undetermined coefficient $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 4e^{3x}$. **(05 Marks)**

OR

4 a. Solve $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^x$. **(05 Marks)**

b. 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)**

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

Module-3

5 a. Find: $L\{t \sin at\}$ (05 Marks)

b. Given $f(t) = \begin{cases} E & 0 < t < a/2 \\ -E & a/2 < t < a \end{cases}$ where $f(t + a) = f(a)$. Show that $L\{f(t)\} = \frac{E}{S}\tanh\left(\frac{as}{4}\right)$. (06 Marks)

c. Find $L\{(3t^2 + 4t + 5)u(t-3)\}$. (05 Marks)

OR

6 a. Find $L\left\{\frac{1-e^{at}}{t}\right\}$. (05 Marks)

b. Prove that $L(\sin at) = \frac{a}{s^2 + a^2}$. (05 Marks)

c. Express the following function in terms of the unit step function and hence find their Laplace transform:

$$f(t) = \begin{cases} \sin t & 0 < t \le \pi/2 \\ \cos t & t > \pi/2 \end{cases}$$ (06 Marks)

Module-4

7 a. Find the inverse Laplace transform of $\frac{1}{(s+1)(s+2)(s+3)}$. (05 Marks)

b. Find $L^{-1}\left\{\log\left(1 + \frac{a^2}{s^2}\right)\right\}$. (05 Marks)

c. Solve the differential equation $y'' - 3y' + 2y = 0$, $y(0) = 0$, $y'(0) = 1$ by Laplace transform techniques. (06 Marks)

OR

8 a. Find $L^{-1}\left\{\frac{s+5}{s^2 - 6s + 13}\right\}$. (05 Marks)

b. Find $L^{-1}\{\cot^{-1}(s/a)\}$. (05 Marks)

c. Solve, $y'' + a^2y = \sin t$ with $y(0) = 0$, $y'(0) = 0$. Using Laplace transform. (06 Marks)

Module-5

9 a. The probability that 3 students A, B, C solve a problem are 1/2, 1/3, 1/4 respectively. If the problem is simultaneously assigned to all of them, what is the probability that the problem is solved? (05 Marks)

b. The probability that a team wins a match is 3/5. If this team play 3 matches in a tournament, what is the probability that the team i) win all the matches ii) loose all the matches. (05 Marks)

c. State and prove Baye's theorem. (06 Marks)

OR

10 a. Prove that

$$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(A \cap C) - P(B \cap C) + P(A \cap B \cap C).$$ (06 Marks)

b. 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 entire red or white? (05 Marks)

c. In a bolt factory there are four machines A, B, C, D manufacturing respectively 20%, 15%, 25%, 40% of the total production. Out of these 5%, 4%, 3%, 2% are defective. If a bolt drawn random was found defective what is the probability that it was manufactured by A. (05 Marks)

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15CS45

Fourth Semester B.E. Degree Examination, July/August 2022
Object Oriented Concepts

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Compare the procedure oriented programming with object oriented programming. Explain three object oriented features. **(06 Marks)**

b. What is function polymorphism? Write a program in C++ using overloaded function AREA to calculate area of circle, triangle and rectangle. **(06 Marks)**

c. What are constructors and destructors? When are they called? What is their utility? Explain with example. **(04 Marks)**

OR

2 a. Explain nested classes with examples. **(04 Marks)**

b. Explain friend data members and member friend classes with examples. **(06 Marks)**

c. What is this pointer? Where and why compiler insert it implicitly? **(06 Marks)**

Module-2

3 a. Explain the features of JAVA. **(06 Marks)**

b. Write and demonstrate a Java program to initialize and display different types of integer and floating point variables. **(04 Marks)**

c. Define type casting. Explain with an example. **(06 Marks)**

OR

4 a. How arrays are defined in Java? Explain with an example. **(08 Marks)**

b. What is jump statements? Explain three jump statements with examples. **(08 Marks)**

c. Explain : i) >>> ii) short circuit logical operators iii) for each.

Module-3

5 a. With an example, explain the use of super and this in Java inheritance. **(06 Marks)**

b. Explain the role of interfaces while implementing multiple inheritance in Java. **(06 Marks)**

c. Create a try block that is likely to generate 2 types of exceptions and incorporate necessary catch block to catch and handle them. **(04 Marks)**

OR

6 a. Write a program in Java to implement stack that can hold 10 integer values. **(06 Marks)**

b. Explain Java's built-in exceptions. **(05 Marks)**

c. Define package. What are the steps involved in creating user defined package with an example. **(05 Marks)**

Module-4

7 a. Why is "main" thread important? Write a Java program that crates multiple child threads and also ensure that main thread stops at last. **(06 Marks)**

b. What is meant by thread priority? How to assign and get thread priority? **(06 Marks)**

c. With syntax explain the use of isAlive( ) and join( ) methods. **(04 Marks)**

OR

8 a. Explain delegation event model used to handle events in Java. What are events, event listeners and event sources? Explain. **(08 Marks)**

b. With a Java program explain handling mouse events. **(08 Marks)**

Module-5

9 a. Explain Applet architecture and demonstrate how to pass parameters for font size, font name and type conversions in applets. **(08 Marks)**

b. Write an applet program to display the message "VTU, BELGAUM" set the back ground color to cyan and foreground color to red. **(08 Marks)**

OR

10 a. What are the deficiencies of AWT that are overcome by swings? Explain the two key features of swings. **(06 Marks)**

b. Explain with syntax the following :

i) JLabel
ii) JTextField
iii) JButton
iv) JCheckBox. **(06 Marks)**

c. Describe the different types of swing buttons. **(04 Marks)**

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