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Total Number of Pages : 02

B.Tech
RMA3A001

3rd Semester Regular / Back Examination: 2021-22

MATHEMATICS - III

BRANCH(S): AEIE, AERO, AG, AUTO, BIOMED,

BIOTECH, C&EE, CHEM, CIVIL, CSE, CSEAIME, CST, ECE, EEE, EIE, ELECTRICAL, ELECTRICAL
& C.E, ELECTRONICS & C.E, ENV, ETC, IT, MANUTECH, MECH, METTA, MINERAL, MINING, MME,
MMEAM, PE, PLASTIC, PT

Time : 3 Hour

Max Marks : 100

Q.Code : OF575

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions : (2×10)

- Rate of convergence of the Newton-Raphson method is generally _____
- Using Newton's Forward formula, find $\sin(0.1604)$ from the following table.

x	0.160	0.161	0.162
f(x)	0.1593182066	0.1603053541	0.1612923412
- Rewrite $dy/dx + 2y = 1.3e^{-x}$ $y(0) = 5$
In $dy/dx = f(x,y)$ $y(0) = y_0$ form
- Given that $x = 2y + 4$ and $y = kx + 6$ are the lines of regression of x on y and y on x respectively. Find the value of k if r is 0.5.
- A coin is tossed three times.
What is the probability of three heads?
- What is the meaning of probability in statistics?
- What will be the variance of the Bernoulli trials, if the probability of success of the Bernoulli trial is 0.3.
- Explain the primary philosophical difference between the parameters of the probability distribution function (PDF) and the cumulative distribution function (CDF).
- The mean of hypergeometric distribution is _____
- A bag contains 4 white, 5 red and 6 blue balls. Three balls are drawn at random from the bag. The probability that all of them are red, is:

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6×8)

- Using Lagrange's interpolation formula find $y(10)$ from the following table:

x	5	6	9	11
y	12	13	14	16

- Find the cube root of 12 using the Newton Raphson method assuming $x_0 = 2.5$.
- Baby boys have a mean weight of 6.4 kg, with a standard deviation of 0.7. Baby girls have a mean weight of 5.9 kg, with a standard deviation of 0.7. The weights of 3-month old babies are normally distributed. What is the probability that a 3-month old baby boy weighs more than 7.3 kg?
- For an integral $\int_a^b f(x) dx$ derive the one-point Gauss quadrature rule.
- valuate $\int_0^2 x^2 dx$ using the Trapezoidal Rule, with $n = 2$.

- e) Find the value of k_1 by Runge-Kutta method of fourth order if $dy/dx = 2x + 3y^2$ and $y(0.1) = 1.1165$, $h = 0.1$
- f) A die is rolled twice and two numbers are obtained, let X be the outcome of first roll and Y be the outcome of the second roll. Given that $X+Y=5$, what is the probability of $X=4$ or $Y=4$?
- g) It is estimated that 50% of emails are spam emails. Some software has been applied to filter these spam emails before they reach your inbox. A certain brand of software claims that it can detect 99% of spam emails, and the probability for a false positive (a non-spam email detected as spam) is 5%. Now if an email is detected as spam, then what is the probability that it is in fact a non-spam email?
- h) The probability of simultaneous occurrence of at least one of two events A and B is p . If the probability that exactly one of A, B occurs is q , then prove that $P(A') + P(B') = 2 - 2p + q$.
- i) Four balls are to be drawn without replacement from a box containing 8 red and 4 white balls. If X denotes the number of red ball drawn, find the probability distribution of X .
- j) A binomial probability experiment is conducted with the given parameters. Compute the probability of x successes in the n independent trials of the experiment $n=10$, $p=0.75$, $x=8$
- k) Let's return to the example in which X_1, X_2, \dots, X_n are normal random variables with mean μ and variance σ^2 . What are the method of moments estimators of the mean μ and variance σ^2 ?
- l) Suppose that X is a discrete random variable with the following probability mass function: where $0 \leq \theta \leq 1$ is a parameter. The following 10 independent observations
- | | | | | |
|--------|-------------|------------|-----------------|----------------|
| X | 0 | 1 | 2 | 3 |
| $P(X)$ | $2\theta/3$ | $\theta/3$ | $2(1-\theta)/3$ | $(1-\theta)/3$ |
- were taken from such a distribution: (3,0,2,1,3,2,0,2,1). What is the maximum likelihood estimate of θ . <https://www.bputonline.com>

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3 a) Find the cube root of 12 using the Newton Raphson method assuming $x_0 = 2.5$. (8)
- b) Solve Equations $2x+5y=16, 3x+y=11$ using Gauss Seidel method (8)
- Q4 a) Find an approximate value of $\int_5^8 6x^3 dx$ using Euler's method of solving an ordinary differential equation. Use a step size of $h = 1.5$. (8)
- b) A pair of dice is thrown and let X be the random variable which represents the sum of the numbers that appear on the two dice. Find the mean of X . (8)
- Q5 a) Use the Trapezoidal Rule and Simpson's Rule to approximate the value of the definite integral for the given value of n . Round your answer to four decimal places and compare the results with the exact value of the definite integral. $\int_0^2 x\sqrt{x^2+1} dx$, $n=4$. (8)
- b) Let X and Y be two independent Uniform (0,1) random variables. Let also $Z = \max(X, Y)$ and $W = \min(X, Y)$. Find $\text{Cov}(Z, W)$. (8)
- Q6 a) Calculate the regression coefficient and obtain the lines of regression for the following data (8)
- | | | | | | | | |
|-----|---|---|----|----|----|----|----|
| X | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| y | 9 | 8 | 10 | 12 | 11 | 13 | 14 |
- b) X is a normally distributed variable with mean $\mu = 30$ and standard deviation $\sigma = 4$. (8)
- Find :
- a) $P(x < 40)$
- b) $P(y > 21)$
- c) $P(30 < x < 35)$