APPLIED MATHEMATICS

Paper A

Time Allowed-3Hours
Maximum Marks-100

Note: Attempt six questions in all, selecting two questions from each section.

SECTION-I

Q-1

a) Solve the differential equation. 9

$$(3y-7x-3)dx+(7y-3x-7)dy=0$$

.

b) Solve the differential equation 8

$$p^3-(x^2+xy+y^2)p+xy^2+x^2y=0$$

Q-2

a) Solve the initial value problem. 9

$$x\frac{dy}{dx}+3y=x^2y^2 \qquad y(1)=2$$

b) The population of Pakistan increases at a rate proportional to the number of inhabitants present at any time t. If the population doubles in 40 years in how many years will it triple? 8

Q-3

a) Solve the differential equation. 9

$$(3x^2y^4+2xy)dx+(2x^3y^3-x^2)dy=0$$

b) Solve by the method of U.C 8

$$2y''+3y'+y=x^2+3\sin x$$

Q-4

a) Find a particular solution of the following 9

$$\frac{d^2y}{dx^2}+4\frac{dy}{dx}+5y=e^{-2x}\sec x$$

b) Apply the power series method to solve the differential equation. 8

$$\left(1-x^2\right)y'=y$$

SECTION – II

Q-5

a) Compute the inverse Laplace transformation of the following 8

$$\frac{2S-3}{2S^3+3S^2-2S-3}$$

b) Find a positive root of a non-linear equation using Bisection method 8

$$x^3-x-10=0$$

Q-6

a) Use the Laplace transformation method to solve the following initial value problem 8

$$\frac{d^2y}{dt^2}+2\frac{dy}{dt}-3y=e^t \qquad y(0)=1, \qquad y'(0)=0$$

b) Find the positive root of the equation 8

$$x^3-4x^2+x-10=0$$

using the Reguler-Falsi method.

Q-7

a) Find the positive root of the equation 8

$$x^3-3x-3=0$$

by Newton's-Raphson method with $x_0=2$

b) Prove that 8

$$\triangle\left(\frac{f_n}{g_n}\right)=\frac{g_n\triangle f_n-f_n\triangle g_n}{g_n g_{n+1}}$$

Q-8

a) Find the first three derivatives from the following table at $x = 2$ 8

x	0	1	2	3	4	5
y	-6	-10	-8	6	38	94

b) Use the Simpson's rule to approximate the given integral 8

$$\int_0^4 x^2 dx \qquad \text{with } n = 8$$

SECTION –III

Q-9

a) Find the maximum value of $z = 7x_1 + 5x_2$ subject to the constraints 9

$$x_1 + 2x_2 \le 6$$
$$4x_1 + 3x_2 \le 12 \qquad x_1, x_2 \ge 0$$

b) Maximize $z = 10x_1 + 11x_2$ with the conditions 8

$$3x_1 + 4x_2 \le 9$$
$$5x_1 + 2x_2 \le 8 \qquad x_1 \ge 0 \ and \ \ x_2 \ge 0$$
$$x_1 - 2x_2 \le 1$$

by using simplex method

Q-10

a) If A and B are any two events defined in a sample spaces S then 9

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

b) Two coins are tossed what is the conditional probability the two heads result, given that there is at least one head? 8

Q-11

a) If A and B are two independent events in a sample space S then show that 9

i) A and $\overline{B}$ are independent
ii) $\overline{A}$ and B are independent
iii) $\overline{A}$ and $\overline{B}$ are independent

b) Find the probability distribution of the sum of the dots when two fair dice are thrown 8

Q-12

a) What is the mathematical expectation of the number of heads when three fair coins are tossed? 9

b) Write down the properties of the binomial distribution 8

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