

[This question paper contains 4 printed pages.]

981

Your Roll No.

B.A. Prog./III

A

(E)

APPLICATION COURSE – MATHEMATICS
FOR SOCIAL SCIENCES

(Admissions of 2004 and onwards)

Time : 2 Hours

Maximum Marks : 55

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

Question No. 1 is compulsory and carries 15 marks.

*Attempt four more questions selecting at
least one question from each Section.*

Each question carries 10 marks.

*Note :- The maximum marks printed on the question paper
are applicable for the students of the regular colleges
(Cat. 'A'). These marks will, however, be scaled up
proportionately in respect of the students of NCWEB
at the time of posting of awards for compilation of
result.*

1. (i) Discuss the concavity of the following function :

$$f(x) = x^3 - 3x^2 + 3x - 3. \quad (3)$$

(ii) If $A = \begin{bmatrix} 3 & 2 \\ 4 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} a & b \\ 3 & 5 \end{bmatrix}$, find a and b

$$\text{such that } AB = BA. \quad (3)$$

P.T.O.

(iii) If $y = \frac{\log x}{x}$, find $\frac{dy}{dx}$. (3)

(iv) Find the all first and second order partial derivatives of the function $Z = 3x^4 - x^2y^2 + xy^3$. (3)

(v) Determine the value of the constant K so that the function

$$f(x) = \begin{cases} x^2 - 3x + 2, & \text{if } x \neq 1 \\ K, & \text{if } x = 1 \end{cases}$$

is continuous at $x = 1$. (3)

SECTION I

2. (i) The total Revenue function of product is $R(x) = 100x + \frac{x^3}{3}$. Find

(a) The average revenue.

(b) The marginal revenue when $x = 5$. (5)

(ii) Find $\int x^3 \sin x^4 dx$. (5)

3. (i) Find $\frac{dy}{dx}$, when $x^3 + y^3 = xy$. (5)

(ii) Sketch the graph of the curve

$$\frac{x^2}{16} + \frac{y^2}{9} = 1. \quad (5)$$

SECTION II

4. (i) Write down the Taylor's Series expansion for e^x and compute $e^{0.2}$ to three places of decimals. (5)

- (ii) Test for convergence of the series

$$\frac{1}{3.7} + \frac{1}{4.9} + \frac{1}{5.11} + \frac{1}{6.13} + \dots \quad (5)$$

5. (i) Find the area of the region bounded by the curves $y = x^2$ and $y = x$. (5)

- (ii) Find the equation of the curve passing through the point $(1, 1)$ whose differential equation is $x dy = (2x^2 + 1)dx$, $x \neq 0$. (5)

SECTION III

6. (i) Find the eigen values of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & -4 & 2 \\ 0 & 0 & 7 \end{bmatrix} \quad (5)$$

- (ii) Solve the following system of equations by Cramer's rule :

$$x - 4y - z = 11; \quad 2x - 5y + 2z = 39$$

$$-3x + 2y + z = 1 \quad (5)$$

P.T.O.

7. (i) Use the graphical method to solve the following Linear programming problem :

$$\text{Maximize } Z = 2x + 5y$$

subject to

$$\begin{aligned} -2x + 3y &\leq 6; & 7x - 2y &\leq 14; & x + y &\leq 5; & x &\geq 0, \\ y &\geq 0. \end{aligned} \quad (5)$$

- (ii) The joint cost function of a firm producing two products of units x and y is given by

$$C = 6x^2 - 9x - 3xy - 7y + 5y^2 + 20.$$

Find the values of x and y that minimize C .

Also find the minimum cost. (5)

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APPLICATION COURSE – BASIC STATISTICS

Time : 2 Hours

Maximum Marks : 55

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

*Instructions to candidates regarding the number of questions
to be answered etc. should be indicated in the space provided
below.*

Question No. 1 is compulsory.

Attempt any four question from question 2 to 7.

*Selecting atleast one from each Section and
give full explanation for each question.*

Marks are indicated against each question.

Use of simple calculator is allowed.

1. Short answers with proper justification are expected in all the five parts of this question. Each part is of 3 marks. (15)

- (i) The probability density function of the random variable X is given by

$$f(x) = \begin{cases} 6x(1-x) & \text{for } 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$$

Find $P\left(X < \frac{1}{4}\right)$ and $P\left(X > \frac{1}{2}\right)$.

P.T.O.

- (ii) The number of a consulting firm rent cars from three rental agencies : 60 percent from agency 1, 30% from agency 2 and 10% from agency 3. If 9% of the cars from agency 1 need to tune up, 20% of the cars from agency 2 need to tune up, and 6% of the cars from agency 3 need a tune-up, what is the probability that a rental car delivered to the firm will need a tune-up?
- (iii) Comment on the following values of regression coefficient : $b_{yx} = 3.2$ and $b_{xy} = 0.8$. Justify your comment.
- (iv) The daily expenditure of 100 families is given as under :

Expenditure :	0-10	10-20	20-30	30-40	40-50
No. of families :	14	?	27	24	15

The median for the distribution is Rs. 25. Find the missing frequencies.

- (v) The A-level counts of 42 students in higher education were :

3	16	11	6	6	9	7	4	3	9
8	6	12	6	6	5	6	4	3	5
3	4	2	3	6	4	11	4	2	9
5	5	5	6	8	5	5	4	3	12
7	5								

Prepare an ungrouped frequency distribution table and calculate Pearson's coefficient of skewness.

SECTION - I

2. Obtain the equations of the lines of regression for the following data :

x :	1	2	3	4	5	6	7	8	9
y :	9	8	10	12	11	13	14	16	15

(10)

3. Suppose that A can hit a target 3 times in 5 shots, B 2 times in 5 shots and C 3 times in 4 shots. They fire a volley. Find the chance that

- (a) 2 shots hit
 - (b) atleast two shots hit
 - (c) exactly one of them hits
 - (d) atmost two shots hit
- (10)

SECTION - II

4. The incidence of occupational disease in an industry is such that the workers have a 20% chance of suffering from it. What is the probability that out of six workers 4 or more will catch the disease?
- (10)

5. The life of electronic tubes of a certain type may be assumed to be normally distributed with mean 155 hours and standard deviation 19 hours. What is the probability (i) that the life of a randomly chosen tube

is between 136 hours and 174 hours (ii) that the life of a randomly chosen tube is less than 117 hours.

(It is given that the area under the standard normal curve between $Z = 0$ and $Z = 1$ is 0.3413, that between $Z = 0$ and $Z = 2$ is 0.4772).

(10)

SECTION - III

6. A soap manufacturing company was distributing a particular brand of soap through a large number of retail shops. Before a heavy advertising campaign, the mean sales per week per shop was 140 dozens. After the campaign a sample of 26 shops was taken and the mean sales was found to be 147 dozens. With standard deviation 16. Can you consider the advertisement effective? (It is given that value of t for 25 degrees of freedom at 5% level of significance is 1.708).
- (10)
7. In a sample of 600 men from a certain city, 450 men are found to be smokers. In a sample of 900 from another city, 450 are found to be smokers. Do the data indicate that the two cities are significantly different with respect to prevalence of smoking habits among men?
- (It is given that the critical value of Z at 5% level of significance is ± 1.96).
- (10)