NEW

Part-III 3-Tier

2016

MATHEMATICS

PAPER—IV

(General)

Full Marks : 90

Time : 3 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Group—A

(Compulsory)

(*Elements of Computer Science*)

[Marks : 45]

1. Answer any *one* question : 1×15

(a) (i) What is Boolean algebra ? 2

(ii) State the basic theorems and properties of Boolean algebra. 4

(iii) What are the main advantages and disadvantages of preparing a flowchart ? 4

(iv) Draw a flowchart to find the value of ${}^{n}C_{r}$. 5

(b) (i) What is source program and object program ?

(ii) What do you mean by CPU, ALU, CU ?

(iii) Write an algorithm and draw a flowchart to find the area of a triangle when three sides are given.

(iv) Write a program to find the trace of a square matrix.

2+3+6+4

(c) (i) Explain the following logic gates with block diagram and truth tables :

OR, AND, NOR, NAND.

(ii) For all x, y, z $\in$ B (a Boolean algebra) prove, not using truth table, that

$xy + x'y' + yz = xy + x'y' + x'z$.

(iii) Construct the circuit diagram, using AND and NOR gates, for the function A + B.C .

6+4+5

2. Answer any *two* questions : 2×8

(a) (i) Express the following algebraic expression into its equivalent FORTRAN expression :

$$\text{Kappa} = (\text{fraction part of a}) \times \sqrt{|a - b| \sin^{-1} a} + \frac{\log_{10} C}{e^d}$$

(ii) Find the value of M if M = A/B * * 3 * (X/K) **2*Y in FORTRAN where A = 4·2; B = 0·7, X = 6·0, Y = 0·5, K = 3.

(iii) Write short notes on I, E and H formats in FORTRAN.

2+2+4

(b) Find the followings :

(i) Binary equivalent of $(11{\cdot}75)_{10}$.

(ii) Decimal equivalent of $(1011{\cdot}11)_2$.

(iii) $(11011)_2 \times (10011{\cdot}11)_2$.

(iv) $(100011)_2 \div (101)_2$.

2+2+2+2

(c) (i) Find the values of the variables A and M at the completion of the following program segment :

```
A = 1·5
DO  10  I = 1, 5
A = A + I
DO  10  J = 1, 5
M = I + J
10  CONTINUE
```

(ii) What are the differences between DO and implied DO statements ?

4+4

(d) (i) Write a program to test whether a positive integer is prime or not.

(ii) A circle of radius a with centre at (0, 0) and a point A(x, y) are given. Draw a flow chart to test the point A lies inside, outside or on the circle. 4+4

3. Answer any *three* questions : 3×4

(a) Draw a circuit using only NAND gate that realize the function $f(x, y, z) = x'yz' + x'yz + xy'z$. 4

(b) Write a FORTRAN program for finding a real root of the equation $x^3 + x - 1 = 0$ by Newton-Raphson method correct to 4 decimal places. 4

(c) Write an algorithm for matrix multiplication. 4

(d) Indicate the errors, if any on the following FORTRAN statements : 4

(i) IF (X + I) 20, 0, 30 ;

(ii) IF (D) 1, 2, 3, 4.

(e) Write a program to find the values of the series $\sum_{r=1}^{100} x^r$ for a given x. 4

(f) Find the output of the following program segment : 4

```
Do  5  I = 1, 10
Do  5  J = I + 1, 11
K = I + J
IF (K/2*2.EQ.K) PRINT *, K.
5   CONTINUE
```

4. Answer any *one* question : 1×2

(a) What are the differences between STOP and END statements in FORTRAN ? 2

(b) What is the difference between RAM and ROM ? 2

Group—B

(Optional Paper — I)

[Marks : 45]

(*Probability and Statistics*)

5. Answer any *one* question : 1×15

(a) (i) State and prove binomial law. 5

(ii) A card is drawn at random from a pack of well shuffled cards. What is the probability that it is a 'heart' or a 'queen' ? 5

(iii) Give an axiomatic definition of probability. Show that the conditional probabilities satisfy the axioms of Probability. 2+3

(b) (i) If two dice are thrown, what is the probability that the sum is greater than 9? 5

(ii) If A and B be any two events corresponding to a random experiment E, then

$P(A + B) = P(A) + P(B) - P(AB)$. 5

(iii) A jar contains three white and three red balls. The balls are drawn at random from the jar and placed on a table in the order drawn. What is the probability that balls are drawn in the order white, red, red, white, red, white. 5

(c) (i) X is a discrete random variable having the following probability mass functions : 5

x :	0	1	2	3	4	5	6
$P(X = x)$:	0	K	2K	3K	4K	5K	6K

Determine the constant K. Find $P(X < 5)$ and $P(X \geq 4)$.

(ii) Define likelihood function. Explain the method of maximum likelihood in parameter estimation. 5

(iii) If X is a random variable having normal (m, σ) distribution, find the distribution of $Y = aX + b$, where a, b are constants. 5

6. Answer any *three* questions : 3×8

(a) The joint probability density function of two random variables X and Y is

$$f(x, y) = 8xy, \quad 0 \le x \le y, \ 0 \le y \le 1$$
$$= 0, \quad \text{otherwise}$$

Examine whether X and Y are independent. Also compute Var(X) and Var(Y). 8

(b) In a frequency distribution, the first four central moments are 0·0, 2·5, 0·7 and 18·75 respectively. Find the skewness and Kurtosis and hence explain the nature of the distribution. 8

(c) Draw the Histogram and frequency polygon of the following frequency distribution of the height of 100 students of a college : 8

Height (cm) :	141–150	151–160	161–170	171–180	181–190
No. of students :	5	16	56	19	4

(d) For the binomial (n, p) distribution, prove that

$$\mu_{r+1} = p(1-p)\left[nr\mu_{r-1} + \frac{d\mu_r}{dp}\right]$$

where μ_r is the rth central moment of the distribution. 8

(e) (i) The mean and variance of a binomial (n, p) distribution are 20 and 16. Find the values of n and p. 4

(ii) Write short notes on class interval and class boundaries. 4

(f) Calculate the median and mode of the following frequency distribution : 8

Marks :	10–19	20–29	30–39	40–49	50–59	60–69
Frequency :	8	11	15	17	17	7

7. Answer any *two* questions : 2×3

(a) Let X be a continuous random variable with probability density function given by :

$$f(x)=\begin{cases} Kx, & 0 \le x \le 1 \\ K, & 1 \le x \le 2 \\ -Kx+3K, & 2 \le x \le 3 \\ 0, & K > 3 \end{cases}$$

Determine K. 3

(b) Two unbiased coins are tossed. If one coin shows head, find the probability that other also shows head. 3

(c) Prove that the fundtion f(x) where :

$f(x) = 4(x - x^3),\ 0 \leq x \leq 1$

$= 0,$ elsewhere

is a possible probability density function. Find E(X). 3

(d) Do you consider these two lines $2x + 3y = 7$ and $3y - 7x + 2 = 0$ as the regression lines ? Give reasons. 3

(Optional Paper — II)

[Marks : 45]

(Application of Mathematics in Finance and Insurance)

5. Answer any *one* question : 1×15

(a) (i) What do you mean by compounding technique and the discounting technique of the time value of money ? 6

(ii) Should profit maximisation goal be regarded as the primary goal of financial management ? 5

(iii) If the discount rate is 10%, calculate the present value of Rs. 1,000 to be received by an individual at the end of the year 8. 4

(b) (i) Distinguish between 'Net Present Value' and 'Internal Rate of Return'. 4

(ii) A company is contemplating to purchase a machine. Two machines A and B are available, each costing Rs. 5 lakhs. In comparing the profitability of the machines, a discount rate of 10% is to be used and machine is to be written off in five years by straight line method of depreciation with neat residual value. Cash in flows after tax are expected as follows :

Year	Machine – A Rs. in lakhs	Machine – B Rs. in lakhs
1	1·5	0·5
2	2·0	1·5
3	2·5	2·0
4	1·5	3·0
5	1·0	2·0

Indicate which machine would be profitable using the Internal Rate of Return (IRR) method.

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6. Answer any *two* questions : 2×8

(a) Rs. 500 is to be deposited at the end of year 1, Rs. 1,000 at the end of year 2 and Rs. 1,500 at all the end of each of the next 13 years. To what sum will these deposit accumulated at the end of 15th year, assuming the rate of interest is 10% ? 8

(b) Derive the measurement of the returns under uncertainty situations, with examples. 8

(c) What makes risk important in the selection of projects ? Explain briefly the various methods of evaluating risk projects. 3+5

7. Answer any *two* questions : 2×4

(a) What are the main differences between Symmetric Risk and Unsymmetric Risk ? 4

(b) Derive briefly the applications of mathematics in finance. 4

(c) What similarities are there between the risk adjusted discount rate method and the certainty equivalent method ? 4

8. Answer any *two* questions : 2×3

(a) Distinguish between Risk and Uncertainties. 3

(b) Why the finance manager should possess a basic knowledge of economics and mathematics ? 3

(c) Find the compound interest of Rs. 3,000 for 4 years @ 4% p.a. 3
