NEW

Part-III 3-Tier

2015

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 :   15×1

   (a) (i) Give the block diagram of a computer and mention the function of the components.

(ii) What are uses of assembler and compiler ?

(iii) What are the differences between the working of a clerk and a computer ?

(iv) What is high level language ? Give examples of two high level languages. 5+3+5+2

(b) (i) What is algorithm ? Give the different characteristics of an algorithm.

(ii) Write an algorithm and draw a flowchart to find the maximum among *n* numbers.

(iii) Write the relation among bit, byte, KB, MB and GB. 3+10+2

(c) (i) What are the rules for naming a FORTRAN variable ?

(ii) State the hierarchy of arithmetic and logical operators.

(iii) Write a short note on Do loop in FORTRAN.

(iv) Discuss the validity of STOP, 2NAME, EXAMINATION, M–N as valid FORTRAN variables.

4+4+5+2

2. Answer any *two* questions :   8×2

(a) (i) **Express** the following algebric expressions into their equivalent FORTRAN expressions :

$$\log_{10}\left|\sqrt{x+y}\right| + \frac{1}{1+e^x}, \quad \frac{pe^4}{24} + \log p + \frac{|x|}{\sin y^3}$$

(ii) Write short notes on assignment statement and library functions with examples.   3+5

(b) (i) Find the value of AJ if AJ = 2*B/2 − L*(M/2) + C/(2**(1E01/2)) − LOG (J/2**L) where J = 4, L = 2, M = 3, C = 4·0, B = (12·5, − 4·0).

(ii) Write a FORTRAN Program to find the sum of two m×n matrices.   4+4

(c) (i) In Boolean algebra B using Hungtington's postulates, prove that :

$$\left(x+y\right)' = x'·y' \text{ and } \left(x·y\right)' = x' + y' \ \forall \ x, y \in B \ .$$

(ii) Give the decimal equivalent of the numbers :

$(100110)_2$ and $(1001·01)_2$.   4+4

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

(ii) What do you mean by subscript ? State the rules used to declare one dimensional array. 4+4

3. Answer any *three* questions : 4×3

(a) Distinguish between IF and Block IF statements.

4

(b) Transform the DNF : $abc + a'b'c' + a'bc' + ab'c'$ into CNF. 4

(c) What is the printed form of the output of the following statement :

PRINT 10, I, M, A, B

    10 FORMAT (5X, 12, 2X, 14//F6·2, 5X, E15·5)

Where I = -4, M = 2, A = $-4·1$, B = $-0·00142$.

4

(d) Explain with block diagram and truth tables the operations of NAND and NOR gates. 4

(e) Write a FORTRAN program to evaluate the integral

$$\int_0^1 \frac{1}{1+x^2} dx$$ using Trapezoidal rule. 4

(f) Minimize the following Boolean expression :

$$f(x, y, z) = \Sigma(0, 1, 2, 3, 7).$$ 4

4. Answer any *one* question :   2×1

(a) State the principle of duality in Boolean Algebra.

(b) Find the output of the following program segment :

             I = 2

             J = 5

             DO 10 K = 1, 5

             J = J + 1

             I = J * 2

             J = J + K

         10 CONTINUE

             PRINT *, I, J.

Group—B

(Optional Paper — I)

[Marks : 45]

(*Probability and Statistics*)

5. Answer any *one* question :   15×1

(a) (i) What do you mean by random experiment ?

   (ii) Give the classical definition of probability of an event and criticize the main drawbacks of the classical theory of probability.

   (iii) Show that the probability that exactly one of the events A and B occur is $P(A) + P(B) - 2P(AB)$.

   3+6+6

(b) (i) State Baye's theorem.

   (ii) There are two identical urns containing 4 white, 3 red balls and 3 white, 7 red balls respectively. An urn is chosen at random and a ball is drawn from it. Find the probability that the ball drawn is white.

   If the ball drawn is white, what is the probability that it was drawn from the first urn ?

(iii) Show that Poisson distribution is a limit of the Binomial distribution under certain condition to be stated by you. $3+6+6$

(c) (i) Consider the function $f(x) = \begin{cases} [x], & 1 < x < 2 \\ 0, & \text{elsewhere} \end{cases}$.

Is it a probability density function ? If so, find the distribution function.

(ii) The runs scored by cricketers X and Y during 8 consecutive innings are as follows :

| X : | 32 | 28 | 47 | 63 | 71 | 39 | 10 | 60 |
| Y : | 29 | 31 | 48 | 53 | 67 | 90 | 10 | 62 |

Find which of the batsman is more consistent in obtaining runs ?

$7+8$

6. Answer any *three* questions : 8×3

(a) The pdf of a random variable X is given by :

$$f(x) = \frac{e^2}{\sqrt{\pi}} e^{-\left(x^2 + 2x + 3\right)}, \ -\alpha < x < \alpha$$

Find the value of the expectation and variance of the distribution. 8

(Turn Over)

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

Height (cms.) :	60–64	65–69	70–74	75–79	80–84	85–89
Frequency :	8	28	118	66	16	8

(c) If λ and μ_r denote the mean and rth moment about the mean respectively of a Poisson distribution then prove that :

$$\mu_{r+1} = \lambda\left(\frac{d\mu_r}{d\lambda} + r\mu_{r-1}\right).$$

Hence find coefficient of Curtosis of this distribution.
8

(d) Calculate the S.D. of the following distribution :   8

Value :	10–20	20–30	30–40	40–50	50–60	60–70	70–80
Frequency :	2	4	4	8	6	3	2

(e) Given $x = 4y + 5$ and $y = kx + 4$ are the regression lines on x on y and y on x respectively. Show that $0 \le k \le \frac{1}{4}$. If $k = \frac{1}{16}$, find the mean of the variables and the coefficient of correlation between them.   8

(f) Obtain the mean and variance of Normal distribution.
8

7. Answer any *two* questions : 3×2

(a) Show that correlation coefficient between two variables is independent of the origin. 3

(b) In an examination 30% of the students failed in Mathematics, 15% of the students failed in Chemistry, and 10% if the students failed in both Chemistry and Mathematics. A student is selected at random. If he failed in Chemistry, then what is the probability that he passed in Mathematics ? 3

(c) Define compound event and mutually exclusive event. 3

(d) What are the coefficient of skewness and coefficient of curtosis ? Interpret. 3

Group—C

(Optional Paper — II)

[Marks : 45]

(Application of Mathematics in Finance and Insurance)

5. Answer any *one* question : 15×1

(a) (i) Derive briefly the nature and scope of the financial management in our life.

(ii) Define the steps of the financial management.

(iii) What is the difference between investing and speculating ?   6+5+4

(b) (i) Suppose you make an investment of ₹1,000. This first year the investment returns 12%, the second year it returns 6% and the third year it returns 8%. How much this investment be worth, assuming no withdrawal are made ?

(ii) What is annuity ? Prove that the amount of an annuity due for n period is :

$$n = \left(1+i\right)\frac{A}{i}\left\{\left(1+i\right)^n - 1\right\}$$

where A is annuity and i is the rate of interest per year.

(iii) Define Markowitz Portfolio Model with identification of each term. What are the demerits of this model ?   4+5+6

6. Answer any *two* questions :   8×2

(a) (i) If you deposit ₹1,00,000 today, a bank promises to pay you annually ₹20,000 for six years. What interest rate is implicit in this offer ?

(ii) What is the importance of insurance in human life ? 5+3

(b) What are the differences between profit maximization and wealth maximization ? 8

(c) Assume that you are the manager of professional soccer team and you are negotiating a contract with your team's star player. You can afford to pay the player only ₹1·5 crore a year over three years. The player's agent insists that the player will not accept the contract with a nominal value less than ₹5 crore. Can you meet the agent's demand without relaxing your financial constraint, on how much you can to pay him ? Assume that the rate of interest is 12% per year. 8

7. Answer any *two* questions : 4×2

(a) Define present value and future value of money for discrete cases. 4

(b) What are the difference between Risk and Gambling ? 4

(c) Define Newton-Raphson method to calculate internal rate of return. 4

8. Answer any *two* questions :   3×2

(a) What types of risk can be eliminated or reduced by holding a larger portfolio ?   3

(b) Find the compound interest of ₹5,000 for 4 years @ 8% p.a.   3

(c) What do you mean by the time value of money ?

3

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TB—