# 2022

## MATHEMATICS — GENERAL

Paper: GE/CC-4

Full Marks: 65

The figures in the margin indicate full marks.

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

### Group - A

1. Choose the correct answer:

1×10

- (a) Which of the following set is a group with respect to addition
  - (i)  $\{-3, -2, -1, 0, 1, 2, 3\}$
- (ii)  $\{-1, 1\}$

(iii)  $\{-1, 0, 1\}$ 

- (iv)  $\{0\}$ .
- (b) -2 is an eigenvalue of the matrix  $M = \begin{pmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{pmatrix}$ . Then  $M^{-1}$  has an eigenvalue
  - (i) -2

(ii) 1

(iii) 2

- (iv)  $-\frac{1}{2}$
- (c) Probability that at least one of the events A and B occurs is
  - (i) P(A) + P(B) P(AB)
- (ii) P(A) + P(B) + 2P(AB)
- (iii) P(A) + P(B) + P(AB)
- (iv) P(A) + P(B) 2P(AB)
- (d) Number of divisor of zero in the Ring  $(\mathbb{Z}_5, \oplus, \odot)$  is
  - (i) 0

(ii) 1

(iii) 2

- (iv) 3
- (e) If (0, 1, 3) = a(2, 1, 1) + b(4, 2, 2), then the values of a and b are
  - (i) (1, 1)

(ii) (-1, 1)

(iii) (0,0)

(iv) None of these.

(f) For the probability density function given by  $f(x) = \begin{cases} e^{-x}, & x \ge 0 \\ 0, & \text{elsewhere} \end{cases}$ 

the mean is

(i) 1

(ii)  $\frac{1}{2}$ 

(iii) 2

- (iv) 4
- (g) If  $E(T_1) = \theta_1 + \theta_2$  and  $E(T_2) = \theta_1 \theta_2$ , then the unbiased estimator of  $\theta_1$  is
  - (i)  $T_1 + T_2$

(ii)  $\frac{1}{2}(T_1 - T_2)$ 

(iii)  $\frac{1}{2}(T_1 + T_2)$ 

- (iv)  $\frac{1}{2}(T_2 T_1)$
- (h) Binary number corresponding to the decimal number 27.625 is
  - (i) 11011.101

(ii) 10111.101

(iii) 11101.011

- (iv) 11011.011
- (i) Which of the following can be a variable name in C?
  - (i) Volatile

(ii) True

(iii) Friend

- (iv) Export.
- (j) The value of the FORTRAN expression : (A\*(B+C))/D + A, where A = 3, B = 5, C = -2 and D = 4 is
  - (i) 3

(ii) 4

(iii) 5

(iv) 6

Group-B

Unit-1

(Algebra - II)

2. Answer any three questions:

5×3

- (a) Prove that the set  $Q \setminus \{-1\}$  is a group with respect to the composition 'o' defined by aob = a + b + ab. Is it abelian?
- (b) Show that the ring of matrix  $\begin{bmatrix} a & b \\ 2b & a \end{bmatrix}$ :  $a, b \in \mathbb{R}$  does not form a Field,  $\mathbb{R}$  being the set of all real numbers.
- (c) Is the set  $U = \{(x, y, z) \in \mathbb{R}^3 : x 2y + 3z = 0\}$  a subspace of the real vector space  $\mathbb{R}^3$ ? If so, find the basis and dimension of this subspace.

- (d) Find the eigenvalues and eigenvectors of the matrix  $\begin{pmatrix} 1 & -1 & 2 \\ 2 & -2 & 4 \\ 3 & -3 & 6 \end{pmatrix}$ .
- (e) Show that the real quadratic form  $5x^2 + y^2 + 14z^2 4yz 10zx$  is positive definite.

#### Unit-2

### (Computer Science and Programming)

- 3. Answer any four questions:
  - (a) Find the product of (11.0011)<sub>2</sub> and (10.01)<sub>2</sub> and also find the octal and hexadecimal equivalents of the product.
  - (b) Draw a flowchart for computing the g.c.d. of two positive integers m and n.
  - (c) (i) Let A = 2.7, B = 3.5 and L = ABS (A 3.\*B)/5. Find what will be stored at L.

(ii) Write FORTRAN expression of 
$$\frac{\sqrt{a + \log_e b}}{c + d \sin x}$$
 2+3

- (d) Write an algorithm to sort n given integers in descending order.
- (e) Write a FORTRAN program to find the area of a triangle whose three sides are given.
- (f) What is positional number system? Why are binary numbers used in computer design? 2+3
- (g) Write a FORTRAN program to check whether a year is a Leap year or not.

#### Unit-3

### (Probability and Statistics)

## 4. Answer any four questions :

- (a) Bag A contains 2 white and 3 red balls; and bag B contains 4 white and 5 red balls. One ball is drawn at random from one of the bags and it is found to be red. Find the probability that it was drawn from bag B.
- (b) Four persons are chosen at random from a group containing 3 men, 2 women and 4 children. Show that the chances that exactly two of them will be children is  $\frac{10}{21}$ .
- (c) Find the coefficient of correlation from the following data:

x	$x \mid 0 \mid 1$		2	3	4
f	2	3	5	10	5

(d) Draw a Histogram from the following distribution:

Age Group	14-15	16-17	18-20	21-24	25 – 29	30-34	35 – 39
No. of wage earners	60	140	150	110	110	100	90

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5

5×4

(e) The population of scores of 10 years children in a test is known to have a standard deviation 5.2. If a random sample of size 20 shows a mean of 16.9, find 95% confidence interval for the mean score of the population, assuming that the population is normal.

Given that 
$$\frac{1}{\sqrt{2\pi}} \int_{1.96}^{\infty} e^{-\frac{x^2}{2}} dx = 0.025$$
.

- (f) If the equations of two regression lines obtained in a correlation analysis are 2y + x = 11 and 2x + 3y 18 = 0, determine which one of them is the regression equation of x on y. Find the means and correlation coefficient of x and y.
- (g) In a random sample of size 400 there are 80 defective items. Test at 5% level whether the proportion of defective items in the population may be regarded as  $\frac{1}{6}$ .

Given 
$$\int_{0}^{1.96} \phi(t)dt = 0.475, \phi \text{ is the pdf of normal variate}.$$