

(For the students whose first two digits of registration number starts from 78 and 79)

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Time: 3 hrs.

Full Marks: 75

Attempt all the questions.

Group 'A'

[11×1=11]

Rewrite the correct option of each question in your answer sheet.

1. Let  $z_1 = \cos\theta_1 + i\sin\theta_1$  and  $z_2 = \cos\theta_2 + i\sin\theta_2$  are two complex numbers, then

A)  $\frac{z_1}{z_2} = \cos(\theta_1 + \theta_2) + i\sin(\theta_1 + \theta_2)$       B)  $\frac{z_1}{z_2} = \cos(\theta_1 - \theta_2) + i\sin(\theta_1 - \theta_2)$

C)  $\frac{z_1}{z_2} = \cos(\theta_1 + \theta_2) - i\sin(\theta_1 + \theta_2)$       D)  $\frac{z_1}{z_2} = \cos(\theta_1 - \theta_2) - i\sin(\theta_1 - \theta_2)$

2. The nature of the roots of the equation  $x^2 - x + 1 = 0$  are.

- A) Real and equal      B) Rational and unequal  
C) Irrational and unequal      D) Imaginary

3. The equation  $\sin x + \cos x = 2$  has

- A) unique solution      B) no solution  
C) finite solution      D) infinite solutions

4. The value of  $\sin\left(2\cos^{-1}\frac{1}{2}\right)$  is equal to

A)  $\frac{\sqrt{3}}{2}$       B) 1      C)  $\frac{1}{2}$       D) -1

5. What is  $\vec{a} \times \vec{b}$  if  $\vec{a} = (0, 2, 0)$  and  $\vec{b} = (0, 0, 2)$  ?

- A) (4, 0, 0)      B) (0, 4, 0)      C) (0, 0, 4)      D) (-4, 0, 0)

6. What is the foci of the hyperbola  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$  ?

- A)  $(0, \pm b)$       B)  $(0, \pm be)$       C)  $(0, \pm ae)$       D)  $(\pm be, 0)$

7. A fair coin is tossed ten times. What is the mean of the binomial distribution ?

- A) 2.5      B) 5      C) 10      D) 20

Contd...

8. The first order derivative of  $f(x) = 2x^2$  at  $x = 1$  ...

- A)  $\frac{1}{8}$       B)  $\frac{1}{4}$       C) 4      D) 8

9. The order of the differential equation  $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + x + 4 = 0$  is

- A) 1      B) 2      C) 3      D) 4

10. Solving a system of equations by Gauss eliminations method, a student obtained the following three equations  $x_1 + x_3 - x_2 = 1$ ,  $x_3 - x_2 = 1$ ,  $0.x_2 = -5$ . What relation can be drawn from above about the the system of given equations ?

- A) Only one solution      B) Two solution  
C) No solution      D) Infinite solution

11. If two like parallel forces of 5N and 15N act on the light rod at two points P and Q respectively 6m apart. The distance of resultant from the point Q is...

- A) 1 m      B) 1.5 m      C) 2.5 m      D) 4.5 m

Or

The supply and demand function for particular items are given by

 $P_s = 160 + 2Q^2$  and  $P_d = 240 - 3Q^2$  then the equilibrium quantity is

- A) 2      B) 4      C) 8      D) 16

Group 'B'

[8×5=40]

12. For binomial expansion of  $(1 + x)^n$ 

- a) Write it in expanded form. [1]  
b) Write down its first four coefficients. [1]  
c) What is the sum of all binomial coefficient when  $x = 1$  ? [1]  
d) If n is even, write the middle term. [1]  
e) If  $C(n, r_1) = C(n, r_2)$ , then write down the relation of  $r_1, r_2$  and n. [1]

13. Prove by mathematical induction,  $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$ , for every natural number n. [5]14. a) If  $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \frac{\pi}{2}$ , prove that  $xy + yz + zx = 1$  [3]

- b) Find the equation of a plane passing through (-3, -2, -1) and parallel to the plane  $2x + 5y - z = 0$ . [2]

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(3) 0081(Old course)

15. a) A factory has two machines P and Q. Machine P produces 70% of the total output and Q produces 45% of the total output. Further 10% of output of machine P and 8% output of machine Q are likely to be defective. If an output selected random is defective, write the probability of defective separately from P and Q. [2]
- b) Find the most likely price in Pokhara corresponding to Rs. 200 in Chitwan for one kilogram of orange using regression from the following data.[3]

	Pokhara	Chitwan
Average price	Rs. 160	Rs. 120
Standard deviation	8	12
Correlation coefficient =	0.6	

16. a) Write the statement of mean value theorem. [1]
- b) Write the derivate of  $y = \cosh x$  ? [1]
- c) Write the integration of  $\sqrt{a^2 + x^2} dx$  ? [1]
- d) Write the geometrical interpretation of mean-value theorem. [1]
- e) If  $f(x)$  and  $g(x)$  are two function with degree of  $f(x) <$  degree of  $g(x)$ , then what the types of function  $\frac{f(x)}{g(x)}$  is called ? [1]

17. Solve the differential equation by reducing in linear form  $\frac{dy}{dx} + \frac{y}{x} - x^2 = 0$  [5]

18. Using Simplex method, maximize  $P(x, y) = 50x + 60y$ , subject to constraints  $3x + 4y \leq 36$ ,  $9x + 4y \leq 60$ ,  $x, y \geq 0$ . [5]

19. a) A straight uniform rod is 3m long when a rod of 5N is placed at one end it balances about a point 25cm from the end. Find the weight of rod.[2]
- b) A force equal to 4.9N acting on a body changes its velocity from 3m/s to 5m/s when it covers a distance of 16m. Find the mass of body. [3]

Or

- a) A firm has demand function  $P = 108 - 5Q$  and the cost function  $C = -12Q + Q^2$ . Find the price at which the profit in maximum. [2]
- b) A person deposits Rs. 1,00,000 in the bank which pays the compound interest 10% p.a. to its customer. What will be the total value of deposit after 5 years if [3]
- i) no extra deposits are made ?
- ii) Rs. 20,000 is deposited at the end of each year ?

0081(Old course) (4)

Group 'C'

[3×8=24]

20. a) Rita has 16<sup>th</sup> birthday party. She has invited 12 friends of whom 7 are relatives. In how many ways can she invite 6 guests so that 4 of them may be relatives ? [3]
- b) Find the sum of the first  $n$  terms of the natural numbers using mathematical induction. [2]
- c) Find the values of  $x, y$  and  $z$  by using matrix method of the equations  $2x - y + z = -1$ ,  $x - 2y + 3z = 4$  and  $4x + y + 2z = 4$ . [3]
21. a) Find the direction cosines of two lines which satisfy the relation  $2l + 2m - n = 0$  and  $lm + mn + nl = 0$ . Also find the angle between two lines. [5]
- b) Prove by vector method  $\sin(A-B) = \sin A \cos B - \cos A \sin B$  [3]
22. a) State Rolle's theorem, interpret it geometrically and verify it for  $f(x) = x(x - 3)^2$  for  $x \in [0, 3]$ . [5]
- b) Evaluate :  $\lim_{x \rightarrow 5} \frac{x^2 - 25}{5 + 4x - x^2}$ , using L-Hospital's rule. [3]

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