



2018 VI 12

1430

Seat No. :

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Time : 2½ Hours

MATHEMATICS &amp; STATISTICS (New Pattern)

Subject Code

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Total No. of Questions : 30

(Printed Pages : 7)

Maximum Marks : 80

- INSTRUCTIONS:**
- 1) **All** questions are **compulsory**.
  - 2) The question paper contains **30** questions divided into **five** Sections **A, B, C, D** and **E**.
  - 3) Section **A** contains **7** questions of **1** mark **each**, which are multiple choice type questions, Section **B** contains **7** questions of **2** marks **each**, Section **C** contains **7** questions of **3** marks **each**, Section **D** contains **7** questions of **4** marks **each**, Section **E** contains **2** questions of **5** marks each.
  - 4) There is no overall choice in the paper. However internal choice is provided in **2** questions of **3** marks, **2** questions of **4** marks and **2** questions of **5** marks. In questions with choices **only one** of the choices to be attempted.
  - 5) **Use** of calculators is not **permitted**.
  - 6) Logarithm- tables will be **provided** on request.
  - 7) **Graph** should be drawn on answer paper only.

## SECTION – A

Question numbers **1** to **7** carry **1** mark **each**.

In each question, **four** options are provided, out of which **one** is correct. Select and write the correct option.

1. A square matrix in which all the non-diagonal entries are zero and diagonal entries are same numbers is called \_\_\_\_\_ matrix.
  - Symmetric
  - Scalar
  - Skew-symmetric
  - Singular



2. If  $R$  is a relation defined on set of integers  $z$ , such that  $R = \{ (a, b) : |a - b| \text{ is a multiple of } 3 \}$  then  $R$  is \_\_\_\_\_
- Reflexive but not symmetric
  - Symmetric but not reflexive
  - Symmetric and reflexive
  - Neither reflexive nor symmetric
3. If  $a * b = a + b - 7$ , where  $a, b \in R$ , then identity element of the binary operation ' $*$ ' is \_\_\_\_\_
- 0
  - 7
  - 6
  - -6
4. If  $y = \sin^2 5x$  then  $\frac{dy}{dx} =$  \_\_\_\_\_
- $\cos^2 5x$
  - $5 \cos^2 5x$
  - $5 \sin 10x$
  - $10 \sin 5x$
5.  $\int \tan x dx =$  \_\_\_\_\_ +C.
- $\sec^2 x$
  - $\tan x \sec x$
  - $\log |\sin x|$
  - $\log |\sec x|$
6. In Bill of exchange, the difference between Banker's discount and true discount is called
- Banker's gain
  - Face value
  - Discounted value
  - Present value
7. In an Annuity if the first periodic payment is done after lapse of some periods then the annuity is called
- Ordinary Annuity
  - Annuity due
  - Deferred Annuity
  - Sinking fund

### SECTION – B

Question numbers **8** to **14** carry **2** marks each.

8. If  $A = \begin{bmatrix} 1 & 0 \\ -1 & 1 \\ 2 & 1 \end{bmatrix}$ ,  $B = \begin{bmatrix} 2 & 3 \\ 4 & -1 \\ 5 & 6 \end{bmatrix}$  and  $C = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$  then find  $(2A - B) C$ .



9. If  $f$  and  $g$  are two real valued functions such that  $f(x) = x^2 + 2$  and  $g(x) = \sqrt{x+1}$  then find  $f \circ g$  and  $g \circ f$ .
10. If  $P = (3, 4)$ ,  $Q = (2, 2)$  and  $R = (1, 6)$ , then find area of  $\Delta PQR$  using determinants.
11. Find  $\int x e^{3x} dx$ .
12. A furniture dealer deals in sales of only tables and chairs. He has Rs. 5,00,000 to invest and a space to store at most 300 pieces. A table costs Rs. 2,500 and a chair costs Rs. 500. He can sell a table at a profit of Rs. 500 and a chair at a profit of Rs. 150. Formulate the constraints and objective function of this linear programming problem to maximise his profit.
13. Define 'Independent Events'. If  $A$  and  $B$  are two independent events,  $P(A) = \frac{3}{4}$  and  $P(B) = \frac{2}{3}$ , then find  $P(A \cup B)$ .
14. Variable cost of  $x$  units of a commodity is  $2x^2 + 3x$ , fixed cost is Rs. 1,800 and total revenue of  $x$  units is  $9x + 1808$ . Find the break even point of the commodity.

### SECTION – C

Question numbers **15** to **21** carry **3** marks **each**.

15. Find the matrices  $X$  and  $Y$  such that

$$X + Y = \begin{bmatrix} 2 & 1 \\ -1 & 1 \end{bmatrix}$$

$$X - 2Y = \begin{bmatrix} -1 & -2 \\ 2 & -2 \end{bmatrix}.$$



16. If  $Y = \sqrt{\frac{(3x+1)(1-2x)}{(2x-3)(5x+2)}}$ , find  $\frac{dy}{dx}$ .

17. Form the differential equation by eliminating the arbitrary constants A and B from  $Ax^2 + By^2 = 1$ .

18. P, Q and R invested in a partnership deed Rs. 2,00,000, Rs. 4,00,000 and Rs. 3,00,000 respectively. After 4 months P invested additional Rs. 2,00,000 and R invested Rs. 1,00,000. The profit for the year is Rs. 6,60,000. Find the share of each partner in the profit.

19. Solve the differential equation.

$$(x^2 + y^2) dx - xydy = 0.$$

OR

Find the particular solution of the differential equation

$$2x \tan y dx - (x^2 + 1) \sec^2 y dy = 0 \text{ when } x = 0 \text{ and } y = \frac{\pi}{4}.$$

20. In a partnership deed, Akbar and Birbal contributed Rs. 9,000 and Rs. 8,000 respectively. They decided to share their profit in the ratio of their capital. At the end of the year Akbar gets Rs. 2,000 more than Birbal as a share of profit. Find the total profit and share of each partner.

21. The cost function of the firm is given by  $C(x) = 900 - 10x + x^2$ . Find the output x, at which the cost is minimum.

OR

The demand function for a product is given by  $P = 34 + 3x + \frac{27}{x}$ . Find total revenue function and marginal revenue function. Also find x so that the marginal revenue is equal to average revenue.



SECTION – D

Question numbers from **22** to **28** carry **4** marks **each**.

$$\begin{aligned} 22. \text{ If } f(x) &= \frac{e^{2x} - 1}{\log(1+x)} \quad \text{if } -1 < x < 0 \\ &= Ax + B \quad \text{if } 0 \leq x \leq 2 \\ &= \frac{x^2 - 4}{x^2 + x - 6} \quad \text{if } 2 < x < 3 \end{aligned}$$

and  $f$  is continuous at  $x = 0$  and  $x = 2$ , find the values of  $A$  and  $B$ .

23. If  $x = t \sin t + \cos t$  and  $y = t \cos t - \sin t$ , where  $t$  is the parameter, then find  $\frac{dy}{dx}$  when  $t = \frac{\pi}{4}$ .

24. Prove that 
$$\begin{vmatrix} x & x^2 & y+z \\ y & y^2 & z+x \\ z & z^2 & x+y \end{vmatrix} = (x-y)(y-z)(z-x)(x+y+z)$$

using properties of determinant.

OR

Find the value of  $x$  if 
$$\begin{vmatrix} x+1 & 3 & 5 \\ 2 & x+2 & 5 \\ 2 & 3 & x+4 \end{vmatrix} = 0$$
 using properties of determinants.



25. Evaluate  $\int_3^7 \frac{\sqrt[3]{16-x}}{\sqrt[3]{16-x} + \sqrt[3]{6+x}} dx$ .

26. Solve the following linear programming problem graphically

$$\text{Maximize } Z = 10x + 15y$$

Subject to the constraints

$$y - 2x \leq 2$$

$$x + y \geq 2$$

$$x \leq 1$$

$$x, y \geq 0$$

27. For X, Y, Z the probabilities of being selected as the manager of a firm are  $\frac{4}{7}, \frac{1}{7}$  and  $\frac{2}{7}$  respectively. The respective probabilities for them to introduce a radical change in marketing strategy are 0.3, 0.8 and 0.5. If change in marketing strategy took place, then find the probability that it is due to the appointment of Y.

OR

An Urn contains 4 white balls, 3 red balls and 5 green balls. If four balls are drawn from the urn one by one with replacement, then find the probability that all the balls are white. Also find the probability that at least one is white ball in the drawn of 4 balls.

28. A bill of Rs. 8,000 for 4 months was discounted for Rs. 7,904 on August 10<sup>th</sup> 2015. If the rate of interest is 6% per annum, then find the date on which the bill was drawn.



SECTION – E

Question numbers 29 to 30 carry 5 marks each.

29. Find  $\int \frac{(\sin x + 1) \cos x}{(\sin x - 1)(\sin x + 2)(\sin x + 3)} dx$ .

OR

Find  $\int \frac{5x + 2}{\sqrt{3x^2 + 2x + 1}} dx$ .

30. Find present value of a sequence of annual payments of Rs. 3,000 each if first payment being made at the end of 4 years, the last at the end of 12 years and money worth 7 % per annum compounded annually. [Given that  $(1.07)^{-3} = 0.8164$ ,  $(1.07)^{-4} = 0.7629$ ,  $(1.07)^{-8} = 0.5820$  and  $(1.07)^{-12} = 0.5326$ ]

OR

At the beginning of each quarter year Rs. 5,000 is deposited in a bank account that pays interest of 8% per annum compounded quarterly. Find the amount in the account at the end of 3 years (Use log tables).

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