Half Yearly Examination 2024 – 2025

Time - 3:00 Hrs.   **M.M. 80**

Section – A

General Instructions :

1.   This Question paper contains five sections A, B, C, D, and E. Each section is compulsory. However, there is some internal choice in some questions.
2.   Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3.   Section B has 5 Very Short Answer (VSA) questions of 2 marks each.
4.   Section C has 6 Short Answer (SA) questions of 3 marks each.
5.   Section D has 4 Long Answer (LA) questions of 5 marks each.
6.   Section E has 3 source-based/case-based passage-based/integrated units of assessment (04 marks each) with sub-parts.
7.   Internal Choice is provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D. You have to attempt only one alternative in all such questions.

Q.1   What is the value of x in the equation $2x + 5 = 11$?

(a) 2   (b) 3   (c) 4   (d) 5

Q.2   Which of the following is a true statement?

(a) $2 > 3$ (b) $2 < 3$ (c) $2 = 3$ (d) $2 \geq 3$

Q.3   What is the order of the matrix $\begin{bmatrix} 2 & 4 \\ 3 & 5 \end{bmatrix}$?

(a) 2×2 (b) 3×3 (c) 2×3 (d) 3×2

Q.4   What is the value of det(A) where $A = \begin{bmatrix} 3 & 5 \\ 2 & 4 \end{bmatrix}$?

(a) 2   (b) 3   (c) 5   (d) 7

Q.5   What is the derivative of $f(x) = 3x^2$?

(a) 6x   (b) 3x   (c) 2x   (d) x

Q.6   What is the maximum value of $2x^3 - 5x^2 + 3x + 1$?

(a) 2   (b) 3   (c) 5   (d) 7

Q.7   What is the value of $\int (2x + 3)\, dx$

(a) $x^2 + 3x + c$ (b) $x^2 - 3x + c$ (c) $x^2 + 2x + c$ (d) $x^2 - 2x + c$

Q.8   What is the general solution of $\dfrac{dy}{dx} = 2x$

(a) $y = x^2 + c$ (b) $y = x^2 - c$ (c) $y = 2x^2 + c$ (d) $y = 2x - c$

Q.9   What is the formula for sinking fund?

(a) $A = P\left(1 + \dfrac{r}{n}\right)^{nt}$ (b) $A = P\left(1 - \dfrac{r}{n}\right)^{nt}$ (c) $A = P\left(1 + \dfrac{r}{n}\right)^{\frac{n}{t}}$ (d) $A = P\left(1 + \dfrac{r}{n}\right)^{\frac{n}{t}}$

Q.10   What is the formula for EMI?

(a) EMI $= \dfrac{P + Pni}{2n}$

(b) EMI $= \dfrac{P + Pni}{n}$

(c) EMI $= \dfrac{Pni}{n}$

(d) EMI $= \dfrac{Pni - P}{n}$

Q.11   What is the formula for written growth?

(a) $A = 12 \left| \dfrac{(1+i)^n - 1}{t} \right|$

(b) $P\left(r - \dfrac{r}{n} \right)^{nt}$

(c) $A = S\dfrac{\bar{n}}{i}$

(d) $\left(1 + \dfrac{r}{n} \right)^n$

Q.12   What is the formula for depreciation?

(a) $D = \dfrac{(C \times R \times T)}{100}$

(b) $D = \dfrac{(C \times R \times T)}{200}$

(c) $D = \dfrac{(C \times R \times T)}{300}$

(d) $D = \dfrac{C.P - S.P}{no.\ of\ life}$

Q.13   What is the value of $\dfrac{d}{dx}\left(x^2 + 4x - 5 \right)$?

(a) $(x+2)$

(b) $(2x-4)$

(c) $(2x+4)$

(d) 0

Q.14   Which of the following is a true statement about matrices?

(a) A + B = B + A

(b) A − B = B − A

(c) A × B = B × A

(d) A ÷ B = B ÷ A

Q.15   What is the determinant of the matrix $\begin{vmatrix} 1 & 2 \\ 3 & 4 \end{vmatrix}$

(a) 2

(b) 3

(c) –2

(d) 7

Q.16   What is the derivative of $f(x) = 2x^3 - 5x^2 + 3x + 1$

(a) $6x^2 - 10x + 3$

(b) $6x^2 + 10x - 3$

(c) $6x^2 - 10x - 3$

(d) $6x^2 + 10x + 3$

Q.17   What is the integral of $\left(3x^2 + 2x - 1 \right) dx$?

(a) $x^3 + x^2 - x + c$

(b) $x^3 - x^2 + x + c$

(c) $x^3 + x^2 + x + c$

(d) $x^3 - x^2 - x + c$

Q.18   What is the solution to the differential equation $\dfrac{dy}{dx} = e^x$?

(a) $y = e^x + c$

(b) $y = e^x - c$

(c) $y = 3e^x + c$

(d) $y = 10e^x + c$

Question 19 to 20 are assertion reasons questions.

Answer these question by selecting instructions given below:

(a) Both A&R are true and R is the correct explanation of A

(b) Both A&R are true and R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

Q.19   Assertion (A): Every square matrix can be expressed as the sum of symmetric and show –
           symmetric matrixes.
       Reason (R):   (A+A′) is symmetric matrix and (A–A′) is Skew symmetric matrix.

Q.20 Assertion (A) : $y = Se^x + 4$ is the solution of the differentiate equation $\frac{dy}{dx} = y - 4$.

Reason (R) : $\frac{d}{dx} e^x = e^x$.

Section – B (each question 2 marks)

Q.21 Write the product of the matrix $A = \begin{vmatrix} 3 & 4 & 5 \\ 6 & 7 & 8 \\ 9 & 1 & 2 \end{vmatrix}$ matrix $B = \begin{vmatrix} 7 & 8 & 9 \\ 4 & 3 & 2 \\ 0 & 1 & 2 \end{vmatrix}$.

OR

Evaluate the determinant of the matrix $\begin{bmatrix} 5 & 4 & 3 \\ 2 & 1 & 0 \\ 3 & 4 & 5 \end{bmatrix}$.

Q.22 Find the derivative of $(x-a)^2 + (y-b)^2 = c^2$.

Q.23 Find the maximum value of $f(x) = \frac{24 - 2x}{2x + 4}$.

OR

Evaluate $\int \frac{2x+3}{x^2 + 3x + 4} dx$.

Q.24 Find $\frac{dy}{dx}$ of $x = \log t \quad y = \frac{1}{t}$.

Q.25 What is the present value of a perpetuity of ₹ 500 payable at the end of each year, if the rate of interest is 5% per annum?

Section – C (each question 3 mark)

Q.26 Find the inverse of the matrix $A = \begin{bmatrix} 7 & 2 & 1 \\ 5 & 3 & 4 \\ 9 & 8 & 3 \end{bmatrix}$.

Q.27 Find the derivative of $f(x) = x^p y^q = (x+y)^{p+q}$ and evaluate it at $x = 2$.

Q.28 Evaluate $\int_0^2 (3x^2 + 2x - 1) dx$.

Q.29 Solve the differential equation $\frac{dy}{dx} = \sqrt{\frac{(x-3)(x^2+4)}{3x^2 + 4x + 5}}$ and find the particular solution if $x = 2$.

Q.30 Find a loan EMI of ₹ 150,000 for 10 years at rate of 12% compounded and also find total intrest.

OR

Find the amount of sinking fund required to repay a debt of ₹ 20,000 in 4 years, if the rate of interest is 5% per annum.

Q.31 Find the return on investment if the cost price of a machine is ₹ 10,000 and the selling price is ₹12,000.

OR

Find the depreciation value of a machine if the cost price is ₹15,000 and the rate of depreciation is 10% per annum.

Section – D (each question 5 marks)

Q.32 Solve the system of linear equations using Cramer's Rule:

X + 2y – z = 4
2x – 3y + 4z = 7
3x + y + 2z = 5

Find the values of x, y, and z

OR

Solve the system of linear equations using Cramer's Rule:

2x + 3y + z = 10
X – 2y + 3z = -3
3x + y – 2z = 4

Find the values of x, y, and z

Q.33 (a) A and B are playing a game where A wins 3 games for every 2 games won by B. If A wins 12 games, how many games did B win?

(b) A boat travels 24 km upstream in 6 hours and returns downstream in 4 hours. If the speed of the stream is 2 km/h, find the speed of the boat in still water.

OR

(a) A boat travels 36 km downstream in 6 hours and returns upstream in 8 hours. If the speed of the boat in still water is 12 km/h, find the speed of the stream.

(b) A and B are playing a game where the probability of A winning a game is $\frac{2}{3}$ and the probability of B winning a game is $\frac{1}{3}$. If A wins 4 games, what is the probability that B wins the next game?

Q.34 Evaluate the integral: $\int \frac{(3x+1)}{x^2+2x+3} dx$ Using partial fractions.

OR

Evaluate the integral: $\int \frac{(2x-3)}{x^2+4x-5} dx$ Using partial fractions.

Q.35 (a) Find the equation of the tangent and normal to the curve $y = x^3 - 2x^2 + x + 1$ at the point (1, 2).

(b) A balloon is rising vertically at a rate of 10 m/s. Find the rate at which its height is increasing when it is 20 m above the ground.
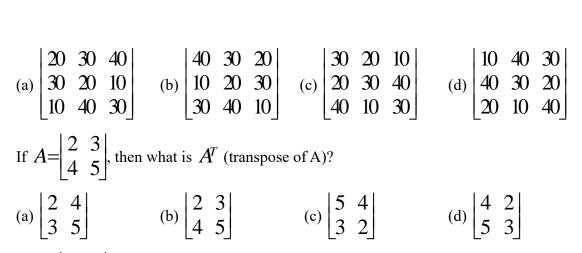
Section – E (each question 4 marks)

Case base studies questions

Q.36 A company has three departments, Production, Marketing, and Sales, and three resources, Labor, Material, and Equipment. The resource allocation data is given in the table below:

Department	Labor	Material	Equipment
Production	20	30	40
Marketing	30	20	10
Sales	10	40	30

(i) Which of the following matrices represents the resource allocation data?

$$\text{(a)} \begin{vmatrix} 20 & 30 & 40 \\ 30 & 20 & 10 \\ 10 & 40 & 30 \end{vmatrix} \quad \text{(b)} \begin{vmatrix} 40 & 30 & 20 \\ 10 & 20 & 30 \\ 30 & 40 & 10 \end{vmatrix} \quad \text{(c)} \begin{vmatrix} 30 & 20 & 10 \\ 20 & 30 & 40 \\ 40 & 10 & 30 \end{vmatrix} \quad \text{(d)} \begin{vmatrix} 10 & 40 & 30 \\ 40 & 30 & 20 \\ 20 & 10 & 40 \end{vmatrix}$$

(ii) If $A = \begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix}$, then what is A^T (transpose of A)?

$$\text{(a)} \begin{vmatrix} 2 & 4 \\ 3 & 5 \end{vmatrix} \qquad \text{(b)} \begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix} \qquad \text{(c)} \begin{vmatrix} 5 & 4 \\ 3 & 2 \end{vmatrix} \qquad \text{(d)} \begin{vmatrix} 4 & 2 \\ 5 & 3 \end{vmatrix}$$

(iii) If $B = \begin{vmatrix} 1 & 2 \\ 3 & 4 \end{vmatrix}$, then what is 2B?

OR

If $C = \begin{vmatrix} 6 & 5 \\ 2 & 3 \end{vmatrix}$, then what is C^{-1} (inverse of C)?

Q.37 A tank contains 100 liters of milk. 20 liters of milk is removed and replaced with an equal amount of water. This process is repeated two more times. Find the final amount of milk in the tank.

(i) What is the percentage of milk in the final mixture?
(a) 51.2% (b) 64.8% (c) 70.4% (d) 81.6%

(ii) How much milk is removed from the tank in total?
(a) 40 liters (b) 60 liters (c) 80 liters (d) 100 liters

(iii) What is the final amount of water in the tank?

OR

What is the ratio of milk to water in the final mixture?

Q.38 A company purchases a machine for ₹1,00,000. The machine has a useful life of 5 years and a residual value of ₹ 20,000. The company expects to earn a return of 20% per annum on its investment. Find the net profit earned by the company in the first year, considering depreciation.

(i) What is the net profit earned by the company in the first year?
(a) ₹16,000 (b) ₹18,000 (c) ₹20,000 (d) ₹22,000

(ii) What is the depreciation charged in the first year?
(a) ₹10,000 (b) ₹16,000 (c) ₹20,000 (d) ₹24,000

(iii) What is the book value of the machine at the end of the first year?

OR

What is the total profit earned by the company in the first year, before considering depreciation?

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