

**A-436 (E/H) HIGHER MATHEMATICS 2017**

**Time : 3 Hours |**

**Class : 12th**

**| M. M. : 100**

**Instructions:**

- (i) All questions are compulsory.
- (ii) Read instructions carefully of the question paper and then write answers of the question
- (iii) Question paper has two sections-Section 'A' and Section 'B'.
- (iv) In the Section 'A' Question Nos.1 to 5 are objective type. Each question carries 5 marks.
- (v) In the Section 'B' Question Nos. 6 to 26 has Internal option.
- (vi) Q.Nos 6 to 10 carry 2 marks each.
- (vii) Q. Nos. 11 to 14 carry 3 marks each.
- (viii) Q. Nos. 15 to 21 carry 4 marks each.
- (ix) Q. Nos. 22 to 26 carry 5 marks each.

**Section 'A'**

Q. 1. Choose the correct options:

$5 \times 1 = 5$

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- (i) if  $\frac{2x+3}{x^2+5x+6} = \frac{A}{x+2} + \frac{B}{x+3}$  then the value of  $A+B$  is :
- (a) 3 (b) 2  
(c) 5 (d) 4

(ii) The value of  $\tan^{-1} \frac{x}{\sqrt{1-x^2}}$  is:

(a)  $\cos^{-1} x$

(b)  $\cot^{-1} x$

(c)  $\sin^{-1} \frac{1}{x}$

(d)  $\sin^{-1} x$

(iii) The value of  $\int_1^3 x^2 dx$  is:

(a)  $\frac{26}{3}$

(b)  $\frac{28}{3}$

(c)  $\frac{25}{3}$

(d)  $\frac{8}{3}$

(iv) The unit vector in the direction of  $\vec{a}$  is:

(a)  $\frac{\vec{a}}{|\vec{a}|}$

(b)  $\vec{a} |\vec{a}|$

(c)  $a^2$

(d)  $\hat{i}$

(v) Differential coefficient of  $\log \sin x$  is:

(a)  $\cos x$

(b)  $\tan x$

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**Q.2. Write True/ False in the follwing statements:  $5 \times 1 = 5$**

- (i) The value of correlation coefficient lies between - 2 to + 2
- (ii) If regression coefficient are 0.8 and 0.2 then the value of correlation coefficient is + 0.4
- (iii) The function  $f(x) = 5x + 2$  is increasing on set of real numbers.
- (iv) If the position vector of centre of sphere is  $\vec{c}$  and radius is a then the vector equarion of sphere is  $|\vec{r} + \vec{c}| = a$ .
- (v) Two vectros  $\vec{a}$  and  $\vec{b}$  are perpendicular if  $\vec{a} \cdot \vec{b} = 0$

**Q.3. Fill in the blanks:  $5 \times 1 = 5$**

- (i) The perpendicular distance of a point (5, 12, 13) from Y-axis is.....
- (ii) The equation of the plane passing through the origin (0, 0, 0) is .....
- (iii) The intercept cut by the plane  $2x + y - z = 5$  on X-axis is .....
- (iv) The centre of the sphere  $x^2 + y^2 + z^2 + 3x + 5y + 2z = 0$  is .....
- (v) The differential coefficient of  $\sin 3x$  with respect to  $3x$  is.....

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Q.4. Give answer in one word/sentence:  $5 \times 1 = 5$

- (i) In Newton-Raphson's method write formula for finding square root of the number N.
- (ii) Write trapezoidal rule formula in numerical methods.
- (iii) Write cube root of 10 by Newton-Raphson's method after first iteration.
- (iv) In which interval does the root of equation  $x^3 + x - 3 = 0$  lie.
- (v) Write the coefficient of y with odd subscripts in Simpson's Rule.

Q.5. Match the correct pair.  $5 \times 1 = 5$

'A'

'B'

(a)  $\int \operatorname{cosec} x dx$

(i)  $\sec x + c$

(b)  $\int \frac{dx}{x\sqrt{x^2 - 1}}$

(ii)  $\frac{1}{2} \left[ x\sqrt{a^2 - x^2} + a^2 \sin^{-1} \frac{x}{a} \right] + c$

(c)  $\int \sqrt{a^2 - x^2} dx$

(iii)  $\log \left[ x + \sqrt{x^2 - a^2} \right] + c$

(d)  $\int \frac{dx}{\sqrt{a^2 - x^2}}$

(iv)  $\log \tan \frac{x}{a} + c$

(e)  $\int \frac{dx}{a^2 + x^2}$

(v)  $\sin^{-1} \frac{x}{a} + c$

(vi)  $\frac{1}{a} \tan^{-1} \frac{x}{a} + c$

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**Section B**

- Q.6. Prove that the vectors  $\vec{a} = 5\hat{i} + 15\hat{j}$  and  $\vec{b} = 3\hat{i} + 9\hat{j}$  are parallel. 2
- (OR) If the position vectors of the points A and B are  $7\hat{i} + 3\hat{j} + \hat{k}$  and  $2\hat{i} + 5\hat{j} + 4\hat{k}$  respectively, then find the magnitude of  $\vec{AB}$ .
- Q.7. The displacement of a particle by the force  $\vec{F} = 2\hat{i} - \hat{j} - \hat{k}$  is  $\vec{d} = 3\hat{i} + 2\hat{j} - 5\hat{k}$ , then find the work done by the force. 2

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(OR) If  $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$  and  $\vec{b} = 3\hat{i} + 2\hat{j} + \hat{k}$ , then find the value of  $\vec{a} \times \vec{b}$ .

Q.8. For what value of  $\lambda$  the planes  $\vec{r} \cdot (2\hat{i} + \lambda\hat{j} - 3\hat{k}) = 2$  and  $\vec{r} \cdot (\lambda\hat{i} - 3\hat{j} + \hat{k}) = 5$  are perpendicular to each other.

(OR) Write the formula to find the shortest distance between two straight lines whose vector equation are

$$\vec{r} = \vec{a}_1 + \lambda \vec{b}_1$$

$$\text{and } \vec{r} = \vec{a}_2 + \mu \vec{b}_2$$

where  $\lambda$  and  $\mu$  are scalars.

Q.9. Find the value of  $\int \frac{\cos(\log x)}{x} dx$ .

2



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(OR) Prove that  $\int \sec x \, dx = \log (\sec x + \tan x) + c$ .

Q. 10. find the value of  $\int x e^x \, dx$ . 2

(OR) find the value of  $\int x \tan^2 x \, dx$ .

Q. 11. Find the distance between the parallel planes  $2x - 2y + z + 3 = 0$  and  $4x - 4y + 2z + 5 = 0$ . 3

(OR) In which ratio does the YZ plane divide the line joining the points  $(-2, 4, 7)$  and  $(3, -5, 8)$ .

Q. 12. Prove that the symmetrical form of equation  $x = ay + b, z = cy + d$  is  $\frac{x-b}{a} = \frac{y}{1} = \frac{z-d}{c}$ . 3



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- (OR) Find the equation of the sphere whose centre is (3, 2, 1) and radius is 5.
- Q. 13. Prove by vector method that the angle in a semicircle is right angle. 3
- (OR) Prove that  $\vec{a} \times (\vec{b} + \vec{c}) + \vec{b} \times (\vec{c} + \vec{a}) + \vec{c} \times (\vec{a} + \vec{b}) = \vec{0}$
- Q. 14. Find the vector equation of the sphere where the points (2, 3, 5) and (4, 9, -3) are extremities of its diameter. 3
- (OR) Find the angle between the planes  $\vec{r} \cdot (2\hat{i} + 3\hat{j} + 4\hat{k}) = 1$  and  $\vec{r} \cdot (\hat{i} + \hat{j}) = 4$ .
- Q. 15. Resolve  $\frac{13x+18}{2x^2+5x+3}$  into partial fractions. 4
- (OR) Resolve  $\frac{8x^2-9}{(3x+2)(x^2+5)}$  into partial fractions.
- Q. 16. Prove that  $\cos^{-1} \frac{4}{5} + \tan^{-1} \frac{3}{5} = \tan^{-1} \frac{27}{11}$ . 4
- (OR) Express  $\sin \left[ 2 \tan^{-1} \sqrt{\frac{1-x}{1+x}} \right]$  in simplest form.
- Q. 17. Find differential coefficient of  $\sqrt{\tan \sqrt{x}}$  4
- (OR) If  $y = \cot^{-1} \left[ \frac{\sqrt{1+x^2} + 1}{x} \right]$ , then find the value of  $\frac{dy}{dx}$ .

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Q. 18. Differentiate  $(\cos x)^{\cos x}$  with respect to  $x$ . 4

(OR) if  $y = \sqrt{\cos x + \sqrt{\cos x + \sqrt{\cos x + \dots \infty}}}$  then prove that

$$1 - 2 \frac{dy}{dx} = \sin x$$

Q. 19. The side of a square sheet of metal is increasing at the rate of 5cm/minute. At what are its area is increasing when the side is 20cm long?

4

(OR) Find the maximum value of  $2x^3 - 24x + 107$  in the interval  $[1, 3]$ .

Q. 20. Calculate the correlation coefficient between  $x$  and  $y$  for the following data: 4

$x$	65	66	67	67	68	69	70	72
$y$	67	68	65	68	72	72	69	71

(OR) Calculate  $\text{cov}(X, Y)$  between two variables  $x$  and  $y$  where:

$$\sum x_i = 15, \sum y_i = 36, \sum x_i y_i = 110, n = 5$$

Q. 21. Prove that correlation coefficient is the geometric mean of the regression coefficients. 4

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(OR) Calculate regression coefficient  $b_{yx}$  and  $b_{xy}$  for variables  $x$  and  $y$  for the following data:

$$\sum x = 24, \sum y = 44, \sum xy = 306, \sum x^2 = 164, \sum y^2 = 574, n = 4$$

Q.22. Find the equation of the plane passing through the point  $(4, 5, 1)$ ,  $(0, -1, -1)$  and  $(-4, 4, 4)$ . 5

(OR) Prove that the lines  $\frac{x}{1} = \frac{y-2}{2} = \frac{z+3}{3}$  and  $\frac{x-2}{2} = \frac{y-6}{3} = \frac{z-3}{4}$  are coplanar. Find the point of intersection of these lines.

Q.23. If  $f(x) = \log_e \left( \frac{1-x}{1+x} \right)$  then prove that  $f(a) + f(b) = f\left(\frac{a+b}{1+ab}\right)$ .

(OR) Find the value of  $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{x^3}$

Q.24. Find the value of  $\int \frac{dx}{5+4\sin x}$  5

(OR) Prove that  $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\tan x}}{1+\sqrt{\tan x}} dx = \frac{\pi}{4}$ .

25. Solve the differential equation  $(x-1) \frac{dy}{dx} = 2x^3y$ . 5

(OR) Solve the differential equation  $\frac{dy}{dx} = \frac{x^2 + 5xy + 4y^2}{x^2}$ .

Q.26. A card is drawn at random from a well shuffled pack of 52 cards. Find the probability that it is neither an ace nor a king. 5

(OR) A fair coin is tossed six times. What is the probability of getting at least three heads.?