

List of 2 marks questions

- (1) Find the unit vector of  $3\hat{i} + 6\hat{j} - \hat{k}$
- (2) For given vectors  $\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}$  and  $\vec{b} = -\hat{i} + \hat{j} - \hat{k}$ , find the unit vector in the direction of  $\vec{a} + \vec{b}$ .
- (3) Find the projection of the vector  $\hat{i} - \hat{j}$  on the vector  $\hat{i} + \hat{j}$ .
- (4) Find the angle between the vectors  $\hat{i} + \hat{j} + \hat{k}$  &  $3\hat{i} + 4\hat{j} + 5\hat{k}$ .
- (5) Find the value of  $\lambda$ , so that the vectors  $\vec{a} = 3\hat{i} + 4\hat{j}$ , &  $\vec{b} = -5\hat{i} + \lambda\hat{j}$  are perpendicular to each other.
- (6) Find the scalar projection of  $\vec{a}$  on  $\vec{b}$  if  $\vec{a} = \hat{i} + \hat{j}$  and  $\vec{b} = \hat{j} + \hat{k}$ .
- (7) Find the vector projection of  $\vec{a}$  on  $\vec{b}$  if  $\vec{a} = \hat{i} - \hat{j} - \hat{k}$  and  $\vec{b} = 3\hat{i} + \hat{j} + 3\hat{k}$ .
- (8) Find  $(\vec{a} \times \vec{b})$ , if  $\vec{a} = \hat{i} - 7\hat{j} + 7\hat{k}$  and  $\vec{b} = 3\hat{i} - 2\hat{j} + 2\hat{k}$ .
- (9) Find the value of  $\lambda$ , so that the vectors  $\vec{a} = \lambda\hat{i} - 3\hat{j} + 5\hat{k}$  and  $\vec{b} = -\lambda\hat{i} + \lambda\hat{j} + 2\hat{k}$  are perpendicular.
- (10) Find the area of the parallelogram whose sides are vectors  $\hat{i} + 2\hat{j} + 3\hat{k}$  and  $-3\hat{i} - 2\hat{j} + \hat{k}$ .

List of 5 marks questions

- (1) Find the angle between the vectors  $\vec{a} = 3\hat{i} + 2\hat{j} - \hat{k}$  and  $\vec{b} = -2\hat{i} - 3\hat{j} + \hat{k}$ .
- (2) Find a vector in the direction of vector  $2\hat{i} - 3\hat{j} + 6\hat{k}$  which has magnitude 21 units.
- (3) Find a unit vector in the direction of the sum of the vectors  $\vec{a} = 2\hat{i} + 2\hat{j} - 5\hat{k}$  and  $\vec{b} = 2\hat{i} + \hat{j} - 7\hat{k}$ .
- (4) Find the value of  $p$  for which the vectors  $3\hat{i} + 2\hat{j} + p\hat{k}$  and  $\hat{i} - 2p\hat{j} + 3\hat{k}$  are parallel.

- (5) Write the value of cosine of the angle which the vector  $\vec{a} = \hat{i} + \hat{j} + \hat{k}$  makes with y-axis.
- (6) Find the sum of the vectors  $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$ ,  $\vec{b} = -2\hat{i} + 4\hat{j} + 5\hat{k}$  and  $\vec{c} = \hat{i} - 6\hat{j} - 7\hat{k}$ .
- (7) For what values of  $\vec{a}$ , the vectors  $2\hat{i} - 3\hat{j} + 4\hat{k}$  and  $a\hat{i} + 6\hat{j} - 8\hat{k}$  are collinear.
- (10) Write the position vector of mid-point of the vector joining points  $P(2, 3, 4)$  and  $Q(4, 1, -2)$
- (11) Find the vector projection of the vector  $\hat{i} + 3\hat{j} + 7\hat{k}$  on the vector  $7\hat{i} - \hat{j} + 8\hat{k}$ .
- (12) Show that the points  $A(1, 2, 7)$ ,  $B(2, 6, 3)$  and  $C(3, 10, -1)$  are collinear.
- (13) Find the area of the triangle with vertices  $A(1, 1, 2)$ ,  $B(2, 3, 5)$  and  $C(1, 5, 5)$ .
- (14) Find the area of the parallelogram whose adjacent sides are determined by the vectors  $\vec{a} = \hat{i} - \hat{j} + 3\hat{k}$  and  $\vec{b} = 2\hat{i} - 7\hat{j} + \hat{k}$ .

### List of 10 Marks question

- (1) Find the scalar and vector projection of the vector  $3\hat{i} - 3\hat{j} - 6\hat{k}$  on the line joining the points  $(3, 4, -2)$  and  $(5, 6, -3)$ .
- (2) Prove that the vectors  $2\hat{i} - \hat{j} + \hat{k}$ ,  $\hat{i} - 3\hat{j} - 5\hat{k}$  and  $3\hat{i} - 4\hat{j} - 4\hat{k}$  form a right angled triangle.
- (3) Find the scalar projection & vector projection of the vector  $9\hat{i} - 5\hat{j} + 7\hat{k}$  on the vector  $5\hat{i} - 8\hat{j} + 8\hat{k}$ .
- (4) Find a unit vector perpendicular to each of the vectors  $2\hat{i} - \hat{j} + \hat{k}$  and  $3\hat{i} + 4\hat{j} - \hat{k}$ . Find the sine of angle between the two vectors.
- (5) Calculate the modulus and the unit vector in the direction of the sum of the vectors  $\hat{i} + 4\hat{j} + 2\hat{k}$ ,  $3\hat{i} - 3\hat{j} - 2\hat{k}$  and  $-2\hat{i} + 2\hat{j} + 6\hat{k}$ .

## UNIT-2

### Limits and Continuity

List of 2 marks questions

- ① Find  $\lim_{x \rightarrow 0} \frac{\sin 2x}{\sin x}$ .
- ② Evaluate  $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$ .
- ③ Evaluate  $\lim_{x \rightarrow 0} \frac{e^{3x} - e^x}{x}$ .
- ④ Evaluate  $\lim_{x \rightarrow 2} \frac{\log(3x-5)}{x-2}$ .
- ⑤ Evaluate  $\lim_{x \rightarrow 2} \frac{\log(x-1)}{x^2-3x+2}$ .
- ⑥ Evaluate  $\lim_{x \rightarrow 0} \frac{\log(x+1)}{\sqrt{x+1}-1}$ .
- ⑦ Evaluate  $\lim_{x \rightarrow 0} \frac{3^x - 2^x}{4^x - 3^x}$ .
- ⑧ Evaluate  $\lim_{x \rightarrow 0} \frac{a^{2x} - 1}{x}$ .
- ⑨ Evaluate  $\lim_{x \rightarrow 0} \frac{3x^2 + 4x - 1}{2x^2 - 3x + 5}$ .
- ⑩ Evaluate  $\lim_{n \rightarrow \infty} \frac{n!}{(n+1)! - n!}$ .

List of 5 Marks questions

(1) Test the continuity of the functions

$$f(x) = \begin{cases} 2x+1 & \text{if } x \leq 0 \\ x & \text{if } 0 < x < 1 \\ 2x-1 & \text{if } x \geq 1 \end{cases} \quad \text{at } x = 0, 1$$

(2) Test the continuity of the function  $f(x) = \begin{cases} (1+2x)^{\frac{1}{x}} & \text{if } x \neq 0 \\ e^2 & \text{if } x = 0 \end{cases}$  at  $x = 0$ .

(3) Evaluate  $\lim_{x \rightarrow 1} \frac{2^x - 1}{\sqrt{x} - 1}$

(4) Evaluate  $\lim_{x \rightarrow 0} \frac{e^{3x} - e^{2x}}{e^{4x} - e^{3x}}$

(5) Evaluate  $\lim_{x \rightarrow 2} \frac{\log(3x-5)}{x-2}$

(6) Evaluate  $\lim_{x \rightarrow 0} \frac{e^{3x} - e^x}{x}$

(7) Evaluate  $\lim_{x \rightarrow 0} \frac{(3+x)^3 - 27}{x}$

(8) Test the continuity of the function  $f(x) = \begin{cases} \frac{\sin 2x}{x} & \text{if } x \neq 0 \\ 2 & \text{if } x = 0 \end{cases}$  at  $x=0$

(9) Evaluate  $\lim_{x \rightarrow 1} \frac{x-1}{\log x}$

(10) Evaluate  $\lim_{x \rightarrow 0} \sqrt{x} \{ \sqrt{x+1} - \sqrt{x} \}$  (11) Evaluate  $\lim_{x \rightarrow 0} \frac{\sin 7x}{\tan 5x}$ .

### List of 10 marks questions

(1) If  $f(x) = \begin{cases} ax^2 + b & \text{if } x < 1 \\ 1 & \text{if } x = 1 \\ 2ax - b & \text{if } x > 1 \end{cases}$  is continuous at  $x=1$ ,

then find  $a$  and  $b$ .

(2) Find the value of  $a$  such that the function  $f$  defined by

$f(x) = \begin{cases} \frac{\sin ax}{\sin x} & \text{if } x \neq 0 \\ \frac{1}{a} & \text{if } x = 0 \end{cases}$  is continuous at  $x=0$ ,

(3) Find the value of  $a$  if

$$\lim_{x \rightarrow 1} \frac{5^x - 5}{(x-1) \log a} = 5$$

(4) Evaluate  $\lim_{x \rightarrow 0} \frac{\sqrt{a+2x} - \sqrt{3x}}{\sqrt{3a+x} - 2\sqrt{x}}$

UNIT-3  
Derivatives

List of 2 marks questions

- (1) Find  $\frac{dy}{dx}$  if  $y = \sqrt{1 + \sin x}$
- (2) Find  $\frac{dy}{dx}$  if  $y = \sqrt{\frac{1 - \cos x}{1 + \cos x}}$
- (3) Find  $\frac{dy}{dx}$  if  $y = x \sin x - \frac{e^x}{1+x^2}$
- (4) Find  $\frac{dy}{dx}$  if  $y = \frac{1 - \tan x}{1 + \tan x}$
- (5) Find  $\frac{dy}{dx}$  if  $y = \cos(\ln x)^2$
- (6) Find  $\frac{dy}{dx}$  if  $y = \sqrt{\sin \sqrt{x}}$
- (7) Find derivatives of  $\sqrt{\sec(2x+1)}$
- (8) Find derivatives of  $\tan^{-1}(\sin^2 x)$
- (9) Find derivatives of  $\sin^{-1} \sqrt{\frac{1-x}{1+x}}$
- (10) Find derivatives of  $\cos^{-1} \sqrt{\frac{1+x}{2}}$
- (11) Find derivatives of  $\sin^{-1} \left( \frac{2x}{1+x^2} \right)$
- (12) Find derivatives of  $\cos^{-1}(2t^2-1)$
- (13) Find derivatives of  $\sin^{-1} 2x\sqrt{1-x^2}$
- (14) Find derivatives of  $(\log x)^{\tan x}$
- (15) Find derivatives  $x^{\sin x}$
- (16) Find  $\frac{dy}{dx}$  if  $x^2 + 3y^2 = 5$ .

(17) Find  $\frac{dy}{dx}$  if  $x = at^2$ ,  $y = 2at$  at  $t = \frac{1}{2}$ .

(18) Differentiate  $\tan^{-1}x$  w.r.t  $\cos^{-1}x$ .

(19) Differentiate  $\tan^{-1}x$  w.r.t  $\tan^{-1}\sqrt{1+x^2}$

(20) Find derivatives of  $\tan^{-1}(\sin^2 x)$

List of 5 marks questions

(1) Find  $\frac{dy}{dx}$  if  $x^y = y^x$

(2) Find  $\frac{dy}{dx}$  if  $y = (\sin x)^{\tan x}$

(3) Find  $\frac{dy}{dx}$  if  $x = a \cos^3 t$ ,  $y = a \sin^3 t$  at  $t = \frac{\pi}{4}$ .

(4) Find  $\frac{dy}{dx}$  if  $x = 3 \cos t - 2 \cos^3 t$ ,  $y = 3 \sin t - 2 \sin^3 t$ .

(5) Find  $\frac{dy}{dx}$  if  $y = \sec^{-1}\left(\frac{\sqrt{a^2+x^2}}{a}\right)$

(6) Differentiate  $\tan^{-1}\left(\frac{\sqrt{x}-x}{1+x^{3/2}}\right)$

(7) Find  $\frac{d\theta}{dt}$  if  $\tan \theta = \frac{1-t}{1+t}$

(8) Differentiate  $\frac{1-\cos x}{1+\cos x}$  w.r.t  $\frac{1-\sin x}{1+\sin x}$

(9) Differentiate  $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$  w.r.t  $\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$

(10) Find  $\frac{dy}{dx}$  if  $x^y = y^x$

(11) if  $x = \sin t$ ,  $y = \sin(pt)$ . then show that

$$(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + p^2y = 0.$$

(12) if  $y = \tan^{-1}x$  prove that

$$(1+x^2)y_2 + 2xy_1 = 0$$

- (13) Find  $\frac{dy}{dx}$  if  $x = a \cos \theta$ , &  $y = a(1 + \sin \theta)$  at  $\theta = \pi/4$
- (14) Find  $\frac{dy}{dx}$  if  $x^y = \sin x^{\cos x}$
- (15) Find  $\frac{dy}{dx}$  if  $y^x = x^{\sin y}$
- (16) Find  $\frac{dy}{dx}$  if  $\sin x = \frac{2t}{1+t^2}$ ,  $\tan y = \frac{2t}{1-t^2}$
- (17) Find  $\frac{dy}{dx}$  if  $x = a(\cos t + t \sin t)$   
and  $y = a(\sin t - t \cos t)$
- (18) Differentiate  $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$  w.r.t  $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$
- (19) if  $y = ax \sin x$  show that  $x^2 y_2 - 2xy_1 + (x^2 + 2)y = 0$
- (20) Find  $\frac{dy}{dx}$  if  $y^3 + 3x^2y - 2x = 10$

### List of 10 marks questions

- (1) Differentiate  $\tan^{-1}\left(\frac{\sqrt{x} + \sqrt{a}}{1 - \sqrt{ax}}\right)$
- (2) Find  $\frac{dy}{dx}$  if  $y = (\sec x + \tan x)^{\cot x}$
- (3) If  $x = \sin t$ ,  $y = \sin 2t$  then prove that  

$$(1-x^2) \frac{d^2y}{dx^2} - x \frac{dy}{dx} + 4y = 0$$
- (4) Find  $\frac{dy}{dx}$  if  $y = \tan^{-1}(\cos^x)$
- (5) Find  $\frac{dy}{dx}$  if  $y = (\cos x)^x + x^{\cos x}$ .
- (6) Find  $\frac{dy}{dx}$  if  $(\cos x)^y = (\cos y)^x$

(7) Find  $\frac{dy}{dx}$  if  $x = a(\theta + \sin\theta)$ ,  $y = a(1 - \cos\theta)$  at  $\theta = \pi/4$

(8) If  $y = \sin^{-1}x$ , then show that

$$(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} = 0$$

(9) If  $y = (\tan^{-1}x)^2$ , show that  $(x^2+1)^2 y_{xx} + 2x(1+x^2)y_x = 2$

(10) If  $y = A \sin x + B \cos x$ , then prove that

$$\frac{d^2y}{dx^2} + y = 0$$

### Partial Differentiation

#### List of 2 Marks questions

(1) If  $z = 2x^2y + xy^2 + 5xy$ , then find  $\frac{\partial z}{\partial x}$  and  $\frac{\partial z}{\partial y}$ .

(2) Find  $\frac{\partial z}{\partial x}$  &  $\frac{\partial z}{\partial y}$  if  $z = x^2 + 3xy$

(3) If  $f(x, y, z) = e^{xyz}$  then find  $x f_x + y f_y + z f_z$

(4) Find the degree of the function  $z = \tan^{-1}\left(\frac{x^3+y^3}{x+y}\right)$

#### List of 5 Marks questions

(1) If  $z = f\left(\frac{y}{x}\right)$ , show that  $x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} = 0$

(2) If  $z = \sin\left(\frac{x}{y}\right)$  then find  $\frac{\partial z}{\partial x}$  and  $\frac{\partial z}{\partial y}$

(3) State and prove Euler's Theorem.

(4) If  $z = \tan^{-1}\left(\frac{x^3+y^3}{x+y}\right)$  then show that  $x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} = \sin 2z$ .



UNIT-4  
Integration

List of 2 Mark Question

- (1)  $\int \left( 4 \cos x - 3e^x + \frac{2}{\sqrt{1-x^2}} \right) dx$
- (2)  $\int \frac{\sin x}{\cos^2 x} dx$
- (3)  $\int \frac{\sin^2 x}{1+\cos x} dx$
- (4)  $\int \sqrt{1-\cos 2x} dx$
- (5)  $\int \sqrt{1+\sin 2x} dx$
- (6)  $\int \sqrt{1+\cos 2x} dx$
- (7)  $\int \frac{dx}{1-\cos^2 x}$
- (8)  $\int e^{2 \tan x} \sec^2 x dx$
- (9)  $\int \frac{\sin^2 x}{\sqrt{1-x^2}} dx$
- (10)  $\int \frac{(\tan^{-1} x)^3}{1+x^2} dx$
- (11)  $\int \frac{3(\ln x)^2}{x} dx$
- (12)  $\int \frac{\operatorname{cosec}^2(\ln x)}{x} dx$
- (13)  $\int \frac{\operatorname{cosec}^2 x}{1+\cot x} dx$
- (14)  $\int \sin 3x \cos 2x dx$
- (15)  $\int \cos^3 x dx$
- (16)  $\int \frac{\cos^3 x}{\sin^4 x} dx$
- (17)  $\int \frac{dx}{\sqrt{25-x^2}}$
- (18)  $\int \tan^2 x dx$
- (19)  $\int x^2 e^x dx$
- (20)  $\int_{-3}^4 |x| dx$
- (21)  $\int_1^4 [x] dx$
- (22)  $\int_0^{\pi/4} \tan^2 x dx$
- (23)  $\int_0^{\pi/2} \frac{dx}{1+\tan x}$
- (24)  $\int_0^{\pi/4} \sin 2x \cdot \cos x dx$
- (25)  $\int_{-2}^1 (|x|+x) dx$
- (26)  $\int_0^2 [x^2] dx$

List of 5 Marks questions

(1)  $\int \frac{e^x + e^{-x}}{e^x - e^{-x}} dx$

(2)  $\int \sin^3 x \cos^3 x dx$

(3)  $\int (\ln x)^2 dx$

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

(5)  $\int e^{ax} \cos bx dx$

(6)  $\int e^{ax} \sin bx dx$

(7)  $\int e^x \left( \frac{1 + \sin x}{1 + \cos x} \right) dx$

(8)  $\int x \sin x dx$

(9)  $\int x \ln(1+x) dx$

(10)  $\int e^{3x} \cos 2x dx$

(11)  $\int e^{2x} \sin x dx$

(12)  $\int e^x \cos^2 x dx$

(13)  $\int \sin^3 x \cos^5 x dx$

(14)  $\int e^{\cos 2x} \sin 2x dx$

(15)  $\int \frac{dx}{\sqrt{25 - 16x^2}}$

(16)  $\int x^2 \tan x dx$

(17)  $\int x \sin x dx$

(18)  $\int_1^2 x \log x dx$

(19)  $\int_0^1 x \tan x dx$

(20)  $\int_0^{\pi/4} \log(1 + \tan x) dx$

(21)  $\int_0^{\pi/4} \frac{\sin x}{\sin x + \cos x} dx$

(22)  $\int_0^{\pi/4} \frac{\cos x}{\cos x + \sin x} dx$

(23)  $\int_0^{\pi/4} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx$

(24)  $\int_0^1 \frac{\ln(1+x)}{1+x^2} dx$

(25)  $\int_0^{\pi} \frac{x dx}{1 + \sin x}$

(26)  $\int \frac{dx}{\sqrt{9+x^2}}$

(27)  $\int \cos^5 x dx$

(28)  $\int \cos 4x \cdot \cos 3x dx$

(29) Find the area of the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

List of 10 Marks questions

(1) Find the area of the circle  $x^2 + y^2 = 9$

(2) Find the area of the region bounded by the ellipse  $\frac{x^2}{16} + \frac{y^2}{9} = 1$

(3) Find the area enclosed by the circle  $x^2 + y^2 = a^2$

(4) Find the area of the parabola  $y^2 = 4ax$ .

(5) Integrate  $\int_0^{\pi/2} \ln \sin x \, dx$

(6) Prove that  $\int_0^{\pi} x \ln \sin x \, dx = \frac{\pi^2}{2} \ln \frac{1}{2}$ .

(7)  $\int_0^1 \frac{e^x - e^{-x}}{e^x + e^{-x}} \, dx$

(15)  $\int \frac{\sin ax - \sin bx}{\cos ax - \cos bx} \, dx$

(8)  $\int \sqrt{x^2 - 4x + 2} \, dx$

(16)  $\int \sin^3 x \sec^{14} x \, dx$

(10)  $\int e^{2x} \sin 2x \, dx$

(17)  $\int \sin^{20} x \cos^3 x \, dx$

(11)  $\int \frac{dx}{x\sqrt{4x^2 - 9}}$

(12)  $\int \frac{x+5}{\sqrt{x^2+6x-7}} \, dx$

(13)  $\int \sec'' \theta \tan \theta \, d\theta$

(14)  $\int \cot \theta \cdot \operatorname{cosec} \theta \, d\theta$

## UNIT-5

### Differential Equation

#### List of 2 Marks questions

(1) Find the order and degree of the equation

$$a \frac{d^2y}{dx^2} = \left\{ 1 + \left( \frac{dy}{dx} \right)^2 \right\}^{3/2}$$

(2) Find the order and degree of the differential equation

$$\frac{d^2y}{dx^2} = \sqrt{1 + \frac{dy}{dx}}$$

(3) Find the general solution of  $\frac{dy}{dx} = \frac{e^{2y} + 1}{e^x}$

(4) Solve the differential equation of  $\frac{dy}{dz} = \sec y$

#### List of 5 Marks questions

(1) Solve  $(1+x^2) \frac{dy}{dx} + 2xy - x^3 = 0$

(2) Solve  $(1+x^2) \frac{dy}{dx} + 2xy = \cos x$

(3) Solve  $\frac{dy}{dx} + y \sec x = \tan x$

(4) Solve  $(1+y^2) dx + x dy = \tan^{-1} y dy$

(5) Solve  $(x^2-1) \frac{dy}{dx} + 2xy = 1$

(6) Solve  $\sin x \frac{dy}{dx} + 3y = \cos x$