S. B. Roll. No.....

APPLIED MATHEMATICS-II
2nd Exam/Common/0553/Nov'24
(For 2018 Batch Onwards)

Duration: 3Hrs. **M.Marks:75**

SECTION-A

Q1. a) Choose the correct answer. **15x1=15**

i. $\frac{d}{dx}(e^{2\log x}) =$ a) 2x b) $2^x \log_2 e$ c) e^x d) 1

ii. $\int_0^1 \frac{1}{1+x^2} dx =$ a) $\frac{\pi}{2}$ b) $\frac{\pi}{4}$ c) 1 d) 0

iii. If x = sin 2t, then velocity at $t = \frac{\pi}{2}$ is (x stands for displacement at time t) a) 0 b) –2 c) 2 d) 1

iv. The equation of the tangent to the curve $y = e^x$ at (0, 0) is a) x = 0 b) y = 0 c) x + y = 0 d) x – y = 0

v. Order of differential equation $(y_3)^2 + 3y_2 + 6y = x$ a) 1 b) 2 c) 3 d) 4

b) State True or False.

vi. $\int \log x dx = \frac{1}{x}$

vii. $\frac{d}{dx}(\sec^{-1} x + \operatorname{cosec}^{-1} x) = 0.$

viii. For tangent parallel to y-axis, $\frac{dy}{dx} = 0.$

ix. A corner point of a feasible region is a point in the region which is the intersection of the two boundary lines.

x. if y = log (sinx), then $\frac{dy}{dx} = \tan x$

c) Fill in the blanks.

xi. $\lim_{x\to 0} \frac{\sin x^\circ}{x}$ =_____

xii. In LPP, the objective function is always_____

xiii. The degree of the differential equation $(y_1)^3 + 3(y_2)^2 = 0$ is_____

xiv. $\int \frac{2x}{1+x^2} =$ _____

xv. $\int \cos^2 x dx =$ _____

SECTION-B

Q2. Attempt any six questions. **6x5=30**

a. Evaluate: $\int_0^\infty x^3 (a^2 + x^2)^{-7/2} dx$

b. If $y = \cot^{-1}\left(\frac{1-\cos x}{\sin x}\right)$, find $\frac{dy}{dx}$.

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c. Solve the differential equation $(1+x^2)\frac{dy}{dx}+2xy-4x^2=0$.

d. Evaluate $\int_0^{\pi/2}\frac{\sin x-\cos x}{1+\sin x\cos x}dx$

e. If $x^m y^n=(x+y)^{m+n}$ then prove that $\frac{dy}{dx}=\frac{y}{x}$.

f. Find equation of the tangent and normal to the curve $y=x^4-6x^3+13x^2-10x+5$ at (-1, 3).

g. A balloon which always remains spherical has a variable radius. Find the rate at which its volume and surface area is increasing with respect to its radius when the radius is 7cm.

h. Evaluate $\int\frac{\sin 2x}{a^2\sin^2 x+b^2\cos^2 x}dx$

i. Evaluate $\lim_{x\to 0}\frac{\cos 5x-\cos 11x}{\cos 3x-\cos 7x}$

SECTION-C

Q3. Attempt any three questions. **3x10=30**

i. Solve the following linear programming problem graphically.
Minimize Z = 20x + 10y, subject to the constraints
$x+2y\le 40$
$3x+y\ge 30$
$4x+3y\ge 60$
$x, y\ge 0$

ii. $x=a(\theta+\sin\theta)$; $y=a(1+\cos\theta)$ find $\frac{d^2y}{dx^2}$ at $\theta=\frac{\pi}{2}$

iii. Differentiate $(\sin x)^{\cos x}+(\cos x)^{\sin x}$ w. r. t. x.

iv. a) Determine the point of maxima of f(x) = sin x + cos x in $0\le x\le\frac{\pi}{2}$

b) Evaluate $\int x\log(1+x)\,dx$

v. Use trapezoidal rule to evaluate $\int_0^1 x^2\,dx$ taking 10 equal intervals.