

# AJAY KUMAR GARG ENGINEERING COLLEGE, GHAZIABAD

## Department of Applied Sciences & Humanities

### Sessional Test-2

Program: B.Tech  
Session : 2024-25  
Subject : Engineering Mathematics-I  
Max. Marks: 50

Semester: I  
Section: S-1 to S-9 & S-11 to S-20  
Subject Code: BAS-103  
Time: 2 Hours

#### OBE Remarks:

Q.No	1	2	3	4	5	6	7	8	9	10	11	12
CO No.	CO2	CO2	CO3	CO3	CO3	CO2	CO2	CO2	CO3	CO3	CO2	CO3
Bloom's Level* (L1 to L6)	L1	L2	L3	L1	L3	L4	L4	L5	L5	L6	L5	L5
Weightage CO2: 26.5						Weightage CO3: 23.5						

\*Bloom's Level: L1: Remember, L2: Understand, L3: Apply, L4: Analyze, L5: Evaluate, L6: Create

Note: Answer all the sections.

#### Section-A

(2\*5=10)

- Find the  $n^{th}$  derivative of  $y = x^2 \sin x$ .
- If  $u = f(r, s, t)$ , where  $r = \frac{x}{y}$ ,  $s = \frac{y}{z}$ ,  $t = \frac{z}{x}$ , show that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z} = 0$ .
- If  $u = x(1 - y)$ ,  $v = xy$ , find  $\frac{\partial(x,y)}{\partial(u,v)}$ .
- State the Taylor's Theorem for two variables.
- Expand  $e^x \log(1 + y)$  in the powers of  $x$  and  $y$  up to terms of first degree.

#### Section-B

(5\*5=25)

- If  $u = x^2 \tan^{-1}\left(\frac{y}{x}\right) - y^2 \tan^{-1}\left(\frac{x}{y}\right)$ ;  $xy \neq 0$  prove that  $\frac{\partial^2 u}{\partial x \partial y} = \frac{x^2 - y^2}{x^2 + y^2}$ .
- If  $u = f(r)$  where  $r^2 = x^2 + y^2$ , show that  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f''(r) + \frac{1}{r} f'(r)$ .
- If  $u = \sec^{-1}\left(\frac{x^3 - y^3}{x + y}\right)$ , prove that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 2 \cot u$ . Also evaluate  $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}$ .
- Expand  $f(x, y) = y^x$  about  $(1, 1)$  upto third degree terms and hence evaluate  $(1.02)^{1.03}$ .
- Find the relation between  $u, v, w$  for the values  
 $u = x + 2y + z$ ;  $v = x - 2y + 3z$ ;  $w = 2xy - zx + 4yz - 2z^2$ .

#### Section-C

(7.5\*2=15)

- If  $y = \sin(\arcsin x)$ , find  $(y_n)_0$ .
- If  $u^3 + v^3 + w^3 = x + y + z$ ,  $u^2 + v^2 + w^2 = x^3 + y^3 + z^3$  and  $u + v + w = x^2 + y^2 + z^2$ , then  
Find  $\frac{\partial(u, v, w)}{\partial(x, y, z)}$ .

Faculty Sign

HoD Sign