

A

Reg. No. :

--	--	--	--	--	--	--	--	--	--

**Question Paper Code: 51002**

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2019

First Semester

Civil Engineering

15UMA102- ENGINEERING MATHEMATICS-I

(Common to ALL branches)

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- $\lim_{x \rightarrow 1} \frac{x^2 - 1}{x - 1} =$  CO1-R  
(a) 0 (b) 1 (c) 2 (d) 3
- Suppose  $f(x) = \begin{cases} \frac{x^2 - x}{2x} & \text{if } x \neq 0 \\ k & \text{if } x = 0 \end{cases}$ . If  $f(x)$  is continuous at  $x=0$ , then the value of 'k' is CO1-R  
(a) -1 (b) 1 (c)  $-\frac{1}{2}$  (d)  $\frac{1}{2}$
- If  $u = (x - y)(y - z)(z - x)$  then  $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} =$  CO2-R  
(a) 1 (b) 0 (c) 3 (d) 6
- If  $x = r \cos \theta, y = r \sin \theta$  find  $\frac{\partial(x, y)}{\partial(r, \theta)}$  CO2-R  
(a) r (b)  $r^2$  (c) 0 (d) 2
- $\Gamma\left(\frac{1}{2}\right) =$  CO3-R  
(a) 1 (b)  $\frac{1}{2}$  (c)  $\sqrt{\pi}$  (d)  $\pi$

6.  $\int_0^{\frac{\pi}{2}} \cos^8 x dx =$  CO3-R
- (a)  $\frac{35\pi}{256}$                       (b)  $\frac{256}{35\pi}$                       (c)  $35\pi$                       (d) 256

7. Value of the double integral  $\int_0^1 \int_0^y dy dx$  is CO4-R
- (a) 0                      (b)  $\frac{1}{2}$                       (c)  $\frac{3}{2}$                       (d)  $\frac{3}{4}$

8.  $\int_0^{\frac{\pi}{2}} \int_0^{\sin \theta} r d\theta dr =$  CO4-R
- (a)  $\frac{1}{8}$                       (b)  $\frac{\pi}{2}$                       (c)  $\frac{\pi}{8}$                       (d)  $\pi$

9. The product of two eigen values of  $A = \begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$  is 16 then the CO5-R  
third eigen value is
- (a) 3                      (b) 2                      (c) 4                      (d) 5

10. If the product of two eigenvalues of third order singular matrix A is 34, CO5-R  
then the third eigenvalue of the matrix A is
- (a) 3                      (b) -1                      (c) 1                      (d) 0

PART – B (5 x 2= 10Marks)

11. Find CO1-R  
 $\frac{dy}{dx}$  given  $x = a \cos^3 \theta$ ;  $y = a \sin^3 \theta$ .

12. State Euler's theorem on homogeneous functions. CO2-U

13. Evaluate  $\int_0^{\frac{\pi}{2}} \sin^4 x \cos^2 x dx$  CO3-R

14. Prove that  $\int_{-1}^3 \int_{x^2}^{2+x} dy dx = \frac{8}{3}$ . CO4-R

15. State Cayley Hamilton theorem. CO5-U

PART – C (5 x 16= 80Marks)

16. (a) (i) Find  $\frac{dy}{dx}$  if  $y = \tan^{-1} \sqrt{\frac{1-\sin x}{1+\sin x}}$  CO1-App (16)

Or

(b) (i) If  $y = e^{ax} \sin bx$ , prove that  $\frac{d^2y}{dx^2} - 2a \frac{dy}{dx} + (a^2 + b^2)y = 0$  CO1-App (8)

(ii) Obtain the Maclaurin's series for  $\log(1+x)$  CO1-App (8)

17. (a) (i) Verify Euler's theorem for the function  $u = \sin^{-1} \frac{x}{y} + \tan^{-1} \frac{y}{x}$  CO2-App (8)

(ii) Given the transformations  $u = e^x \cos y$  and  $v = e^x \sin y$  and that  $\phi$  is a function of  $u$  and  $v$  and also of  $x$  and  $y$ , prove that CO2-App (8)

$$\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = (u^2 + v^2) \left[ \frac{\partial^2 \phi}{\partial u^2} + \frac{\partial^2 \phi}{\partial v^2} \right]$$

Or

(b) Given the transformation  $u = e^x \cos y$  and  $v = e^x \sin y$  and that  $f$  is a function of  $u$  and  $v$  and also of  $x$  and  $y$ , prove that CO2-App (16)

$$\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} = (u^2 + v^2) \left( \frac{\partial^2 f}{\partial u^2} + \frac{\partial^2 f}{\partial v^2} \right)$$

18. (a) (i) Evaluate  $\int \frac{1}{1+\cos x} dx$  CO3-App (8)

(ii) Evaluate  $\int e^{2\log x} e^{x^3} dx$  CO3-App (8)

Or

(b) Prove that CO3-App (16)

$$\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$$

19. (a) Change the order of integration  $\int_0^1 \int_{y^2}^{2-y} xydydx$  and hence evaluate it CO4-App (16)

Or

- (b) (i) Find the smaller area bounded by the CO4-App (8)  
parabolas  $y^2 = 4 - x$  and  $y^2 = 4 - 4x$ .

- (ii) Find the volume of the Sphere  $x^2 + y^2 + z^2 = a^2$ . CO4-App (8)

20. (a) (i) Find the eigen values and eigen vectors of the matrix CO5-App (8)

$$A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

- (ii) Using Cayley Hamilton's theorem find the inverse of the CO4-App (8)

matrix  $\begin{bmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

Or

- (b) Reduce the Q.F  $6x^2 + 3y^2 + 3z^2 - 4xy - 2yz + 4zx$  in to a canonical CO5-App (16)  
form by an orthogonal transformation.