

**1E2201**

Roll No. \_\_\_\_\_

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**1E2201****B.Tech. I semester (Back) Examination, Dec. - 2018  
MA-101 Engineering Mathematics - I****Time : 3 Hours****Maximum Marks : 80****Min. Passing Marks : 28****Instructions to Candidates:**

Attempt any five questions, including Question No.1, which is compulsory. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

1. **Compulsory.** Answers for each sub - question be given in about 25 words.

**(8×2=16)**

- (a) How many asymptotes are there for the curve  $xy(x+y) = a(x^2 - a^2)$ .
- (b) Find the degree of homogenous function  $f(x,y) = \frac{x^2(x^2 - y^2)^{1/3}}{(x^2 + y^2)^{2/3}}$ .
- (c) In which direction a function  $f(x,y)$  increases most rapidly and decreases most rapidly at any point P.
- d) Give an example of a function which is not continuous at origin although its partial derivative exist at origin.
- (e) Evaluate  $\int_0^1 \int_0^{\sqrt{1-x^2}} (x^2 + y^2) dy dx$ .
- f) Give the value of  $\Gamma\left(\frac{1}{4}\right)\Gamma\left(\frac{3}{4}\right)$ .
- (g) Check whether  $f(r)\vec{r}$  is irrotational or not?
- h) Give the value of  $\text{div}(\text{curl } \vec{F})$  where  $\vec{F} = 2xy\hat{i} + (xyz^2 - \sin yz)\hat{j} + ze^{xy}\hat{k}$ .

- (2) (a) Find the equation of the cubic curve whose asymptotes are same as that of the curve  $x^3 - 6x^2y + 11xy^2 - 6y^3 + x + y + 1 = 0$  and which touches the axis of y at origin and passes through the point (3,2).

b) Find the flux of  $\vec{F} = yz\hat{i} + x\hat{j} - z^2\hat{k}$  through the parabolic cylinder  $y = x^2$ ,  $0 \leq x \leq 1, 0 \leq z \leq 4$  in the outward direction of normal. (16)

3. a) Using Taylor's theorem, find a quadratic approximation to  $f(x,y) = \sin x \sin y$  near the origin. How accurate is the approximation if  $|x| \leq 0.1$  and  $|y| \leq 0.1$ .

b) If  $\vec{A} = (x + 2y + az)\hat{i} + (bx - 3y - z)\hat{j} + (4x + cy + 2z)\hat{k}$ , find a, b, c so that  $\vec{A}$  is irrotational. Find scalar potential of  $\vec{A}$ . (16)

4. a) Trace the curve  $r = 3 + 2\cos\theta$ .

b) Find the directional derivative of  $f(x,y,z) = x^2yz + 4xz^2$ , at  $P_0 = (1, -2, -1)$  in the direction of  $\hat{u} = 3\hat{i} + 6\hat{j} - 2\hat{k}$ . (16)

5. a) Find Tangent Plane and Normal Line to the surface  $x^2 + y^2 + z - 9 = 0$  at point  $P_0 = (1, 2, 4)$ . <http://rtuonline.com>

b) Evaluate the following integral by change of order of Integration.

$$\int_0^a \int_m^a \frac{y^2}{\sqrt{y^4 - y^2x^2}} dy dx. \quad (16)$$

6. a) Find the volume of the wedgelike solid that lies beneath the surface  $z = 16 - x^2 - y^2$  and above the region R bounded by the curve  $y = 2\sqrt{x}$  and the line  $y = 4x - 2$  and the x-axis.

b) The plane  $x + y + z = 1$  cuts the cylinder  $x^2 + y^2 = 1$  in an ellipse. Find the points on the ellipse that lie closest to and farthest from the origin. (16)

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

b) Use Stoke's theorem, evaluate  $\int_C \vec{F} \cdot d\vec{r}$  if  $\vec{F} = xz\hat{i} + xy\hat{j} + 3xz\hat{k}$  and C is the boundary of the portion of the plane  $2x + y + z = 2$  in the first octant, traversed counterclockwise as viewed from above. (16)

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