1E2201

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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 $\int_0^1\int_0^{\sqrt{1-x^2}}(x^2+y^2)dydx$.

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 $div(curl\vec{F})$ where $\vec{F}=2xy\hat{i}+(xyz^2-\sin yz)\hat{j}+ze^{x+y}\hat{k}$.

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 $y = x^2$, $0 \le x \le 1, 0 \le z \le 4$ 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 $|x| \le 0.1$ and $|y| \le 0.1$.

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 $P_0 = (1,2,4)$

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

$$\int_0^a \int_{\sqrt{ax}}^{a} \frac{y^2}{\sqrt{y^4 - y^2x^2}}\,dy\,dx.$$ **(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 $\int_C \vec{F}.\vec{dr}$ 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)**