Paper / Subject Code: FE201 / Engineering Mathematics - II

FE201

Total No. of Printed Pages:3

FE (Sem - II) (Revised Course 2016-17) EXAMINATION MAY/JUNE 2019
Engineering Mathematics - II

[Duration : Three Hours] **[Total Marks : 100]**

Please check whether you have got the right question paper.

Instructions:
1. Attempt **any five** questions, two each from part A and part B and one from part C.
2. Figures to the right indicate full marks.
3. Assume suitable data, if necessary.

PART A

Q.1

a) Evaluate $\int_0^{\pi} \frac{\log_e(1+\alpha Cosx)}{Cosx} dx$ by applying differentiation under the integral sign. **08**

b) Find length of the curve $y = \frac{1}{6}(x^2+4)^{\frac{3}{2}}$ for $0 \le x \le 3$ **06**

c) Evaluate $\int_0^{\infty}\int_0^{x} xe^{-x^2/y}\, dxdy$ **06**

Q.2

a) Change the order of integration and evaluate $\int_0^1\int_{-\sqrt{x}}^{\sqrt{x}} 2y+3dxdy + \int_1^2\int_{x-2}^{2-x} 2y+3dxdy$ **10**

b) Evaluate $\int_0^1\int_0^{\sqrt{x}}\int_0^{1-x} x+ydzdydx$ **05**

c) For the curve $\bar{r}(t) = 3cost\bar{\imath} + 2S\ int\,\bar{\jmath} + t\bar{k}$. Find the curvature at $t = \pi/2$. **05**

Q.3

a) The loop of the curve $9y^2 = (x-2)(5-x)^2$ is revolved about the x-axis. Find the surface area of the object generated. **07**

b) The moving particle starting at time $t = 0$ from $2\bar{\imath} + 3\bar{\jmath}$ has velocity $\bar{v} = sin2t\bar{\imath} + 2cos2t\bar{\jmath} + 2\bar{k}$ at time t. find its position vector and acceleration at any time t. **06**

c) Evaluate $\iiint 2y + z \;\; dxdydz$ over the region $\{(x,y,z)/y^2 \le x, x^2 \le y, 0 \le z \le 1\}$ **07**

PART B

Q.4

a) In which direction is the rate of change of $f(x,y,z) = 3x^2 + 2yz\ at\ (-1,1,2)$ maximum? Find the magnitude of this maximum. **04**

b) Show that $F = 8xCosy\bar{\imath} + (\cancel{4ze^y} - 4x^2\ siny + 6y)\bar{\jmath} + 4e^y\bar{k}$ irrotational and find its scalar potential. **06**

$4ze^y$

c) Solve the following **10**

i) $(x^2+y^2)dx-(x^2+xy)dy=0$

ii) $\frac{d^2y}{dx^2}+5\frac{dy}{dx}+6y=3x^2+2x$

Q.5 a) Use Stoke's Theorem to evaluate the surface integral $\iint_s(\nabla\times\bar{F}).\bar{n}ds$ where $\bar{F}=(xy)\hat{\imath}+(2x+3z)\hat{\jmath}+y^2\hat{k}$ and $\hat{n}$ is the unit outward normal vector to surface S. S being the surface of the tetrahedron bounded by $x=0, y=0, z=0$ and $x+y+z=2$ excluding the surface in the xy plane. **08**

b) If $f(x,y,z)=2x\bar{\imath}+zy\bar{\jmath}+3xz\bar{k}$ and $g(x,y,z)=x^2+2yz$ $compute$ **06**

i) $f.\nabla g$

ii) $\nabla|f|^2$

c) Solve $x^2\frac{d^2y}{dx^2}-3x\frac{dy}{dx}+5y=2\sin(\log_e x)$ **06**

Q.6 a) Verify Green's Theorem in the plane for $\oint(2x+y^2)dx+(5+xy)dy$ along the boundary of the region bounded by $y^2=4x$ and $y=2x$. **10**

b) Solve **10**

i) $\frac{d^2y}{dx^2}-5\frac{dy}{dx}+6y=e^{2x}\cos x$

ii) $(1+x^2)\frac{dy}{dx}+2xy=x\sqrt{1-x^2}$

PART C

Q.7 a) Find the area of $r\leq 3+\cos\theta$ **05**

b) If $f=x^2\bar{\imath}-2xy\bar{\jmath}+yz\bar{k}$. Compute $\int_c f.dr$ between (1,2,1) and (2, 5, 4) where C is the path having parametric equations $x=t,\ \ y=t^2+1, z=3t-2$. **05**

c) Solve $i)$ $(1+x)\frac{dy}{dx}+1=2e^{-y}$ **05**

d) Define divergence of a vector filed. When is it said to be solenoidal? Show that the vector field $\bar{F}=2x^3y\bar{\imath}+(2xz-3x^2y^2)\bar{\jmath}-xy^2\bar{k}$ _ is solenoidal. **05**

Q.8

a) The curve $r = 2\,a\cos\theta$ is revolved about the initial line. Find the volume of the object generated. **06**

b) Find the volume of the region $\{(x,y,z)/x^2 + y^2 \leq 1, 2x + y + 2z \leq 4, z \geq 0\}$ **08**

c) Solve $x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = x^2 + 2\log_e x$ **06**