Paper / Subject Code: FE201 / Engineering Mathematics - II

FE201

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F.E. (Sem - II) (Revised Course 2016-17)
EXAMINATION Nov/Dec 2019
Engineering Mathematics - II

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

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) Applying differentiation under the integral sign, evaluate **(7)**

$$\int_0^{\frac{\pi}{2}} \cos ec^2\theta \quad \log_e(1+\alpha\tan^2\theta)d\theta.$$

b) Find the perimeter of the asteroid $x^{2/3}+y^{2/3}=4$ **(6)**

c) Change the order of integration and evaluate $\int_0^2\int_{2x-2}^{x} y+2xdxdy$ **(7)**

Q.2

a) Evaluate $\int_0^1(3t\,\bar{i}+2\bar{j})\mathrm{x}(t\bar{i}+2\bar{j}+\bar{k})\mathrm{dt}$ **(5)**

b) Evaluate $\int\int\int\frac{z\,dxdydz}{(x^2+y^2+z^2)^{3/2}}$ over the region $x^2+y^2+z^2\le 4\;and\;0\;\le z\;\le 1.$ **(8)**

c) Write a single integral and evaluate $\int_0^2\int_0^{\sqrt{y}} 2x+1dxdy+\int_2^4\int_{y-2}^{\sqrt{y}} 2x+1\;dxdy$ **(7)**

Q.3

a) Define curvature of the path of a moving object. A moving object's position vector at time t is $\bar{r}(t)=Cos2t\bar{i}+Sin2t\bar{j}+t\bar{k}.$ Find its curvature at time t. **(7)**

b) Find the area of the surface generated by the revolution of the loop of the cure curve $9y^2=x(x-3)^2$ about the x-axis. **(7)**

c) Evaluate $\int_{-1}^1\int_o^x\int_0^{(x+y)} 2z+x\;\;dzdydx$ **(6)**

Part B

Q.4

a) Find the directional derivative of $f\,(x,y,z)=x^2y+xyz+4$ in the direction of $\hat{\imath}+\hat{\jmath}-\hat{k}$ At the point (1,0,1). **(5)**

b) Find the work done in moving a particle in the force field $\bar{F}=(2y+3)\hat{\imath}+xz\hat{\jmath}+$ **(5)**

$(yz - x)\hat{k}$ along the curve $x = 2t^2, y = t$ and $z = t^3$ from $t = 0$ to $t = 1$.

c) Solve the following (10)

i) $\frac{dy}{dx} = e^{3x-2y} + e^{-2y} Cos2x$ ii) $\frac{d^2y}{dx^2} + y = Cotx$

Q.5 a) Verify Green's Theorem in a plane for $\oint (xy + 4y^2)dx + (x^2 + 3)dy$ along the boundary of the region bounded by $x = y$ and $x = y^2$. (10)

b) Solve the following (10)

i) $Y(2xy + 3)dx + x(1 + 2xy - x^2y^2)dy = 0$ ii) $x^2 \frac{d^2y}{dx^2} - x\frac{dy}{dx} + 2y = x(\log_e x)^2$

Q.6 a) Verify Stoke's theorem for $\bar{F} = xy\hat{\imath} - 2yz\hat{\jmath} - zx\hat{k}$ where S is the open surface of the region bounded by the planes $x = 0, x = 2, y = 0, y = 1$ and $z = 0, z = 3$ excluding the face on the XY plane. (10)

b) Solve (i) $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = xCos2x$ ii) $(1 + x^2)\frac{dy}{dx} + 2xy = 4x^2$ (10)

Part C

Q.7 a) Find the length of the curve $y = \sqrt{4 - x^2}$ from $x = 0$ to $x = 2$. (5)

b) Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} \frac{1}{1-x^2+y^2} dxdy$ (5)

c) Find the equation of the line, normal to the surface $2x + 3z^2 = 14$ at the point (1, -2, 2). (5)

d) Solve $(D^2 + D - 12)y = 2\sin^2 x + 3$ (5)

Q.8 a) IF$\overline{r(t)}$ = 2sint$\hat{\imath}$ + $3cos2t\hat{\jmath} + 4t\hat{k}$ is the position vector of a particle in space at time 't' then find it's velocity and acceleration vectors at $t = \frac{\pi}{2}$. (5)

b) Evaluate $\int_0^{\pi/2} \int_0^{\pi} \int_0^{1+\cos\varphi} 3\,\rho \sin\varphi d\rho d\theta d\varphi$ (6)

c) Prove that for a scalar field φ, $Curl\ (\nabla\varphi) = 0$. (4)

d) Solve $\frac{dy}{dx} = \frac{2y-3x+1}{4y-6x+5}$ (5)