SEM 2 – 1 (RC 16-17)

F.E. (Semester – II) (RC 2016 – 17) Examination, Nov./Dec. 2018
ENGINEERING MATHEMATICS – II

Duration : 3 Hours | Total Marks : 100

Instructions : *i) Attempt **five** questions, two **each** from Part – **A** and Part – **B** and **one** from Part – **C**.*
*ii) Assume suitable data, if **necessary**.*
*iii) Figures to the **right** indicate **full** marks.*

PART – A

1. a) Evaluate $\int_0^{\pi} \frac{\log_e(1+\sin\alpha\cos x)dx}{\cos x}$ by applying differentiation under the integral sign. 7

1. b) Find the length of the loop of the curve $9y^2 = (x-2)(x-5)^2$. 6

1. c) Change the order of integration and evaluate $\int_0^1 \int_x^{2\sqrt{x}} 2x + 1dxdy$. 7

2. a) Evaluate $\int_0^1 (3t\overline{i} + 2\overline{j}) \times (t\overline{i} + 3\overline{k})dt$. 5

2. b) Evaluate $\iiint \frac{xz\ dxdydz}{(x^2+y^2+z^2)^2}$ over the region $x^2 + y^2 + z^2 \le 4$ and $x \ge 0$, $z \ge 0$. 8

2. c) Write a single integral and evaluate $\int_0^1\int_0^1 3y + 2dxdy + \int_1^2\int_{x-1}^1 3y + 2dxdy$. 7

3. a) Define curvature. Show that the circle $x^2 + y^2 = a^2$ has constant curvature. 7

3. b) Find the area of the surface generated by the revolution of the curve $y = \sqrt{x+1}, 0 \le x \le 4$ about the x-axis. 7

3. c) Evaluate $\int_{-1}^1 \int_0^x \int_0^{(x+y} 2y + x\ dzdydx$ 6

P.T.O.

PART – B

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

4. b) Find the work done in moving a particle in the force field $\overline{F} = (2y + 3)\hat{i} + xz\hat{j} + (yz - x)\hat{k}$ along the curve $x = 2t^2$, $y = t$ and $z = t^3$ from $t = 0$ to $t = 1$. 5

4. c) Solve the following :

i) $\dfrac{dy}{dx} = e^{3x-2y} + x^2e^{-2y}$

ii) $(1+x^2)\dfrac{dy}{dx} + 2xy = 4x^2$ 10

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 $x = 1$ and $x = y^2$. 10

5. b) Solve the following :

i) $(D^2 - 6D + 9)\, y = \dfrac{e^{3x}}{x^2}$

ii) $x^2 \dfrac{d^2y}{dx^2} + x\dfrac{dy}{dx} + y = (\log_e x)^2$ 10

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

b) Solve :

i) $(D - 2)(D + 1)^2y = e^{-2x} + 2$

ii) $(D^2 - 2D - 3)y = \sin(2x)$. 10

PART – C

7. a) Find the length of $x = a(2\cos t - \cos 2t)$ and $y = a(2\sin t - \sin 2t)$ from $t = 0$ to $t = \dfrac{\pi}{2}$. Where a is a constant. 5

7. b) Evaluate $\int_{1}^{2}\int_{0}^{y}\frac{1}{x^2+y^2}\,dxdy$. 5

7. c) Find the equation of the line, normal to the surface $2x + 3z^2 - y^2 = 10$ at the point $(1, -2, 2)$. 5

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

8. a) If $\overline{r(t)} = 2\cos t\hat{i} + 3\sin t\hat{j} + 4t\hat{k}$ 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

8. 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

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

8. d) Solve $\frac{dy}{dx} = \frac{2y - x + 1}{4y - 2x + 2}$. 5
