



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

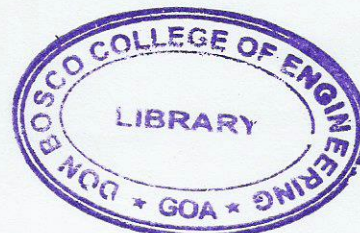
Instructions : i) Attempt **five** questions, two **each** from Part – A and Part – B and **one** from Part – C.

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 $\int_0^{12\sqrt{x}} \int_x^{2\sqrt{x}} 2x + 1 dx dy$. 7
2. a) Evaluate $\int_0^1 (3t\bar{i} + 2\bar{j}) \times (t\bar{i} + 3\bar{k}) dt$. 5
2. b) Evaluate $\iiint \frac{xz dx dy dz}{(x^2 + y^2 + z^2)^2}$ over the region $x^2 + y^2 + z^2 \leq 4$ and $x \geq 0$, $z \geq 0$. 8
2. c) Write a single integral and evaluate $\int_0^1 \int_0^1 3y + 2 dx dy + \int_{1 \times -1}^2 \int_{1 \times -1}^1 3y + 2 dx dy$. 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 $y = \sqrt{x+1}$, $0 \leq x \leq 4$ about the x-axis. 7
3. c) Evaluate $\int_{-1}^1 \int_0^x \int_0^{x+y} 2y + x dz dy dx$ 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 $\vec{F} = (2y + 3)\hat{i} + xz\hat{j} + (yz - x)\hat{k}$ 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) $\frac{dy}{dx} = e^{3x-2y} + x^2e^{-2y}$

ii) $(1+x^2)\frac{dy}{dx} + 2xy = 4x^2$ 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) $(D^2 - 6D + 9)y = \frac{e^{3x}}{x^2}$

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

6. a) Verify Stoke's theorem for $\vec{F} = xy\hat{i} - 2yz\hat{j} - zx\hat{k}$ 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 $t = \frac{\pi}{2}$. Where a is a constant. 5





7. b) Evaluate $\int_1^2 \int_0^y \frac{1}{x^2 + y^2} dx dy$. 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 $\vec{r}(t) = 2\cos t \hat{i} + 3\sin t \hat{j} + 4t \hat{k}$ 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 $\int_0^{\pi/2} \int_0^{\pi} \int_0^{1+\cos\phi} 3\rho \sin\phi d\rho d\theta d\phi$. 6

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

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