



SEM 2 – 1 (RC 07-08)

F.E. (Semester – II) (RC 2007 - 08) Examination, November/December 2018 APPLIED MATHEMATICS – II

Duration : 3 Hours

Total Marks : 100

- Instructions :** 1) Attempt any five questions at least one from each Module.
2) Assume suitable data, if necessary.

MODULE – I

1. a) Assuming the validity of differentiation under integral sign rule evaluate the following integrals.

$$\int_0^{\infty} \frac{\tan^{-1} ax}{x(1+x^2)} dx.$$

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- b) Find the length of the curve $y = \frac{1}{3}(x^2 + 2)^{\frac{3}{2}}$ measured from $x = 0$ to $x = 3$.

6

- c) The curve $r = 2a \cos \theta$ is revolved about x-axis, find the surface area of the solid generated.

7

2. a) State and prove Serret-Frenet formula.

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- b) If $\vec{r}(t)$ has constant magnitude. Show that $\vec{r}(t)$ is perpendicular to its

$$\text{tangent } \frac{d\vec{r}}{dt}.$$

6

- c) Show that $\vec{r}(t) = Pte^{2t}\mathbf{i} + Qe^{3t}\mathbf{j}$ satisfies $\frac{d^2\vec{r}}{dt^2} - 4\frac{d\vec{r}}{dt} + 4\vec{r} = 0$.

6

MODULE – II

3. a) Evaluate $\int_0^1 \int_0^{x^2} x(x^2 + y^2) dx dy$.

6

- b) Change the order of integration and evaluate.

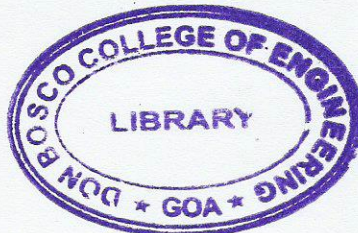
$$\int_1^2 \int_1^{x^2} \frac{x^2}{y} dy dx.$$

6

- c) Evaluate $\iint (x + y) dx dy$ over the region enclosed by the curves $x = 0$, $x = 2$,

$$y = x, y = x + 2.$$

8



P.T.O.



4. a) Evaluate :

6

$$\int_{-1}^1 \int_0^z \int_{x-z}^{x+z} x + y + z \, dx dy dz.$$

b) Find the volume of the region enclosed by the planes $x = 0$, $y = 0$, $z = 0$,

$$x + y + z = a.$$

6

c) Evaluate $\int_0^{\frac{\pi}{2}} \int_0^{a \cos \theta} \int_0^{\sqrt{a^2 - r^2}} r \, dz dr d\theta$.

8

MODULE – III

5. a) In what direction from the point $(1, 2, 1)$ is the directional derivative of $\phi = x(x - y) + y(y + z)$ is maximum ? What is its magnitude ?

7

b) Find the total work done in moving a particle in the force field $\vec{F} = 2x^2 \mathbf{i} + (2yz - x) \mathbf{j} + y \mathbf{k}$ along $x = 3t^2$, $y = t$, $z = 3t^2 - t$ from $y = 0$ and $t = 1$.

6

c) A vector field is given by $\vec{F} = (x^2 - y^2 + x) \mathbf{i} - (2xy + y) \mathbf{j}$ show that the field is irrotational and find its scalar potential.

7

6. a) Verify Greens theorem $\vec{F} = (x^2 - xy) \mathbf{i} + (x^2 - y^2) \mathbf{j}$ over the boundary of the region bounded by $x^2 = 2y$ and $x = y$.

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b) Verify Stoke's theorem for $\vec{F} = (x^2 + y^2) \mathbf{i} + 4xy \mathbf{j}$ taken over the region bounded by the parabola $y^2 = 4x$ and the line $x = 4$.

12

MODULE – IV

7. Solve the following differential equations

a) $(e^y + 1) \cos x dx + e^y \sin x dy = 0.$

5

b) $\frac{dy}{dx} + y \tan x = y^3 \sec x.$

5





c) $\frac{dy}{dx} = \frac{x-y+3}{2x-2y+5}$ 5

d) $\frac{dy}{dx} - 2xy = x$ 5

8. Solve the following differential equations.

a) $(D^3 - D)y = \sin x$ 5

b) $\frac{d^3 y}{dx^3} - 7\frac{dy}{dx} - 6y = xe^{2x}$ 5

c) $(D^2 - 3D + 2)y = e^{3x} + 5$ 5

d) $x^2 \frac{d^2 y}{dx^2} - 3x \frac{dy}{dx} - 4y = 2x^2$ 5

