Total No. of Printed Pages:2

F.E. Semester- II (Revised Course 2016-17)
EXAMINATION FEBRUARY 2021
Engineering Mathematics-II

[Duration : Two Hours] **Total Marks (60)**

Instructions:

1. Answer THREE FULL QUESTIONS with ONE QUESTION FROM EACH PART.
2. Assume suitable data, if necessary.
3. Figures to the **right** indicate full **marks**.

Part – A

Q.1

a) Evaluate the following integral by using differentiation under integral sign. (7)
$\int_0^\infty \frac{\tan^{-1} px}{x(1+x^2)} dx$

b) Evaluate $\int_0^2 \int_0^{\sqrt{2x}} xydydx$ (6)

c) Find the length of the cardioid $r = 2(1 + cos\theta)$ which lies outside the circle $r + 2\cos\theta = 0$ (7)

Q.2

a) A particle moves along the curve $x = t^3 + 2t, y = -3e^{-2t}, z = 2\sin 5t$. Find the velocity and acceleration vectors and their magnitudes at $t = 0$. (6)

b) Change the order of integration and solve. (8)
$\int_0^1 \int_0^{\sqrt{1-y^2}} \frac{\cos^{-1} x}{\sqrt{1-x^2}\sqrt{1-x^2-y^2}} dxdy$

c) State and prove Serret- Frenet formulas. (6)

Q.3

a) Calculate $\iint r^3\, drd\theta$ over the area included between the circles $r = 3sin\theta\ and\ r = 6\ sin\theta$ (7)

b) Evaluate $\int_0^{\frac{\pi}{2}} \int_0^{a\ sin\theta} \int_0^{\frac{(a^2-r^2)}{a}} r\ d\theta drdz$ (7)

c) Find the volume of tetrahedron bounded by the planes x=0, y=0, z=0 and $x + y + z = 4$. (6)

Part- B

Q.4

a) Solve the following differential equations. (10)

i) $(x^2 - 4xy - 2y^2)dx + (y^2 - 4xy - 2x^2)dy = 0$

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

b) Verify Green's Theorem $\int_c (2xy - x^2)dx + (x + y^2)dy$ where C is a closed curve in xy plane bounded by $x = y^2$ and $y = x^2$ (10)

Q.5

a) Solve the following differential equations. (10)

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i) $D^2y + 9y = e^x - \cos^2 x$
ii) $(D^3 + 2D^2 + D)y = x^2 + x$

b) In what direction from the point (2, 1,-1) is the directional derivative of $\emptyset = x^2yz^3$ a maximum? What is its magnitude? (6)

c) Prove that $\nabla.(\overline{a} \times \overline{r}) = 0$ (4)

Q.6

a) Solve the following differential equation. (6)
$x^2 \frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 5y = \sin(logx)$

b) Verify Stoke's theorem for $\overline{F} = x^2i + xyj$ integrated round the square in the plane z=0 and bounded by x=0, y=0, x=a, y=a. (10)

c) Find value of p if $\overline{F} = (x + 3y)i + (y - 2z)j(pz + x)k$ is solenoidal. (4)

Part- C

Q. 7

a) Solve the following differential equation. (6)
$\tan y \frac{dy}{dx} + tan\ x = cos\ y.\cos^3 x$

b) Find the length of the loop of the curve $12y^2 = x^2(4 - x)$ (7)

c) Change into polar coordinates and evaluate. (7)
$\int_0^a \int_0^{\sqrt{a^2-x^2}} e^{-(x^2+y^2)}dydx$

Q. 8

a) Find the total work done in the moving particle in the force field. $\overline{F} = 3xyi - 5zj + 10xk$ along $x = t^2 + 1, y = 2t^2, z = t^3$ from $t = 1$ to $t = 2$ (7)

b) Solve the differential equation $(x + 2y^3)\frac{dy}{dx} = y$ (6)

c) Given the space curve $= t, y = t^2, z = \frac{2}{3}t^3$. Find the curvature K. (7)

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