

Total No. of Questions : 9]

PD4032

SEAT No. :

[Total No. of Pages : 4

[6401]-1909

F.E.

ENGINEERING MATHEMATICS - II

(2019 Pattern) (Credit System) (Semester - I/II) (107008)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Q.1 is Compulsory.
- 2) Solve Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 6) Assume suitable data, if necessary.

Q1) Write the correct option for the following multiple choice questions :

a) $\int_0^{2\pi} \sin^6 t \, dt =$ [2]

i) $\frac{5\pi}{8}$

ii) $\frac{5\pi}{32}$

iii) $\frac{5}{4}$

iv) 0

b) The equation of asymptote parallel to x-axis to the curve represented by the equation $y(1+x^2) = x$ is [2]

i) $x = 0$

ii) $y = 0$

iii) $y = x$

iv) $x = -1, x = -1$

c) Centre (c) & radius (r) of the sphere $x^2 + y^2 + z^2 - 4x + 6y - 2z - 11 = 0$ is [2]

i) $c \equiv (2, 3, 1) \text{ \& } r = 5$

ii) $c \equiv (2, 3, 1) \text{ \& } r = \sqrt{14}$

iii) $c \equiv (2, -3, 1) \text{ \& } r = 5$

iv) $c \equiv (2, -3, 1) \text{ \& } r = \sqrt{14}$

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d) The value of the double integration $\int_0^1 \int_0^1 xy^2 \, dx dy$. [2]

i) $\frac{1}{4}$

ii) $\frac{1}{9}$

iii) $\frac{1}{2}$

iv) $\frac{1}{6}$

e) $\overline{n+1} =$ [1]

i) $(n+1)!$

ii) $(n-1)!$

iii) $(n+2)!$

iv) $n!$

f) The curve $r = 2a \sin \theta$ is symmetrical about [1]

i) Pole

ii) $\theta = 0$

iii) $\theta = \frac{\pi}{2}$

iv) $\theta = \frac{\pi}{4}$

Q2) a) If $I_n = \int_0^{\pi/2} x \sin^n x \, dx$ then prove that $I_n = \frac{n-1}{n} I_{n-2} + \frac{1}{n^2}$. [5]

b) Evaluate $\int_0^\infty x^2 e^{-h^2 x^2} \, dx$. [5]

c) Evaluate $\frac{d}{dx} \operatorname{erf}(ax^n)$. [5]

OR

Q3) a) If $I_n = \int_0^{\pi/2} \cos^n x \cos nx \, dx$, then prove that $I_n = \frac{1}{2} I_{n-1}$. [5]

b) Evaluate $\int_0^2 x(8-x^3)^{1/3} \, dx$. [5]

c) Show that $\int_0^\infty \frac{e^{-bx} \sin ax}{x} \, dx = \tan^{-1} \frac{a}{b}$ [5]

Q4) a) Trace the curve $x^2 y^2 = a^2 (u^2 - x^2)$. [5]

b) Trace the curve $r = a \sin 2\theta$. [5]

c) Trace the curve $x = a(t + \sin t)$, $y = a(1 + \cos t)$. [5]

OR

Q5) a) Trace the curve $y(x^2 + 4a^2) = 8a^3$. [5]

b) Trace the curve $r = a(1 - \cos \theta)$. [5]

c) Find the arc length of cardioid $r = a(1 + \cos \theta)$ which lies outside the circle $r + a \cos \theta = 0$. [5]

Q6) a) Prove that the sphere $x^2 + y^2 + z^2 + 2x - 4y - 2z - 3 = 0$ touch the plane $2x - 2y - z + 16 = 0$ and Find the point of contact. [5]

b) Find the equation of right circular cone with vertex at origin and axis as the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ & semivertical angle is 30° . [5]

c) Find the equation of right circular cylinder of radius '2', whose axis passes through (1, 2, 3) and has direction cosines proportional to 2, 1, 2. [5]

OR

Q7) a) Show that the sphere $x^2 + y^2 + z^2 - 10x - 10y - 2z + 2 = 0$ and $x^2 + y^2 + z^2 + 6x + 2y - 2z + 2 = 0$ touches externally. Also find the point of contact. [5]

b) Find the equation of right circular cone whose vertex at $(0, 0, 10)$ & whose intersection with XOY plane is a circle of radius '5'. [5]

c) Find the equation of right circular cylinder of radius '5' and axis $\frac{x-2}{2} = \frac{y-3}{1} = \frac{z+1}{1}$. [5]

Q8) a) Evaluate $\iint e^{-(x^2+y^2)} dx dy$ over the positive quadrant of the circle $x^2 + y^2 = a^2$. [5]

b) Find the area between the curve $y = (x-4)(x+2)$ and the x -axis. [5]

c) Find the centre of gravity of the area enclosed by the parabolas $y^2 = x$ and $x^2 = y$. [5]

OR

Q9) a) Evaluate the following integration by changing the order : [5]

$$\int_0^\infty \int_y^\infty \frac{e^{-x}}{x} dx dy$$

b) Evaluate $\iiint \frac{dx dy dz}{1+x^2+y^2+z^2}$ taken throughout the volume of the sphere $x^2 + y^2 + z^2 = 1$ in the positive octant. [5]

c) Find the moment of inertia of one loop of the rose curve $r = a \cos 2\theta$ about initial line. (Given that density $\rho = \frac{8M}{a^2\pi}$, where M is Mass of the area). [5]

