Total No. of Questions: 9] P-9074 [Total No. of Pages: 4] [6178]-9 F.E. ENGINEERING MATHEMATICS - II (2019 Pattern) (Semester - II) (107008) Time: $2^{1/2}$ Hours] [Max. Marks: 70 Instructions to the candidates: 1) Question No. I is compulsory. 2) Solve Q. No. 2 or Q. No. 3, Q. No. 4 or Q. No. 5, Q. No. 6 or Q. No. 7, Q. No. 8 or Q. No. 9. 3) Neat-diagrams must be drawn wherever necessary. 4) Figures to the right indicate full marks. 5) Use of electronic pocket calculator is allowed. 6) Assume suitable data, if necessary. Q1) Write the correct option for the following multiple choice questions. a) $\int_0^{2\pi} \sin^3\theta \cos^4\theta d\theta$ [2] ii) $\frac{2}{35}$ ii) $\frac{1}{15}$ iii) 0 iv) $\frac{2\pi}{35}$									
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b) The equation of tangents to the curve $3ay^2 = x(x-a)^2$, at the origin, if exist is i) $x = a$ ii) $x = 0, y = 0$	i)	::)	u=0 0=0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1						
$ \begin{array}{cccc} i) & x - a \\ iii) & x = 0 \end{array} $ $ \begin{array}{cccc} iv) & v = 0 \end{array} $		II)	x - 0 y = 0						

iv) y = 0iv) $\frac{\pi}{2}$ c) $\int_{\theta=0}^{\pi/2} \int_{r=0}^{2} r \, dr \, d\theta =$ [2] i) π

iii) 2

	d)	Radius r of a sphere $x^2 + y^2 + z^2 - 2$	200	4y + 2z - 3 = 0 is	[2]
		i) $r=9$	ii)	r = 2	
		iii) $r=4$	iv)	r = 2 $r = 3$	
	e)	The total number of loops for the c	urve	$r = a \sin 3\theta$ are	[1]
		i) 2	ii)	3	
		iii) 6	iv)	4	
	f)	$\iint \rho P^2 dx dy$ where ρ -density and ρ	² is	distance of particle from a	axis,
		represents			[1]
		i) Area	ii)	Mass	
		iii) Moment of Inertia	iv)	Volume	
		5.7			
()2)	a) (If $u_n = \int_0^{\pi/4} \sin^{2n} x dx$ then prove that	u <u>≠</u> ($1 - \frac{1}{2} $ $u = -\frac{1}{2}$	[5]
Q2)	a)		>		[5]
	b)	Prove that : $\beta(m, n) = \beta(m, n + 1) + \beta(m, n)$	Bin	n+1, n)	[5]
	a)	If $f(x) = \int_{0}^{x} (x-t)^{2} G(t) dt$ then prove that $\frac{d^{3} f}{dx^{3}} = 2G(x)$			
		If $f(x) = \int_0^x (x-t) G(t) dt$ then prov	e illa	$\frac{1}{dx^3} - 2O(x)$	[5]
		If $U_n = \int_0^{\pi/4} \tan^n \theta d\theta$, then prove that Evaluate: $\int_0^\infty 2^{-9x^2} dx$			3
(12)	o)	If $II = \int \tan^n \theta d\theta$ then prove that	, ,,, []	ı +ıı]_1) IEI
Q3)	a)	If $O_n = \int_0^1 \tan^2 \theta d\theta$, then prove that	n_{\perp}	$O_{n+1} \cap O_{n-1} \subseteq O_n$	ျေ
	h)	Evaluate: $\int_{0}^{\infty} 2^{-9x^2} dx$		9, 3	[5]
	U)			2, 2.	[2]
	c)	Evaluate:			[5]
		i) $\frac{d}{dt} \left[erf \left(\sqrt{t} \right) \right]$		3	
		$dt \vdash $	2	$J_{n+1} + U_{n-1} = 1$	
		ii) $\frac{d}{dt} \left[erf_c \left(\sqrt{t} \right) \right]$			
		$dt \vdash $		2	

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Q4) a)	Trace the curve $y^2(2a - x) = x^3$, $a > 0$	[5]

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

c) Find the arc length of cycloid $a = a(t + \sin t)$, $y = a(1-\cos t)$ from one cusp to another cusp. [5]

OR

Q5) a) Trace the curve
$$xy^2 = a^2(a - x), a > 0$$
 [5]

b) Trace the curve
$$r = a\cos 3\theta$$
. [5]

c) Trace the curve [5]
$$r^{2/3} + v^{2/3} - a^{2/3}$$

- Q6) a) Show that the plane 2x + y + 2z = 6 touches the sphere $x^2 + y^2 + z^2 6x 6y 6z + 18 = 0$. Also find the point of contact. [5]
 - b) Find the equation of right circular cone whose vertex is at origin, axis is the line $\frac{x}{1} = \frac{y}{1} = \frac{z}{1}$ and has a semi-vertical angle of 30°. [5]
 - c) Find the equation of right circular cylinder of radius 4 and axis is the line

$$\frac{x}{1} = \frac{y}{-1} = \frac{z}{1}$$
 [5]

QR

- Q7) a) If the sphere $x^2 + y^2 + z^2 + 2\lambda x + 3\lambda y + 4\lambda z 1 5\lambda = 0$ cuts the sphere $x^2 + y^2 + z^2 + 3x 3y + 3z 56 = 0$, orthogonally, then find the value of λ .
 - b) Find the equation of right circular cone whose vertex is at origin, generator is the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ and axis is the line $\frac{x}{-1} = \frac{y}{1} = \frac{z}{2}$. [5]
 - c) Find the equation of right circular cylinder of radius 2, whose axis passes through the origin and has direction ratios 1, 1, 1. [5]
- Q8) a) Change order of integration and evaluate $\int_0^\infty \int_y^\infty dx dy$ [5]
 - b) Find the area of cardioide $r = a(1 + \cos\theta)$ using double integration. [5]

[6178]-9

- Prove that moment of inertia of the area included between curves $y^2 = 4ax$ and $x^2 = 4ay$ about x-axis is $\frac{144}{35}$ Ma², given that density $\rho = \frac{3M}{16a^2}$ and M is the mass. [5]
- Q9) a) Change following double integration to its polar form and evaluate $\iint_R \frac{x^2 y^2}{x^2 + y^2} dx dy \text{ where R is annulus between } x^2 + y^2 = 4 \text{ and } x^2 + y^2 = 9.$ [5]
 - b) Prove that the volume bounded by cylinders $y^2 = x$ and $x^2 = y$ and planes z = 0, x + y + z = 2 is $\frac{11}{30}$. [5]
 - c) Find the x co-ordinate of centre of gravity of a loop of $r = a\sin 2\theta$ in first quadrant, given that area of loop is $A = \frac{\pi a^2}{8}$. [5]