Seat No. | | | | | | |

AOI 1310

Engineering Mathematics-II
(New) (102113)

P. Pages: 3 **Max. Marks: 80**

Time: Three Hours

Instructions to Candidates:

1. Do not write anything on question paper except seat number.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Student should note, no supplement will be provided.
4. Figures to the right indicate full marks.
5. All questions are compulsory.
6. Use of non-programmable electronic calculator is allowed.

Unit I

1 **Attempt any Two**

a i) If $v(x,y,z) = \cos 3x \cos 4y \sinh 5z$ then find the value of $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 v}{\partial z^2}$ **4**

ii) If $u = \log\left(\frac{x^5+y^5+z^5}{x^2+y^2+z^2}\right)$, then show that **4**

$$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = 3u$$

b i) If $z = f(x,y)$ where $x = e^u + e^{-v}$ and $y = e^{-u} - e^v$ show that **4**

$$\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x\frac{\partial z}{\partial x} - y\frac{\partial z}{\partial y}$$

ii) If $ye^{xy} = \sin x$, find $\frac{d^2y}{dx^2}$ **4**

c If $u = f\left(\frac{y-x}{xy}, \frac{z-x}{xz}\right)$, show that **8**

$$x^2\frac{\partial u}{\partial x} + y^2\frac{\partial u}{dy} + z^2\frac{\partial u}{\partial z} = 0$$

Unit II

2 **Attempt any Two**

a i) Verify that JJ'=1, for $x = u, y = u\tan v, z = w$ **4**

ii) Examine for functional dependence $u = x^2e^{-y}\cosh z$ $v = x^2e^{-y}\sinh z$, $w = 3x^4e^{-2y}$, if functionally dependent, find the relation between them. **4**

b i) The power dissipated in a resistor is given by $P = \frac{E^2}{R}$. 4
Using calculus, find the approximate percentage change in P when E is increased by 4% and R decreased by 1%.
ii) Compute an approximate value of $(4.02)^{3.01}$. 4

c Find the maximum and minimum distances of the point (3,4,12) from the sphere $x^2 + y^2 + z^2 = 1$. 8

Unit III

3 **Attempt any Two**

a i) Trace the curve $r = a(1 - \cos\theta)$ with justification. 4
ii) Find the Fourier series expansion for
$f(x) = x^3$, in the interval $-\pi < x < \pi$ 4

b i) Trace the curve $y^2(a - x) = x^3$ with justification. 4
ii) Find the half range Cosine series for the function 4
$f(x) = (x - 1)^2$ in the interval $0 < x < 1$.

c Find the Fourier series for $f(x) = e^x$ in the interval $0 < x < 2\pi$. 8

Unit IV

4 **Attempt any Two**

a i) Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} xy\, dydx$ 4
ii) Change the order of integration in
$I = \int_0^1 \int_{x^2}^{2-x} f(x,y)dydx$. 4

b Evaluate the integral $\iiint (x^2 + y^2 + z^2)dxdydz$, taken over the volume enclosed by the sphere $x^2 + y^2 + z^2 = 1$. 8

c i) Find the area between the parabolas 4
$y^2 = 4ax$, $x^2 = 4ay$ using double integration.
ii) Find the volume bounded by the cylinder $x^2 + y^2 = 4$ and 4
the planes $y + z = 3$ and $z = 0$.

Unit V

5 **Attempt any Two**

a i) Using Taylor's series method find $y(0.2)$ correct to four 4
decimal places, given that $\frac{dy}{dx} = 2y + 3e^x, y(0) = 0$.

ii) Using modified Euler's method find y(0.2) correct to three decimal places, given that $\frac{dy}{dx} = 1 - y,\ y(0) = 0, h = 0.1$ **4**

b Using Picard's method, find a solution of $\frac{dy}{dx} = 1 + xy$ up to the fourth approximation when y(0)=0. **8**

c Apply Runge-Kutta method (fourth order), to find an approximate value of y when $x = 0.2$ given that $\frac{dy}{dx} = x + y^2$ and $y = 1$ when $x = 0, h = 0.1$. **8**