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AU – 2471

First Semester B. E./B. Tech./B. Text. (Common For All) Examination

ENGINEERING MATHEMATICS–I

Paper – 1A1/1 SCT3

(USC – 10082)

P. Pages : 4

Time : Three Hours] [Max. Marks : 80

Note : (1) Due credit will be given to neatness and adequate dimensions.
(2) Assume suitable data wherever necessary.
(3) Illustrate your answer wherever necessary with the help of neat sketches.
(4) Use of slide rule logarithmic tables, Calculators is permitted.
(5) Figures to the right indicates full marks
(6) Use pen of Blue/Black ink/refill only for writing the answer book.

1. (a) Find the n^{th} derivative of $\cos x \cos 2x \cos 3x$ 5

(b) If $y = (x+\sqrt{x^2+a^2})^m$, prove that $(x^2+a^2)y_{n+2}+(2n+1)xy_{n+1}+(n^2-m^2)y_n=0$ 5

(c) Evaluate $\lim_{x\to 0} (a^x+x)^{1/x}$ 3

OR

2. (a) Find the n^{th} derivative of $\frac{1}{x^2-4x+3}$ 5

(b) Using Taylors theorem, expand $2x^3 + 7x^2 + x - 6$ in powers of $(x-2)$ 5

(c) Evalute $\lim_{x\to 0} \tan x.\log x$ 3

3. (a) Verify Eulers theorem on hamogeneous function for $u = \sqrt{x}+\sqrt{y}+\sqrt{z}$ 7

(b) If $u = \tan^{-1}\left(\frac{\sqrt{x^2+y^2}}{x-y}\right)$, using Eulers theorem, find the value of

$$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2}$$ 6

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OR

4. (a) If z is a function of x and y and if $x = e^u + e^{-v}$, $y = e^{-u} - e^v$, show that $\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x \frac{\partial z}{\partial x} - y \frac{\partial z}{\partial y}$ 7

(b) If $u = \sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, then using Eulers theorem on homogeneous function show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{\tan u}{2}$ 6

5. (a) Find $\frac{\partial(u, v, w)}{\partial(x, y, z)}$ if

$u^2 + v + w = x + y^2 + z^2$

$u + v^2 + w = x^2 + y + z^2$

$u + v + w^2 = x^2 + y^2 + z$ 7

(b) Find the stationary values of $u = x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$ 7

OR

6. (a) Find $\frac{\partial u}{\partial x}$ using Jacobians if

$x = u + v + w$

$y = u^2 + v^2 + w^2$

$z = u^3 + v^3 + w^3$ 7

(b) Divide 24 into three parts such that the continued product of the first, square of the second and cube of the third may be maximum by using Lagrange's method of undetermind multipliers. http://www.sgbauonline.com 7

7. (a) Prove that :

$$(1+i)^n + (1-i)^n = 2^{\frac{n}{2}+1} \cos \frac{n\pi}{4}$$ 4

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(b) If $\sin(\alpha + i\beta) = x + iy$. Prove that

$$\frac{x^2}{\cosh^2\beta} + \frac{y^2}{\sinh^2\beta} = 1$$ 4

(c) Show that $\text{Log}_i i = \frac{4n+1}{4m+1}$ 5

OR

8. (a) Show that the continued product of all the values of $(1+i)^{1/5}$ is $(1+i)$ 6

(b) If $u+iv = \text{cosec}(\pi/4+ix)$, where u, v, x are all real, then show that $(u^2 + v^2)^2 = 2(u^2 - v^2)$ 7

9. (a) Evaluate $(x+y+1)^2 \frac{dy}{dx} = 1$ 4

(b) Evaluate $(x + y - 10)dx + (x - y - z)dy = 0$ 4

(c) Evaluate $xdy - y\,dx = (x^2 + y^2)(xdx + ydy)$ 5

OR

10. (a) Solve $\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$ 4

(b) Solve $\frac{dy}{dx} + 2xy = 2e^{-x^2}$ 5

(c) Solve $(ax + hy + g)dx + (hx + by + f)dy = 0$ 4

11. (a) Solve $y = 2px + \sin(xp^2)$ 4

(b) Solve $e^{3x}(p - 1) + p^3 e^{2y} = 0$ 5

(c) Find the orthogonal trajectories of the family of circles $x^2 + 4y^2 = c^2$ 5

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OR

12. (a) Solve $y = 2px + x^2p^4$ 4

(b) Solve $e^{2y}p^3 + (e^{2x} + e^{3x})P - e^{3x} = 0$ 5

(c) Find the orthogonal trajectories of the family of curves $r = a(1+\cos\theta)$ 5

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