B.E. / B.Tech. (Common for All Branch) (Model Curriculum) Semester-II

ESC104 / BSC104- Engineering Mathematics-II

P. Pages : 3

Time : Three Hours

GUG/W/23/13173

Max. Marks : 80

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Notes :
1. All questions carry equal marks.
2. Use of non-programmable calculator is permitted.

UNIT – I

1. a) Solve $\frac{2x}{y^3}dx + \frac{y^2 - 3x^2}{y^4}dy = 0$ **8**

b) Solve $r\sin\theta - \cos\theta\frac{dr}{d\theta} = r^2$ **8**

OR

2. a) Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = -2\cosh x$ **8**

b) Solve $\left(D^2 + 2D + 1\right)y = x\cos x$ **8**

UNIT – II

3. a) Solve $\left(x^3D^3 + x^2D^2 - 2\right)y = x + \frac{1}{x^3}$ **8**

b) Solve by the method of variation of parameters $\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$. **8**

OR

4. a) Solve $(x-1)^3\frac{d^3y}{dx^3} + 2(x-1)^2\frac{d^2y}{dx^2} - 4(x-1)\frac{dy}{dx} + 4y = 4\log(x-1)$. **8**

b) The voltage V and the current i at a distance x from sending end of the transmission line satisfy the equation $-\frac{dv}{dx} = Ri$ & $-\frac{di}{dx} = GV$ where R & G are constants. **8**

If $V = V_0$ at the sending end $(x = 0)$ & $V = 0$ at the receiving end $(x = \ell)$ show that

$V = V_0\left[\frac{\sinh(\ell - x)}{\sinh n\ell}\right]$ where $n^2 = RG$

UNIT – III

5. a) Evaluate $\iint_R xy(x+y)\,dx\,dy$, where R is the area between the curves $y = x^2$, $y = x$. **8**

b) Evaluate $\int_0^1 \int_{x^2}^{2-x} xy\,dx\,dy$ by changing the order of integration. **8**

OR

6. a) Evaluate $\int_0^1 \int_0^{1-x} \int_0^{x+y} e^x\,dz\,dy\,dx$. **8**

b) Find the volume of the solid generated by revolving the region bounded by $y = x^2 + 2$ and $y = x + 4$ about the x-axis. **8**

UNIT – IV

7. a) For the curve **8**

$x = \cos t + t \sin t,$

$y = \sin t - t \cos t,$

Find the tangential & normal components of acceleration at any time t.

b) Find $\nabla\phi$ if **8**

i) $\phi = \log\left(x^2 + y^2 + z^2\right)$

ii) $\phi = x \sin z - y \cos z$

iii) $\phi = r^2 e^{-r}$

OR

8. a) Find the direction at derivative of $\phi = 5x^2y - 5y^2z + 2.5z^2x$ at the point P (1, 1, 1) in the direction of the line. **8**

$$\frac{x-1}{2} = \frac{y-3}{-2} = z$$

b) Find the cosine of the angle between the normals to the surfaces. **8**

$x^2y + z = 3$ & $x \log z - y^2 = 4$ at the point of intersection $P(-1, 2, 1)$

UNIT – V

9. a) Prove that **8**

$\operatorname{div}\left(r^n \vec{r}\right) = (n+3)\,r^n$ Hence show that $\dfrac{\vec{r}}{r^3}$ is solenoidal.

b) Find the total work done in moving a particle in a force field, given by **8**

$\vec{f} = 3xy\ i - 5z_j + 10xk$ along the curve $x = t^2 + 1,\ y = 2t^2$ & $z = t^3$ from t = 1 to t = 2.

OR

10. a) Verify the Green's theorem for $\int_C \left(xy + y^2\right)dx + x^2 dy$ where C is bounded by **8**

$y = x$ & $y = x^2$.

b) Apply Stoke's theorem to evaluate $\int_C \left\{4y\ dx + 2z\,dy + 6y\,dz\right\}$ where C is the curve of **8**

intersection of $x^2 + y^2 + z^2 = 6z$ & $z = x + 3$

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