B.E (Model Curriculum) (CBCS Pattern) Semester-II

ESC104 / BSC104 - Applied / Engineering Mathematics-II

P. Pages : 2 **GUG/W/22/13173**

Time : Three Hours Max. Marks : 80

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

1. a) Solve $\left(2x+e^{x}\log y\right)dx+\left(\dfrac{e^{x}}{y}+1\right)dy=0$ **4**

b) Solve $\left(1+x^{2}\right)\dfrac{dy}{dx}+y=e^{\tan^{-1}x}$ **4**

c) Solve $\dfrac{d^{2}y}{dx^{2}}+4y=x\sin x+2^{x}$ **8**

OR

2. a) Solve $\dfrac{dy}{dx}+\dfrac{1}{x}\tan y=\dfrac{1}{x^{2}}\tan y\cdot\sin y$ **4**

b) Solve $\left[\cos x\log\left(2y-8\right)+\dfrac{1}{x}\right]dx+\dfrac{\sin x}{y-4}dy=0$ **4**

c) Solve $\dfrac{d^{2}y}{dx^{2}}+3\dfrac{dy}{dx}+2y=\cos\left(e^{x}\right)$ **8**

3. a) Solve $\dfrac{d^{2}y}{dx^{2}}-y=e^{-2x}\sin\left(e^{-x}\right)$ **8**

b) Solve $x^{2}\dfrac{d^{2}y}{dx^{2}}+x\dfrac{dy}{dx}+y=\log x\cdot\sin\left(\log x\right)$ **8**

OR

4. a) Solve $\dfrac{d^{2}y}{dx^{2}}=\sec^{2}y\tan y$ given that $y=0\ \&\ \dfrac{dy}{dx}=1$ when $x=0$ **8**

b) Solve $(3x+2)^{2}\dfrac{d^{2}y}{dx^{2}}+5(3x+2)\dfrac{dy}{dx}-3y=x^{2}+x+1$ **8**

5. a) Evaluate $\int_0^{4a}\int_{x^2/4a}^{2\sqrt{ax}} dy\,dx$ by change of order of Integration. **8**

b) Evaluate $\int_0^{\pi/2}\int_0^{a\sin\theta}\int_0^{\left(\frac{a^2-r^2}{a}\right)} r\,dr\,d\theta\,dz$ **8**

OR

6. a) Find volume bounded by x – y plane the cylinder $x^2+y^2=1$ and plane $x+y+z=3$. **8**

b) Find centre of gravity of the area between $y=6x-x^2$ & $y=x$ **8**

7. a) A particle moves along the curves $x=2t^2, y=t^2-4t, z=3t-5$. Find the component of velocity and acceleration at time t = 1 in the direction of $\overline{i}-2\overline{j}-2\overline{k}$ **6**

b) Find the unit tangent vector to any point an the curve. **4**
X = a cos wt, y = a sin wt, z = at where a, b, w are constant.

c) Find directional derivatives of $\phi=x^2+y^2+4xyz$ at the point $(1,-2,2)$ in the direction $2\hat{i}-2\hat{j}-2k$ **6**

OR

8. a) Show that tangent vectors to the curve $x=t^2-1, y=2t^2+1, z=2t^2-6t$ at $t=\pm1$ are orthogonal **8**

b) A particle moves so that its position vector is given by $\overline{r}=a\cos wt\,\hat{i}+\sin wt\,\hat{j}$ when w is constant. Show that **8**
i) $\overline{v}\perp\overline{r}$
ii) $\overline{r}\times\overline{v}$ is constant vector.

9. a) If $\overline{r}$ is position vector, prove that **8**
i) $\nabla\left(r^n\cdot\overline{r}\right)=(n+3)r^n$
ii) $\nabla^2\left(r^n\right)=M(M+1)r^{n-2}$

b) Show that vector field $\overline{f}=\left(2xy+z^3\right)\hat{i}+x^2\hat{j}+3xz^2k$ is irrotational find its scalar potential ϕ. Also find the work done in moving an object in this field from $(1,-2,1)$ to $(3,1,4)$ **8**

OR

10. a) Use Stoke's theorem to evaluate $\int_c \overline{f}\cdot d\overline{r}$ where $\overline{f}=y^2i+x^2j-(x+z)k$ and c is boundary of triangle with vertices $(0,0,0),(1,0,0),(1,1,0)$ **8**

b) Evaluate by Gauss Divergence Theorem $\iint_s \overline{f}\circ n\,ds$ where $\overline{f}=4x\hat{i}-2y^2\hat{j}+z^2k$ and s is region bounded by cylinder. **8**

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