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Code No. : 1202

**VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD**  
**BE I Year II – Semester (Main) Examinations, July - 2015**

**Mathematics – II**

Time: 3 hours

Max. Marks: 70

Note: Answer ALL questions in Part-A and any FIVE questions from Part-B

**Part-A (10 X 2=20 Marks)**

1. Find the unit normal to the surface  $xy^3z^3 = 4$  at  $(-1, -1, 2)$
2. Explain concept of line integral.
3. Find the curl of vector function  $\vec{F} = (x-y)\mathbf{i} + (y-z)\mathbf{j} + (z-x)\mathbf{k}$ .
4. Define orthogonal trajectories of the family of curves.
5. Solve the differential equation  $y'' + y = 0$ .
6. Find particular integral of  $y'' - 2y' + 4y = e^x \cos x$ .
7. State Gauss Divergence theorem.
8. Evaluate  $\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-x^2/2} dx$  by using gamma function.
9. Express  $J_5(x)$  in terms of  $J_0(x)$  and  $J_1(x)$
10. Express Legendre's polynomials  $4P_3(x) + 6P_2(x) - 3P_1(x) - 2P_0(x)$  in powers of  $x$ .

**Part-B (5 X 10=50 Marks)**

11. a) Find the Directional derivative of the scalar function  $\phi = 2x^2 + y^2 + z^2$  at  $(1, 2, 3)$  [5]  
in the direction of the line  $\frac{x}{3} = \frac{y}{4} = \frac{z}{5}$
- b) Evaluate  $\iint_S \vec{A} \cdot \vec{n} ds$  where  $\vec{A} = z\mathbf{i} + x\mathbf{j} - 3y^2z\mathbf{k}$  and  $S$  in the surface of the cylinder [5]  
 $x^2 + y^2 = 16$  included in the first octant between  $z = 0$  and  $z = 5$ .
12. a) Find the orthogonal trajectories of the family of confocal conics  $\frac{x^2}{a^2} + \frac{y^2}{a^2 + \lambda} = 1$  [5]  
where  $\lambda$  is the parameter.
- b) Find the general solution of the differential equation  $y' = y^2 - (2x - 1)y + x^2 - x + 1$ , [5]  
if  $y = 1$  is a solution of the equation.
13. a) Solve  $\frac{d^2y}{dx^2} - 4y = x \sinh x$ . [5]
- b) Show that the frequency of free vibration in a closed electrical circuit with inductance [5]  
 $L$  and capacity  $C$  in series is  $\frac{30}{\pi\sqrt{LC}}$  per minute.

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14. a) Find the series solution of the differential equation  $y'' + xy = 0$  about  $x_0=1$ . [5]

b) Show that  $P'_n(x) = xP'_{n-1}(x) + nP_{n-1}(x)$  [5]

15. a) Show that  $J_n(x) = \frac{1}{\pi} \int_0^\pi \cos(n\theta - x \sin \theta) d\theta$ ,  $n$  being an integer. [5]

b) Discuss orthogonality of Bessel function. [5]

16. a) Prove  $\nabla^2 f(r) = f''(r) + \frac{2}{r} f'(r)$ . [5]

b) Show that the family of curves  $y^2 = 4c(x+c)$  is a self orthogonal. [5]  
where  $c$  is a parameter.

17. Answer any two of the following:

a) Solve the differential equation  $y'' + y' - 2y = x^2 \sin x$  [5]

b) Express  $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$  in terms of Legendre's polynomials. [5]

c) Prove that  $J_{\frac{5}{2}}(x) = \sqrt{\frac{2}{\pi x}} \left\{ \frac{3-x^2}{x^2} \sin x - \frac{3}{x} \cos x \right\}$  [5]

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