Hall Ticket Number:

| | | | | | | | | | | | | |

Code No.: **8121 M**

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, **HYDERABAD**
M.E. I Year (Mech.) I-Semester (Make Up) Examinations, March-2016
(Advanced Design & Manufacturing)

Mathematical Methods for Engineers

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. Prove that $\bar{a} \times \bar{b} = \bar{b} \times \bar{c} = \bar{c} \times \bar{a}$, when $\bar{a} + \bar{b} + \bar{c} = 0$.

2. Define Solenoidal of vector function.

3. Define symmetric and skew symmetric tensors.

4. Write the christoffel symbols of second kind.

5. Discuss the consistency of the equations $x + 2y = 1$, $7x + 14y = 12$.

6. Find the eigen vectors of the matrix $\begin{bmatrix} 1 & -2 \\ -5 & 4 \end{bmatrix}$

7. Show that $L\{F''(t)\} = s^2 F(s) - sF(0) - F'(0)$, where s is real number.

8. Write down the Strum-Liouville problem.

9. Classify whether the wave equation is Parabolic?

10. Write the solution of two dimensional heat equation by variable separable method.

Part-B (5 X 10=50 Marks)
(All bits carry equal marks)

11. a) Prove that $\vec{a} \times (\vec{b} \times \vec{c}) + \vec{b} \times (\vec{c} \times \vec{a}) + \vec{c} \times (\vec{a} \times \vec{b}) = \vec{0}$
    b) Show that Div.(Curl $\bar{v}$) = $\vec{0}$

12. a) Show that any inner product of tensors A_r^p and B_t^{qs} is a tensor of rank 3.
    b) Define metric tensors and Conjugate tensors and determine the metric tensor in cylindrical coordinate system.

13. a) Solve the system of equations
    $2x_1 - x_2 + 0. x_3 = 7$
    $-x_1 + 2 x_2 - x_3 = 1$
    $0. x_1 - x_2 + 2 x_3 = 1$
    Using Gauss – Seidal method

    b) Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$

14. a) Solve the equation

$$\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 0 \text{ where } y = 1, \frac{dy}{dx} = 2 ;$$

$$\frac{d^2y}{dx^2} = 2 \text{ at } \quad t = 0 \quad \text{ Using Laplace transforms.}$$

b) State and Prove final value theorem.

15. a) A tightly stretched string of length ℓ with fixed ends is initially in equilibrium position. It is set vibrating by giving each point a velocity $v_o \sin^3\frac{\pi x}{l}$. Find the displacement y(x, t).

b) Explain the transformation of two dimensional Laplace's equation in spherical coordinate system and write the equation in spherical coordinate system.

16. a) Find the solution of following system of equations using Cramer's rule

$$x + y + z = 4, \quad x - y + z = 0, \quad 2x + y + z = 5.$$

b) Prove that Curl Grad $f = \nabla \times \nabla f = \bar{0}$

17. a) Find the eigen function and eigen value for the Strum-Liouville problem $y'' + \lambda y = 0$, $y(0) = 0, y'(\ell) = 0$.

b) Express the value of $\left\{\begin{smallmatrix}1\\22\end{smallmatrix}\right\}, \left\{\begin{smallmatrix}2\\21\end{smallmatrix}\right\}, \left\{\begin{smallmatrix}2\\33\end{smallmatrix}\right\}, \left\{\begin{smallmatrix}3\\32\end{smallmatrix}\right\}$ in rectangular co-ordinate system.

****