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Vidya Jyothi Institute of Technology (Autonomous)

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(Aziz Nagar, C.B.Post, Hyderabad -500075) **Subject code: A21002**

I B. Tech I SEM REGULAR EXAMINATION – DECEMBER 2018
MATHEMATICS-I
(COMMON TO CE, EEE, MECH, ECE, CSE AND IT)

Time: 3hrs **Max.Marks:75**

Note: This question paper contains two PARTs A and B.
PART A is compulsory which carries 25 marks. Answer all questions.
PART B consists of 5 questions. Answer all the questions.

PART - A

ANSWER ALL THE QUESTIONS **25 M**

1. Define unitary matrix. 2M
2. Define rank of the matrix 3M
3. Define Eigen value and Eigen vector of a matrix 2M
4. Find the nature, index and signature of the quadratic form $2x^2 + 2y^2 + 2z^2 + 2yz$ 3M
5. State Limit comparison test 2M
6. Test the series $\sum u_n$ whose nth term is $\frac{1}{(4n^2-1)}$ 3M
7. State Rolle's theorem. 2M
8. Show that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$ 3M
9. If $x = r\cos\theta, y = r\sin\theta$, find $\frac{\partial(x,y)}{\partial(r,\theta)}$ 2M
10. Write the procedure to find maximum and minimum values of a function of two variables. 3M

PART-B

ANSWER ALL THE QUESTIONS **5QXIOM=50M**

11.i) a) Find the rank of $A=\begin{pmatrix}-1 & 2 & 1 & 8\\ 2 & 1 & -1 & 0\\ 3 & 2 & 1 & 7\end{pmatrix}$ by reducing it in to echelon form. 5M

b) Prove that the following set of equations are consistent $3x + 3y + 2z = 1;$ $x + 2y = 4; 10y + 3z = -2; 2x - 3y - z = 5$ 5M

OR

ii) a) Find the rank of the matrix $A = \begin{bmatrix}0 & 1 & 2 & -2\\ 4 & 0 & 2 & 6\\ 2 & 1 & 3 & 1\end{bmatrix}$ by reducing it to normal form 5M

b) Show that the equations $x - 4y + 7z = 14; 3x + 8y - 2z = 13;$ $7x - 8y + 26z = 5$ are not consistent. 5M

12.i) a) Find the Eigen values and the corresponding Eigen vectors of the matrix $\begin{bmatrix}8 & -6 & 2\\ -6 & 7 & -4\\ 2 & -4 & 3\end{bmatrix}$ 10M

OR

ii) Determine the modal matrix P of $A = \begin{pmatrix}-2 & 2 & -3\\ 2 & 1 & -6\\ -1 & -2 & 0\end{pmatrix}$. Verify that $P^{-'}AP$ is a diagonal matrix. 10M

13.i) a) Discuss the convergence of $\sum \frac{x^{2n}}{(n+2)\sqrt{(n+1)}}$, $(x > 0)$ 5M

b) Examine the following series for absolute and conditional convergence $\frac{1}{5\sqrt{2}} - \frac{1}{5\sqrt{3}} + \frac{1}{5\sqrt{4}} - \cdots + (-1)^n \frac{1}{5\sqrt{n}} + \cdots$ 5M

P.T.O

OR

ii) Test the convergence of the series

$\frac{1}{2}+\frac{1.3}{2.4}+\frac{1.3.5}{2.4.6}+-----$ 10M

14.i) Prove that by using Lagrange's Mean Value theorem 10M

$$\frac{b-a}{\sqrt{(1-a^2)}} < Sin^{-1}b - Sin^{-1}a < \frac{b-a}{\sqrt{(1-b^2)}}$$

and hence deduce that $\frac{\pi}{6}-\frac{1}{2\sqrt{3}} < \sin^{-1}\frac{1}{4} < \frac{\pi}{6}-\frac{1}{\sqrt{15}}$

OR

ii) Prove that $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ 10M

15.i) a) Find the maximum and minimum values of the function 5M

$f(x,y) = x^3y^2(1-x-y)$

b) If $u = x^2 - 2y$; $v = x + y + z$; $w = x - 2y + 3z$ find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ 5M

OR

ii) A rectangular box open at the top is to have volume of 32 cubic ft. Find the dimensions of the box requiring least material for its construction. 10M

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