(Pages : 2) **1662**

Reg. No. : ....

Name : ....

Combined First and Second Semester B.Tech. Degree Examination, April 2013

(2008 Scheme)

08-101 : ENGINEERING MATHEMATICS – I

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Find the n^{th} derivative of $e^x(2x+3)^3$
2. Expand $\sin\left(\frac{\pi}{4}+x\right)$ in powers of x
3. If $x = a(u+v)$, $y = b(u-v)$ and $u = r^2\cos 2\theta$ $v = r^2\sin 2\theta$, find $\frac{\partial(x,y)}{\partial(r,\theta)}$.
4. If $\vec{r} = xi + yj + zk$ and $r = |\vec{r}|$, then show that $\Delta(\vec{a}.\vec{r}) = \vec{a}$ where $\vec{a}$ is a constant vector.
5. Solve $(D^2+2D+1)y = x^3$
6. Find $L\left(\frac{e^{-at}-e^{-bt}}{t}\right)$
7. Find the orthogonal trajectories of hyperbolas $xy = c$
8. Find the rank of the matrix
$$\begin{bmatrix} 4 & 3 & 0 & -2 \\ 3 & 4 & -1 & -3 \\ 7 & 7 & -1 & -5 \end{bmatrix}$$
9. Show that the vectors (1, 2, –1, 3) (2, –1, 3, 2) and (–1, 8, –9, 5) are linearly dependent and find a relation connecting them.
10. Show that the eigen values of a triangular matrix are its diagonal elements.

P.T.O.

PART – B

Answer **two** questions from **each** module.

Module – I

11. Show that the evolute of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is $(ax)^{2/3}+(by)^{2/3}=(a^2-b^2)^{2/3}$

12. If $u=\sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, prove that

    i) $xu_x+yu_y=\frac{1}{2}\tan u$

    ii) $x^2u_{xx}+2xyu_{xy}+y^2u_{yy}=-\frac{\sin u\cos^2 u}{4\cos^3 u}$

13. Find the values of the constants a, b, c, so that $\vec{F}=(axy+bz^3)\hat{i}+(3x^2-cz)\hat{j}+(3xz^2-y)\hat{k}$ may be irrotational. For these values of a, b, c, find also the scalar potential of $\vec{F}$.

Module – II

14. Solve $\frac{dx}{dt}+5x-2y=t,\ \frac{dy}{dt}+2x+y=0$

15. Using method of variation of parameters, solve $(D^2+2D+1)y=e^{-x}\log x$

16. Using Laplace transform, solve

    $\frac{d^2y}{dt^2}-3\frac{dy}{dt}+2y=4$ given $y(0)=2,\ y'(0)=3$

Module – III

17. For what values of K, the equations $x+y+z=1,\ 2x+y+4z=K,\ 4x+y+10z=K^2$ have a solution and solve them in each case.

18. Obtain an orthogonal transformation which will transform the quadratic form $6x^2+3y^2+3z^2-4xy-2yz+4zx$ into sum of squares and find the reduced form. Examine for definiteness.

19. Given $A=\begin{bmatrix}1&0&-2\\2&2&4\\0&0&2\end{bmatrix}$. Find A^{-1} and A^4 using Cayley – Hamilton theorem.

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