Roll No. ☐☐☐☐☐☐☐☐☐☐☐   **Total No. of Pages : 02**

Total No. of Questions : 16

B.Tech. (Ind. Engg. & Mgt. (TQM)   (Sem.–1)
APPLIED MATHEMATICS
Subject Code : IEM-104
M.Code : 61004

Time : 3 Hrs.   **Max. Marks : 40**

INSTRUCTIONS TO CANDIDATES :
 1. **Attempt any EIGHT out of TEN Questions from SECTION-A carrying THREE marks each.**
 2. **Attempt any FOUR out of SIX questions from SECTION-B carrying NINE marks each.**

SECTION-A

1. Evaluate $\sin 225º$.

2. Find the area of the triangle formed by the lines joining the vertex of the parabola $x^2 – 12y$ to the ends of its latus rectum

3. Differentiate $(\log x)^{\cos x}$ w.r.t x.

4. Find all vectors of magnitude $10\sqrt{3}$ that are perpendicular to the plane of $\hat{i} + 2\hat{j} + \hat{k}$ and $-\hat{i} + 3\hat{j} + 4\hat{k}$.

5. If $A = \begin{pmatrix} 3 & -2 \\ 4 & -2 \end{pmatrix}$ and $I = A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$. Find k so that $A^2 = kA – 2I$.

6. If $A = \begin{pmatrix} -1 & 2 \\ 4 & k \end{pmatrix}$ is a singular matrix, then find k.

7. (a) Evaluate $(4x^3 – 9x^2 + 7x + 3)\, e^{-x}\, dx$.

   (b) Evaluate $\int (4x^3 – 9x^2 + 7x + 3)\, e^{-x}\, dx$.

8.   A wheel makes 270 revolutions in one minute. Through how many radians does it turn in one-second ?

9.   A particle moves along the x-axis. The function $x(t)$ gives the particle's position at anytime $t \geq 0$, $x(t) = t^3 - 3t^2 + 7t - 6$. What is the particle's acceleration $a(t)$ at $t = 3$.

10. Evaluate $\lim\limits_{x \to 0} \dfrac{\sin 3x}{5x}$.

SECTION-B

11. If three consecutive coefficients in the bionomial expansion of $(1 + x)^n$ are in the ratio 6 : 33 : 110, find n and the rth term of this Binomial expansion.

12. The moon's distance from the earth is 385000 kms and its diameter subtends an angle of 31' at the eye of the observer. Find the diameter of the moon.

13. If $A = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ a & 2 & b \end{pmatrix}$ is a matrix satisfying $AA^T = 9I_3$, then find the values of a and b.

14. Using vectors, prove that the perpendiculars from the vertices to the opposite sides (altitudes) of a triangle are concurrent.

15. Evaluate $\int \dfrac{x \sin^{-1} x}{\sqrt{1 - x^2}} \, dx$.

16. Find the area of the region bounded by the curves $y^2 = 4ax$ and $x^2 = 4ay$, $a > 0$.

NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.