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

Total No. of Questions : 18

B.Tech. (BT) (2012 to 2017)   (Sem.–3)
MATHEMATICS
Subject Code : BTBT-301
M.Code : 55071

Time : 3 Hrs.   Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :
1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Find the centre and the radius of the circle $2x^2 + 2y^2 - x = 0$.

2. Find rank of $\begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & -2 \end{bmatrix}$.

3. Which term of the A.P. 5, 2, –1, …….. is –22?

4. Find the equation of the normal to the parabola $y^2 = 12x$ which is perpendicular to the line $x - 3y + 6 = 0$.

5. Find the number of permutations of the letters of word ALLAHABAD.

6. Find the inverse of the matrix $\begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$.

7. In what ratio, the line joining (–1, 1) and (5, 7) is divided by $x + y = 4$?

8. Prove that $\sin 105° + \cos 105° = \cos 45°$.

9.   Prove that $\cos 4x = 1 - 8 \sin^2 x \cos^2 x$.

10. For what values of k does the equation $2x^2 + 3xy + y^2 - 3x + ky - 2 = 0$ represents a pair of straight lines?

SECTION-B

11. For what value of λ, does the system $\begin{bmatrix} 1 & -2 & 1 \\ 3 & -1 & 2 \\ 0 & 1 & \lambda \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = O$ has

   a) A unique solution.

   b) Infinitely many solutions.

12. Three urns A, B, and C contain 6 red and 4 white, 2 red and 6 white, 1 red and 5 white balls respectively. An urn is chosen at random and a ball is drawn. If the ball drawn is found to be red, find the probability that the ball was drawn from urn A.

13. The sum of three numbers in G.P. is 28 and their product is 512. Find them.

14. In how many ways can 5 books on Chemistry and 4 books on Physics be arranged on a shelf so that the books on same subject remain together ?

15. If the 21st and 22nd terms of the expansion $(1 + x)^{44}$ are equal , then find the value of x.

SECTION-C

16. State and prove Cayley-Hamilton Theorem.

17. Find the equation of the circle passing through the points $(1, 2)$, $(3, -4)$, $(5, -6)$.

18. Five defective bulbs are accidentally mixed with twenty good ones. It is not possible to just look at a bulb and tell whether or not it is defective. Find the probability distribution of the number of defective bulbs, if four bulbs are drawn at random from this lot.

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.