

Roll No.

Total No. of Pages :03

Total No. of Questions :18

**B.Tech.(Agriculture Engg./Automation & Robotics/Automation
Engg./Civil Engg./Computer Science & Engg./Electrical & Electronics
Engg./Electrical Engg./Electronics & Communication Engg./Electronics
& Electrical Engg./Information Technology/Mechanical Engg.)/**

B.Tech. (CSE/ECE) (PIT)(Sem.-1)

MATHEMATICS-I

Subject Code : BTAM-101-18

M.Code : 75353

Date of Examination : 01-07-22

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 & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Solve the following :

- 1) What is maximum value of function $f(x) = -x^2$.
- 2) Find the equation of normal line to the surface $xyz = 6$ at $(1, 2, 3)$.
- 3) Show that the function $f(x, y) = \begin{cases} \frac{xy}{2y^2 + x^2}; & (x, y) \neq (0, 0) \\ 0; & (x, y) = (0, 0) \end{cases}$ is discontinuous at $(0, 0)$.
- 4) Evaluate $\lim_{x \rightarrow \frac{\pi}{2}} \frac{\log\left(x - \frac{\pi}{2}\right)}{\tan x}$.
- 5) Calculate approximate value of $\sqrt{10}$ to two decimal places by Taylor's theorem.

- 6) Evaluate $\int_0^1 \int_1^a \frac{1}{xy} dy dx$.
- 7) Examine the nature of the series $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots + \infty$.
- 8) Define orthogonal matrices with example.
- 9) Show that $(1, 1, 2)$ is an eigen vector of the matrix $A = \begin{bmatrix} 3 & 1 & -1 \\ 2 & 2 & -1 \\ 2 & 2 & 0 \end{bmatrix}$ corresponding to the eigen value 2.
- 10) Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$.

SECTION-B

- 11) a) Verify Cauchy's mean value theorem for $f(x) = \log x, g(x) = \frac{1}{x}$ in $[1, e]$.
- b) Apply Maclaurin's theorem with Lagrange's remainder to function $f(x) = \cos x$.
- 12) Discuss the convergence of the following improper integral
- a) $\int_0^{\infty} \frac{1}{b^2 x^2 + a^2} dx$ b) $\int_1^2 \frac{x+1}{\sqrt{x-1}} dx$.
- 13) Show that the rectangular solid of maximum volume that can be inscribed in a given sphere is a cube.
- 14) a) Evaluate by changing the order of integration of $\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{x}{\sqrt{x^2 - y^2}} dy dx$.
- b) Find the volume enclosed between the cylinders $x^2 + y^2 = 2ax$ and $z^2 = 2ax$.

SECTION-C

15) a) Discuss the convergence or divergence of the series $\sum \frac{n^p}{(n+1)^q}$.

b) Test the convergence of $\sum_{n=2}^{\infty} \frac{1}{[\log(\log n)]^n}$.

16) a) Test the convergence of $1 + \frac{(1+\alpha)}{(1+\beta)} + \frac{(1+\alpha)(1+2\alpha)}{(1+\beta)(1+2\beta)} + \frac{(1+\alpha)(1+2\alpha)(1+3\alpha)}{(1+\beta)(1+2\beta)(1+3\beta)} + \dots$

b) Discuss the convergence or divergence of the series $\sum_{n=2}^{\infty} \frac{n+\sqrt{n}}{n^2-n}$.

17) a) Use Gauss Jordan method to find the inverse of a matrix $\begin{bmatrix} 2 & 4 & 3 & 2 \\ 3 & 6 & 5 & 2 \\ 2 & 5 & 2 & -3 \\ 4 & 5 & 14 & 14 \end{bmatrix}$.

b) Find a matrix B which transforms $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ into a diagonal form.

18) Determine the values of a and b for which the system $\begin{bmatrix} 3 & -2 & 1 \\ 5 & -8 & 9 \\ 2 & 1 & a \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} b \\ 3 \\ -1 \end{bmatrix}$ has

- a) a unique solution,
- b) no solution,
- c) infinitely many solutions.

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

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B.Tech. (CSE/IT) (2018 & Onwards) (Sem.-2)

MATHEMATICS-II

Subject Code : BTAM-204-18

M.Code : 76257

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 & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Answer the following :

1. Give any four characteristics for an ideal measure of dispersion.
2. Define skewness.
3. A bag contains 3 red, 6 white and 7 blue balls. What is the probability that two balls drawn are white and blue?
4. Give the formula of mean and standard deviation for Binomial distribution.
5. Write any four properties of normal distribution.
6. Find the coefficient of correlation of two uncorrelated variables x and y .
7. Write the normal equations for the curve $x = b + cy$.
8. Define sampling error and confidence interval.
9. Define Type-I error.
10. Define degrees of freedom.

SECTION-B

11. a) Calculate standard deviation from the table giving age distribution of 542 members :

Age group	20-30	30-40	40-50	50-60	60-70	70-80	80-90
No. of members	3	61	132	153	140	51	2

- b) The first four moments of a distribution about the value 4 of the distribution are -1.5 , 17 , -30 and 108 . Find the moments about mean.

12. a) Estimate $E(X)$ and $E(X)^2$ from the following probability distribution :

X	-3	6	9
P(X)	1/6	1/2	1/3

- b) A can hit a target 3 times in 5 shots, B 2 times in 5 shots and C 3 times in 4 shots. All of them fire one shot each simultaneously at the target. What is the probability that (i) 2 shots hit (ii) at least 2 shots hit?
13. a) During war 1 ship out of 9 was sunk on an average in making a certain voyage. What was the probability that (i) exactly 3 out of a convoy of 6 ships would arrive safely (ii) a minimum of 7 ships would arrive safely.
- b) A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the proportion of days on which (i) neither car is used, and (ii) some demand is refused.
14. a) If X is normally distributed and the mean of X is 2 and standard deviation is 4. Find out the probability of the following :
- (i) $X \geq 20$ (ii) $0 \leq X \leq 12$.
- b) Calculate the coefficient of correlation for the following height (in inches) of fathers (X) and their sons (Y) :

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

SECTION-C

15. The diameter of an electric cable, say X , is assumed to be a continuous random variable with probability density function $f(x) = 6x(1-x)$, $0 \leq x \leq 1$,
- i) Check that above is p.d.f., (ii) Determine a number b such that $P\{X < b\} = P\{X > b\}$.

16. Fit a parabola of second degree to the data :

X	0	1	2	3	4
Y	1	1.8	1.3	2.5	6.3

17. a) If 60 new entrants in a given university are found to have a mean height of 68.60 inches, and 50 seniors a mean height of 69.51 inches, is the evidence, conclusive that the mean height of the seniors is greater than that of the new entrants? Assume the standard deviation of height to be 2.48 inches.
- b) A dice is thrown 9000 times and a throw of 3 or 4 is observed 3240 times. Show that the dice cannot be regarded as an unbiased.
18. a) In an experiment on the immunization of goats from anthrax the following results were obtained. Derive your inference on the efficiency of the vaccine.

	Died of anthrax	Survived	Total
Vaccinated	2	10	12
Not vaccinated	6	6	12

(Take $\chi^2_{0.05}$ for 1 degree of freedom = 3.841)

- b) The means of two single large samples of 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can be samples be regarded as drawn from the same population of standard deviation 2.5 inches? (Test at 5% level of significance).

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