REG. NO.:

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ADVANCED SCIENCES
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2024-2025

SLOT: G2+TG2

Programme Name & Branch : **B. Tech. (Common)**
Course Code and Course Name : **BMAT202L-Probability and Statistics**
Faculty Name(s) : **Common Slot QP**
Class Number(s) : **Common Slot QP**
Date of Examination : **22/03/2025**
Exam Duration : **90 minutes** **Maximum Marks: 50**

General instruction(s):

- Answer All Questions.
- Use of statistical table is permitted.
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes: CO2. Understand the basic concepts of random variables and find an appropriate distribution for analyzing data specific to an experiment.
  CO3. Apply statistical methods like correlation, regression analysis in analyzing, interpreting experimental data.
  CO4. Make appropriate decisions using statistical inference that is the central to experimental research.

Q. No.	Question	Max Marks	CO	BL
1.	Find the regression equations for the following data and estimate the values of Y for X=3, 5 and 19: X: 2, 6, 4, 12, 10, 8, 0, 18, 14, 16 Y: 0, 2, 1, 5, 4, 3, -1, 8, 6, 7	10	3	3
2.	If X is a Poisson variate satisfying $P(X=2)=9P(X=4)+90P(X=6)$. Find $P(X<3), P(X\geq 3)$ and $P(X<3 \mid X>0)$.	10	2	3
3.	A random variable X follows normal distribution with mean 3 and variance 16. Write the probability density function of X. Also find $P(X\leq 3)$, $P(\lvert X-1\rvert > 2)$ and $P(X<5 \mid X>2)$.	10	2	3
4.	A sample of 900 members has a mean 3.5 cms and SD 2.61 cms. Is the sample from a large population of mean 3.35 cms and SD 2.61 cms? Test at 2% and 5% LOS. Also, find the 95% confidence interval for the population mean.	10	4	2
5.	Random samples of 400 men and 600 women were asked whether they would like to have a flyover near their residence. 225 men and 340 women were in favour of proposal. Test the hypothesis that the proportions of men and women in favour of proposal are same against that they are not, at 5% LOS.	10	4	2

BMAT202L - Probability and Statistics
Cat II Ans Key (Winter 2024-25)

Q.1. $\Sigma x = 90,\ \Sigma y = 35,\ \Sigma x^2 = 1140,\ \Sigma y^2 = 205,\ \Sigma xy = 480$

$$y - \bar{y} = \frac{n\Sigma xy - \Sigma x \cdot \Sigma y}{n\Sigma x^2 - (\Sigma x)^2}(x - \bar{x}) \Rightarrow y = \frac{x}{2} - 1 \quad (y \text{ on } x)$$

$$x - \bar{x} = \frac{n\Sigma xy - \Sigma x \cdot \Sigma y}{n\Sigma y^2 - (\Sigma y)^2}(y - \bar{y}) \Rightarrow x = 2y + 2 \quad (x \text{ on } y)$$

$y(3) = 0.5,\ y(5) = 1.5,\ y(19) = 8.5$

Q.2. $P(x=2) = 9P(x=4) + 90P(x=6)$

$\Rightarrow \lambda = 1 \quad \therefore P(x=x) = \frac{1}{e\,\lfloor x}$

$P(x<3) = P(x=0) + P(x=1) + P(x=2)$

$= \frac{2.5}{e} = \frac{5}{2e}$

$P(x \geq 3) = 1 - P(x<3) = 1 - \frac{2.5}{e} = \frac{2e-5}{2e}$

$P(x<3 \mid x>0)$

$= \frac{P(0<x<3)}{P(x>0)}$

$= \frac{P(x=1) + P(x=2)}{1 - P(x=0)}$

$= \frac{1.5}{e-1} = \frac{3}{2(e-1)}$

Q.3. Here $\mu = 3$ and $\sigma = 4 \therefore f(x) = \frac{1}{4\sqrt{2\pi}} e^{-\left(\frac{x-3}{4}\right)^2/2},\ -\infty < x < \infty$

$P(x \leq 3) = P(z \leq 0) = 0.5,$

$P(|x-1| > 2) = 1 - P(|x-1| \leq 2) = 1 - P(-2 \leq x-1 \leq 2)$

$= 1 - P(-1 \leq z \leq 0) = 0.6587,$

$$P(x<5 \mid x>2) = \frac{P(2<x<5)}{P(x>2)} = \frac{P(-\frac{1}{4} \leq z \leq \frac{2}{4})}{P(z > -\frac{1}{4})}$$

$$= \frac{P(-0.25 \leq z \leq 0) + P(0 \leq z \leq 0.5)}{P(-0.25 \leq z \leq 0) + P(0 \leq z < \infty)}$$

$$= \frac{0.0987 + 0.1915}{0.0987 + 0.5} = 0.4847.$$

Q4. $H_0: \mu = 3.35$

$H_1: \mu \neq 3.35$

$z = \frac{3.5 - 3.35}{2.61/\sqrt{900}} = 1.72 \quad z_\alpha = \begin{cases} 2.33 \text{ at } \alpha = 2\% \text{ LOS} \\ 1.96 \text{ at } \alpha = 5\% \text{ LOS} \end{cases}$

Since $|z| < z_\alpha$ at $\alpha = 5\%$ and 2% LOS $\therefore$ accept H_0.

$\mu \in [3.33, 3.67]$

Q.5. $H_0: P_1 = P_2$

$H_1: P_1 \neq P_2$

$p_1 = \frac{225}{400},\ p_2 = \frac{340}{600},\ n_1 = 400,\ n_2 = 600$

$p = \hat{p} = \frac{225 + 340}{1000} = 0.565 \Rightarrow \hat{q} = 0.435$

$$z = \frac{p_1 - p_2}{\sqrt{\hat{p}\hat{q}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = -0.1302. \text{ At } \alpha = 5\% \text{ LOS}$$

$z_\alpha = 1.96 < |z| \therefore$ accept H_0.