UNIVERSITY OF THE PUNJAB

B.S. 4 Years Program : Fifth Semester – Fall 2021

Roll No. ....

Paper: Probability Theory (Theory) **Course Code: STAT-307** **Time: 3 Hrs.** **Marks: 60**

Q.1. Give short answers of the following: **(6x5=30)**

i) Suppose that the probability of event A is 0.2 and the probability of event B is 0.4. Also suppose that the two events are independent. Then, find $P(A/B)$?

ii) Use m.g.f. technique to prove that the sum of two independent Poisson variables is a Poisson variable.

iii) Differentiate between independent and mutually exclusive events. Are independent events mutually exclusive?

iv) A coin is tossed three times. What is the probability that it lands on heads exactly one time?

v) The moment generating function of a random X is, $M_{x(t)} = \frac{2}{5} + \frac{1}{3}e^{2t} + \frac{4}{15}e^{3t}$. Find the expected value of X?

vi) State and prove the Bayes theorem and its uses.

Answers the following questions. **(3x10=30)**

Q.2.a) Urn A contains 3 red and 2 white balls and Urn B contains 2 red and 5 white balls. An urn is selected at random; a ball is drawn and put into the other urn; then a ball is drawn from the second urn. Find the probability that both balls drawn are of the different colour?

b) A manufacturer of a flu vaccine is concerned about the quality of its flu serum. Batches of serum are processed by three different departments having rejection rates of 0.10, 0.08, and 0.12, respectively. The inspections by the three departments are sequential and independent.

i) What is the probability that a batch of serum survives the first departmental inspection but is rejected by the second department?

ii) What is the probability that a batch of serum is rejected by the third department?

(5+5)

Q.3. Compute mean, variance, and coefficient of skewness and kurtosis of negative binomial distribution and show that its variance is greater than its mean. **(10)**

Q.4.a) Derive the Poisson distribution as the limiting form of the binomial distribution, stating clearly the assumptions you make.

b) In a certain region of Russia the probability that a person lives at least 80 years is 0.75 and the probability that he/she lives 90 years is 0.63. What is the probability that a randomly selected 80 year old person from this region will survive to become 90.

(5+5)