

**INDIRA GANDHI NATIONAL OPEN UNIVERSITY (IGNOU) - 2005**

**B. TECH DEGREE EXAMINATION**

**MATHEMATICS - II**

**(CIVIL ENGINEERING)**

**TIME - 3 HOUR**

**MARKS - 70**

**NOTE : ALL QUESTIONS ARE COMPULSORY. USE OF CALCULATOR IS FOLLOWED. USE STATISTICAL TABLE WHEREVER NECESSARY.**

1. Answer any six of the following :

(6x5=30)

- (a) The chance that doctor A will diagnose a disease X is 6%. The chance that a patient will die by his treatment after correct diagnosis is 40% and the chance of death by wrong diagnosis is 70%. A patient of doctor A who had disease X died. What is the chance that his disease was diagnosed correctly?
- (b) Box A contains 2 white and 4 black balls. Another box B contains 5 white and 7 black balls. A ball is transferred from the box A to the box B. Then a ball is drawn from the box B. Find the probability that it is a white ball.
- (c) Find the errors in each of the following statements. Give reasons also.
- (i) The probability that it will rain tomorrow is 0.40 and the probability that it will not rain tomorrow is 0.52.
- (ii) On a single draw from a deck of playing cards, the probability of selecting a heart is  $\frac{1}{4}$ , the probability of selecting a black card is  $\frac{1}{2}$ , and the probability of selecting both a heart and a black card is  $\frac{1}{8}$ .
- (d) Hoping to increase the chances of reaching a performance goal, the director of a research project has assigned three separate research teams the same task. The director estimates that the team reliabilities are 0.9, 0.8, and 0.7 for successfully completing the task in the allotted time. The task will be completed if any one team completes it in the allotted time. Assuming that the teams work independently, what is the probability that the task will not be completed in time ?
- (e) A system consists of three identical components. In order for the system to perform as intended, all of the components must perform. Each component has the same probability of performance. If the system is to have a 0.92 probability of performing, what is the minimum probability of performance needed by each of the individual components ?
- (f) Let E and F be two independent events. The probability that both E and F happen is  $\frac{1}{12}$  and the probability that neither E nor F happen is  $\frac{1}{2}$ . Find out  $P(E)$  and  $P(F)$ .
- (g) A student takes his examination in four subjects P, Q, R, and S. He estimates his chances of passing in P as  $\frac{4}{5}$ , in Q as  $\frac{3}{4}$ , in R as  $\frac{5}{6}$  and in S as  $\frac{2}{3}$ . To qualify, he must pass in P and at least two other subjects. What is the probability that he qualifies ?
- (h) Police plan to enforce speed limits by using radar traps at 4 different locations within the city limits. The radar traps at each of the locations L1, L2, L3, and L4 are operated 40%, 30%, 20% and 30% of the time. If a person who is over-speeding on his way to work has probabilities of 0.2, 0.1, 0.5 and 0.2 respectively of passing through these locations, what is the probability that he will receive a speeding ticket ?

2. Answer any two of the following :

(2x10=20)

- (a) A certain screw making machine produces an average of 2 defective screws out of 100 and packs them in boxes of 500. Find the probability that a box contains 15 defective screws.
- (b) A random sample of 5 units is selected from a steady stream of products from a punch press and the fraction

defective is 0.10.

- (i) What is the probability of 1 defective unit in the sample ?
- (ii) What is the probability of 1 or less defective unit ?
- (iii) what is the probability of 2 or more defective units ?

(c) If the probability that a heat-treating batch will be defective is 0.01, what is the probability of two defective batches out of 250 ? What is the probability of 2 or less ? Use Poisson distributor.

3. Answer any two the following:

(2x10=20)

(a) A group of 200 students has the mean height of 154 cm. Another group of 300 students has the mean height of 152 cm. Can these be from the same population with standard deviation (S.D) of 5 cm ?

(b) A random sample of 16 values from a normal population is found to have a mean of 41.5 and standard deviation of 2.795. On this basis, is there any reason to reject the hypothesis that the population mean  $\mu = 43$  ? Also find the confidence limits for  $\mu$ .

(c) A manufacturer of sports equipment has developed anew synthetic fishing line that he claims has a mean breaking strength of 8 kilograms with a standard deviation of 0.5 kilogram Test the hypothesis that  $\mu = 8$  kilograms against the alternative that  $\mu > 8$  kilograms if a random sample of 50 fishing lines is tested and found to have a mean breaking strength of 7.8 kilograms. Use a 0.01 level of significance.