Time: 150 min

Total Mark: 50

Answer the following questions:

Q1. (a). Your Instructor AC discussed during one of his class lectures that the structure of a scientific paper mirrors that of an hourglass. Elaborate the issue using a diagram for hourglass. [10]

(b) Label your diagram to clearly show which part of the hourglass relates to which sub-section of a scientific paper. [5]

Q2. Read the following statements carefully and then answer if true (T) or false (F). For each correct answer one point will be given but for wrong answer one (1) point will be deducted. This is to discourage you from guessing. [10]

a) Ludwig Wittgenstein said "Philosophy is a battle against the bewitchment of our intelligence by means of our language".

b) Truth can never be subjective; it is always absolute.

c) Rubidium atoms can be cooled to absolute zero (0°K) to validate Bose-Einstein statistics.

d) The five Platonic solids are tetrahedron, octahedron, cube, icosahedron and dodecahedron.

e) According to materialism mind and consciousness are by-products of the biochemistry of the human brain and nervous system.

f) Galileo made careful measurements of balls by rolling them down inclines, and showed
that gravitational acceleration is not the same for all objects.

g) The work of Boyle, Charles, Gay-Lussac and Avogadro led to the discovery of the universal gas constant and was found to be consistent with the atomic and molecular theory of matter.

h) Ammonia synthesis from N_2 and H_2 is thermodynamically unfavorable and it is for this reason the K_2O promoted Fe-catalyst is used in the Haber-Bosch process.

i) Polyethylene with uniformly spaced short side chains is called LLDPE, while if the side chains are many, and vary widely and randomly in length it is called LDPE.

j) In 100% isotactic polypropylene all the methyl group containing carbon atoms are expected to have only *(R-)* or only *(S-)* stereochemistry while in 100%

syndiotactic polypropylene they will have 50% *(R-)* and 50% *(S-)* stereochemistry alternately.

Q3. From a random sample of 36 officers in Delhi, the mean age and the sample standard deviation were found to be 40 years and 4.5 years respectively. Construct a 95 percent confidence interval for the mean age of officers in Delhi. The standard variate, z, for 95% confidence is 1.96. [5]

Q4. In a random selection of 64 of the 2400 people in the city Kalyani, the mean number of scooter riders was 3.2 and the sample standard deviation was 0.8. Based on this observation answer followings:

a) Make an estimate of the standard deviation of the population from the sample standard deviation.

b) Work out the standard error of mean for this finite population.

c) At 90% confidence level, what will be the upper and lower limits of the confidence interval for mean number of scooter rider in the city? The standard variate, z, for 90% confidence is 1.645. [1+2+4]

Q5. In a survey of buying habits, 400 shoppers are chosen at random in a super market 'A'. Their average weekly food expenditure is INR 250 with a standard deviation of INR 40. For 400 shoppers chosen at random in some other super market 'B', the average weekly food expenditure is INR 220 with a standard deviation of INR 55. Do these two populations have similar shopping habits? Is the average weekly food expenditure of two populations of shoppers equal? Test at 5% significance level. Z_c for 5% significance level is 1.96. [5]

Q6. A marketing company claims that it receives 8% response from its mailing. It seems that the company is giving an exaggerated picture and the said percentage is less. To test this claim, a random sample was surveyed with 30 responses. Test the company's claim at the 5% significance level against that the company is giving an exaggerated picture. [4]

Q7. Suppose assembly elections are announced in three states. A political party wishes to test if the proportions of its supporters in the three states are same or not. The party conducts a sample survey of 1000 people in each state and finds that there are 300, 350 and 425 supporters in the sample in the surveyed states. Using Chi-Square Tests check if the three proportions are the same or not. [4]