

PRN No.	Total No. of Questions: 09
---------	----------------------------

RB72897006

QP Code: 8-18524  
23-24

JSPM's  
Rajarshi Shahu College of Engineering, Tathawade, Pune- 411033  
(An autonomous institute affiliated to Savitribai Phule Pune University)

Examination: End Semester Examinations (ESE)

Academic Year: 2023-24 Semester:II

Class: F. Y. B. Tech. ( COMP / IT / CSBS )

Department: Engineering Sciences and Humanities

Subject Code: ES1205

Subject Name and Pattern: Statistical Methods (2023 Pattern)

Duration: 2.30 hour

Max. Marks: 50 Marks

Instructions to the Candidates

1. Q.1, Q. 2 and Q.3 are compulsory.
2. Solve Q.4 or Q.5 , Q.6 or Q.7 and Q.8 or Q.9.
3. Assume suitable and necessary data wherever required.
4. Use of non-programmable pocket calculator is allowed

Q. No.

1 Solve any one.

Marks BL CO

a) The weights of packets received by departmental store have a mean of 300 pounds and the standard deviation of 50 pounds. What is the probability that 25 packages received at random and loaded on an elevator will exceed the specified safety limit of the elevator listed as 8200 pounds.

[ Given:  $A (Z = 2.8) = 0.0.4974$  ] 0.4974

b) The election returns showed that a certain candidate received 65% of the votes. Find the probability that two random samples each consist of 200 voters, indicated a greater than 10% difference in the proportions that voted for the candidate. [ Given:  $A (Z = 2.096) = 0.4817$  ]

4 BL3 CO1

2 Solve any one.

4 BL3 CO1

a) Suppose  $X_1, X_2, \dots, X_n$  are normal random variables in a sample of size  $n$  with mean  $\mu$  and variance  $\sigma^2$ . Find estimator of  $\mu$  and  $\sigma^2$  using method of moments.

b) If  $X \sim N(\mu, \sigma^2)$  then find sufficient estimation for  $\mu$  if  $\sigma^2$  is known ( $\sigma^2=1$ ).

4 BL3 CO2

3 Solve any one.

4 BL3 CO2

a) A sample of 100 students is taken from a large population. The mean height of the students in this sample is 160cm. Can it be reasonably regarded that in the population, the mean height is 165cm and the S.D. is 10cm at 1% level of significance? (Take  $Z = 2.58$ )

b) A company manufacturing automobile tyres finds that the tyres life is normally distributed with a mean of 40000 km and s. d. of 3000 km. It is believed that a change in production process will result in a better product and the company has developed a new tyre. A sample of 100 new tyres has been selected the company has found that the mean life of this new tyres is 40900 km. Can it be concluded that is significantly better than the old one using the significance level of 0.01. (Take  $Z = 2.33$ )

4 BL3 CO3

- 4 a) Suppose that we have a random sample of 4 observations from density function 6 BL3 CO3

$$f(x) = \frac{e^{-\lambda} \lambda^x}{x!} \text{ for } x = 0, 1, 2, 3.$$

Using Neyman-Pearson lemma find best critical region to test the simple null hypothesis  $H_0 : \lambda = 20$  against alternative hypothesis  $H_1 : \lambda = 16$  at 5% level of significance. Also find the power of the test.

[ Given:  $Z_1 = 1.645$  for the Area = 0.45.] & [Area ( $Z = 0.1605$ ) = 0.0636 ]

- b) A completely randomized designed experiment with 10 plots and 3 treatments 7 BL4 CO3 gave the following result. Analyse the result for treatment effects.

Plot No.	1	2	3	4	5	6	7	8	9	10
Treatment	A	B	C	A	C	C	A	B	A	B
yield	5	4	3	7	5	1	3	4	1	7

[ Given: Critical value of F (7, 2) at 5% Level of Significance = 4.74 ]

OR

- 5 a) Suppose  $X$  is a single observation from the population with probability distribution 6 BL3 CO3

$$f(x, \theta) = \theta x^{\theta-1}; \quad 0 \leq x \leq 1$$

Find the most powerful test with significance level of 5% for testing the simple null hypothesis  $H_0 : \theta = 3$  against  $H_1 : \theta = 2$ . Also find the power test. Use Neyman-Pearson Lemma.

- b) Three groups of five salesmen, each were imparted training related to the marketing of consumer products by three management institutes. The amount of salesmen during the first month after training was recorded and are given in the following table. Solve by Two Way ANOVA, 7 BL4 CO3

		Salesman				
Institutes		1	2	3	4	5
	1	67	70	65	71	72
	2	73	68	73	70	66
	3	61	64	64	67	69

Test whether the three institutes training programs are equally effective in improving the performance of trainees at 5% significance.

[ Given: At 5 % LoS, critical value of  $F(4, 8) = 3.84$  and  $F(2, 8) = 4.46$  ].

- 6 a) Two equally competent groups of 10 salesmen were imparted training by two different methods A and B. The following data gives sales of brand of 5 kg tins, per week per salesman after one month of receiving the training. Test whether both the methods of imparting training are equally effective. 4 BL3 CO4

Method A	1500	1540	1860	1230	1370	1550	1840	1250	1300
Method B	1340	1300	1620	1070	1210	1170	950	1380	1460

[ Use Mann-Whitney Test. [Given: Critical value of  $U_{0.05} = 15$  ]



- b) The PQR company claims that the lifetime of a type of battery that it manufactures is more than 250 hours. A consumer advocate wishing to determine whether the claim is justified, measures the lifetimes of 24 of the company's batteries, the results are listed in the following table assuming the sample to be random. Using Sign test, determine whether the company's claim is justified at the 0.05 significance level. [Given : The critical value of  $S_{0.05} = 7$ ]

271, 230, 198, 275, 282, 225, 284, 219, 253, 216, 262, 272, 268,  
288, 236, 291, 253, 224, 264, 295, 211, 252, 294, 243,

- c) In beauty context, two examiners ranked 12 candidates (A to L) for a position. The results from most preferred to least preferred are given below:

Candidate	A	B	C	D	E	F	G	H	I	J	K	L
Interviewer 1	1	5	2	4	3	6	7	8	9	10	11	12
Interviewer 2	1	2	4	3	6	5	8	7	10	9	12	11

Find the correlation coefficient by using Kendall Tau Test.

OR

- 7 a) Following table displays the marks of two subjects of the students. Test whether the population distribution for Maths and English are identical. By using Wilcoxon Signed Rank test. [ Given Critical Value of  $W_{0.05} = 34$  ]

Maths	21	18	24	14	5	26	15	29	15	9	25	31	35	12
Eng.	40	25	38	27	31	21	32	38	25	18	32	28	33	29

- b) Suppose following series is of 29 college students. After performing a class test, increases their pulse rate were recorded as follows

22, 23, 21, 25, 33, 32, 25, 30, 17,  
20, 26, 12, 21, 20, 27, 24, 28, 14,  
29, 23, 22, 36, 25, 21, 23, 19, 17,  
26, 26,

Using Run test, determine at the 5% level of significance, check whether the pulse rate sequence is random or not.

[Given: Critical Value of  $R(12,14) = (8, 20)$  ]

- c) Find the Spearman's coefficient of rank correlation between two kinds of assessment of P. G. student's performance out of 100 marks, in a college.

Internal Assessment	51	63	73	46	50	60	47	36	60
External Assessment	49	72	74	44	58	66	50	30	35

Check whether the relationship between internal and external assessment is strong. [ Given : For 5 % level of significance,  $\rho_{(9, 0.05)} = 0.6$  ]

- 8 a) Test whether the given time series model is stationary and/or invertible. If yes, find ACF. 5 BL3 CO

$$X_t = \frac{1}{12} X_{t-1} + \frac{1}{12} X_{t-2} + Z_t$$

- b) Check the given time series model is stationary and/or invertible and classify the model as ARIMA (p, d, q). 4 BL3 CO

$$X_t - 0.75 X_{t-1} + 0.5625 X_{t-2} = Z_t + 1.25 Z_{t-1}$$

- c) Data of demand of a firm for six months are given below. 4 BL3 CO

Month	1	2	3	4	5	6
Demand	46	56	54	43	57	67

Find Forecast in the 7<sup>th</sup> period using Exponential smoothing method.  
[ Take  $\alpha = 0.5$  ]

OR

- 9 a) Test whether the given time series model is stationary and/or invertible. If yes, find ACF. 5 BL3 CO

$$X_t = 10 + Z_t + 0.5 Z_{t-1} + 0.3 Z_{t-2}$$

- b) Check the given time series model is stationary and/or invertible and classify the model as ARIMA (p, d, q). 4 BL3 CO

$$X_t = 0.5 X_{t-1} + Z_t + 0.3 Z_{t-1} + 1.2 Z_{t-2}$$

- c) Sales (in lakhs) of a firm from year 1996 to 2005 is given below. Using Exponential Smoothing Method calculate the forecast for the year 2005 [ Take  $\alpha = 0.3$  ] 4 BL3 CO

Year	1996	1997	1998	1999	2000	2001	2003	2004	2005
Sales	433.20	440.01	430.21	445.36	453.20	454.41	422.38	456.04	440.39

\*\*\*\*\*