87STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 86
(For candidates admitted from the academic year 2023– 2024 and thereafter)

B.Sc. DEGREE EXAMINATION, APRIL2026
BRANCH I - MATHEMATICS
FOURTH SEMESTER

COURSE : ALLIED CORE
PAPER : MATHEMATIAL STATISTICS II
SUBJECT CODE : 23MT/AC/ ST45
TIME : 3 HOURS MAX. MARKS: 100

Q. No.	SECTION A ($5 \times 2 = 10$) **Answer ANY FIVE questions**	CO	KL
1.	What are main objectives of sampling?	1	1
2.	State any two characteristics of standard Normal distribution	1	1
3.	What are the criteria for a good estimator?	1	1
4.	What is meant by Type I error and Type II error in statistical decision?	1	1
5.	Write the uses of Chi-square test	1	1
6.	State the components of time series.	1	1
Q. No.	**SECTION B ($10 \times 1 = 10$)** **Answer ALL questions**	**CO**	**KL**
7.	A sample which is selected on the basis of individual judgment of the sampler is called _____sample . a) Simple b) random c) purposive d) stratified	2	2
8.	The standard deviation of Chi-square distribution is _____. a) n b) $\sqrt{2n}$ c) np d) $\sqrt{n}$	2	2
9.	A statistic is said to be a _____ estimator of a parameter θ if it contains all information in the sample about θ a) Efficient b) Most Efficient c) Consistent d) Sufficient	2	2
10.	The sample mean $\bar{x}$ is an unbiased estimator of the population mean μ because _____ a) $E(\bar{x}) = 0$ b) $E(\bar{x}) = 2\mu$ c) $E(\bar{x}) = \mu$ d) $E(\bar{x}) = \mu^2$	2	2
11.	A sample is said to be large sample if a) $n > 30$ b) $n = 30$ c) $n < 30$ d) None of the above	2	2
12.	The degrees of freedom of a 2×2 contingency table is a) 2 b) 1 c) 3 d) 0	2	2
13.	Power of the test is equal to _____ a) Probability of Type I error b) Probability of Type II error c) 1- Probability of Type II error d) 1- Probability of Type I error	2	2
14.	F test is widely used to test _____ a) Goodness of fit b) Analysis of variance c) Independence of attributes d) None of these	2	2

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<table>
<tr><td>15.</td><td>The total seasonal variation in the additive model is _____
a) 1 b) 0 c) 100 d) 400</td><td>2</td><td>2</td></tr>
<tr><td>16.</td><td>Oscillatory movement of time series with period more than one year refer to ____
a) Seasonal fluctuations b) Cyclical fluctuations
c) Fluctuations due to sampling d) none of these</td><td>2</td><td>2</td></tr>
<tr><td>Q. No.</td><td>SECTION C ($\mathbf{2 \times 15 = 30}$)
Answer ANY TWO questions</td><td>CO</td><td>KL</td></tr>
<tr><td>17.</td><td>a) For a random sample of observations: 14, 19, 17, 20, 25 from an unknown population, estimate the mean and standard deviation of the population. Also find the estimate of standard error of sample mean.
b) Discuss the advantages of any two sampling methods
(9+6)</td><td>3</td><td>3</td></tr>
<tr><td>18.</td><td>In a survey of 200 boys of which 75 were intelligent, 80 had skilled fathers; while 85 of the unintelligent boys had unskilled fathers. Do these figures support the hypothesis that skilled fathers have intelligent boys? Use Chi –Square test.</td><td>3</td><td>3</td></tr>
<tr><td>19.</td><td>In a large city A, 20 per cent of a random sample of 900 school children had defective eye - sight. In another large city B 15 per cent of a random sample of 1600 children had the same defect. Is this difference between the two proportions significant? Obtain 95 % confidence limits for the difference in the population proportions .</td><td>3</td><td>3</td></tr>
<tr><td>20.</td><td>Using 1972 as origin , Obtain a straight line trend equation by the method of least squares:
<table>
<tr><td>Year</td><td>1969</td><td>1970</td><td>1971</td><td>1972</td><td>1973</td><td>1974</td><td>1975</td></tr>
<tr><td>Value</td><td>76</td><td>87</td><td>95</td><td>81</td><td>91</td><td>96</td><td>90</td></tr>
</table>
Find the trend value of the missing year 1976.</td><td>3</td><td>3</td></tr>
<tr><td>Q. No.</td><td>SECTION D ($\mathbf{2 \times 15 = 30}$)
Answer ANY TWO questions</td><td>CO</td><td>KL</td></tr>
<tr><td>21.</td><td>The population consists of four members 3, 7,11,15.
Consider all possible samples of size two which can be drawn with replacement and without replacement from this population. Find
(a) the population mean
(b) the population standard deviation
(c) the mean of the sampling distribution of means
(d) the S.D. of sampling distribution of mean.
Verify (c) and (d) directly from (a) and (b) by using suitable formulae.</td><td>4</td><td>4</td></tr>
</table>

<table>
<tr><td>22.</td><td>An I.Q test was administered to 5 persons before and after they were trained. The results are given below:
<table>
<tr><td></td><td>I</td><td>II</td><td>III</td><td>IV</td><td>V</td></tr>
<tr><td>I.Q. before Training</td><td>110</td><td>120</td><td>123</td><td>132</td><td>125</td></tr>
<tr><td>I.Q. after Training</td><td>120</td><td>118</td><td>125</td><td>136</td><td>121</td></tr>
</table>
Apply appropriate test at 1 % level of significance to check whether there is any change in I.Q. after the training programme.</td><td>4</td><td>4</td></tr>
<tr><td>23.</td><td>Three experimenters determine the moisture content of samples of power, each man taking a sample from each of 4 consignments. The results are given below.
<table>
<tr><td rowspan="2">Experiment</td><td colspan="4">Consignment</td></tr>
<tr><td>I</td><td>II</td><td>III</td><td>IV</td></tr>
<tr><td>A</td><td>9</td><td>10</td><td>9</td><td>10</td></tr>
<tr><td>B</td><td>12</td><td>11</td><td>9</td><td>11</td></tr>
<tr><td>C</td><td>11</td><td>12</td><td>10</td><td>12</td></tr>
</table>
Perform an ANOVA on these data and discuss whether there is any significant difference between consignments or between experiments.</td><td>4</td><td>4</td></tr>
<tr><td>24.</td><td>Compute the average seasonal movements by the method of quarterly average for the following series of observations
<table>
<tr><td colspan="5">Total Production pf Paper (thousand tons)
Quarters</td></tr>
<tr><td>Year</td><td>I</td><td>II</td><td>III</td><td>IV</td></tr>
<tr><td>1951</td><td>37</td><td>38</td><td>37</td><td>40</td></tr>
<tr><td>1952</td><td>41</td><td>34</td><td>25</td><td>31</td></tr>
<tr><td>1953</td><td>35</td><td>37</td><td>35</td><td>41</td></tr>
</table></td><td>4</td><td>4</td></tr>
<tr><td>Q. No.</td><td>SECTION E (2 × 10 = 20)
Answer ANY TWO questions</td><td>CO</td><td>KL</td></tr>
<tr><td>25.</td><td>In a certain factory there are two different processes of manufacturing the same item. The average weight in a sample of 250 items produced from one process is found to be 120 grammes with a S.D. of 12 grammes; the corresponding figures in a sample of 400 items from the other process are 124 and 14. Is the difference between two sample means significant?</td><td>5</td><td>5</td></tr>
<tr><td>26.</td><td>A set of 5 coins is tossed 320 times and the number of heads appearing each time is noted. The results are given below:
<table>
<tr><td>No. of Heads</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Frequency</td><td>14</td><td>45</td><td>80</td><td>112</td><td>61</td><td>8</td></tr>
</table>
Would you conclude that the coins are biased?</td><td>5</td><td>5</td></tr>
</table>

<table>
<tr>
<td>27.</td>
<td>Each of the following sets of observations is a random sample from a normal population
<table>
<tr><td>Sets</td><td>Observations</td></tr>
<tr><td>I</td><td>249, 242, 247, 250, 252</td></tr>
<tr><td>II</td><td>251, 256, 255, 258</td></tr>
<tr><td>III</td><td>266, 261, 265, 264</td></tr>
<tr><td>IV</td><td>262, 260, 263, 262, 261, 264, 262</td></tr>
</table>
Test whether the population means are equal. (Use 250 to reduce the sample observations)</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>28.</td>
<td>Determine the trend for the following series using a three-year moving averages
<table>
<tr><td>Year</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Values</td><td>2</td><td>4</td><td>5</td><td>7</td><td>8</td><td>10</td><td>13</td></tr>
</table>
</td>
<td>5</td>
<td>5</td>
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