Name :

Reg No :
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
07 THRISSUR CLUSTER
FIRST SEMESTER M.TECH. DEGREE EXAMINATION FEBRUARY 2021
07 MA 6021 MANAGERIAL STATISTICS
(Common for Manufacturing Systems Management, Industrial Engineering and Management \& Health Safety and Environmental Management)

## Time: 3 hours

Max.Marks: 60
Answer all six questions. Part 'a' of each question is compulsory.
Answer either part 'b' or part 'c' of each question (Any missing data may suitably be assumed.)
Q. No

Module 1
Marks
1(a) Find the mean and variance of the random variable $X$ with pdf

$$
f(x)=\left\{\begin{array}{cl}
k x^{2} & ; 0<x<1 \\
0 & ; \text { Othewise }
\end{array}\right.
$$

Answer b or c
1(b) The time required to assemble a piece of machinery is a random variable having normal distribution with $\mu=12.9$ minutes and $\sigma=2.0$ minutes. Find the probability that the assembly of a piece of machinery of this kind will take (a) at least 11.5 minutes (b) anywhere from 11.0 to 14.8 minutes
1 (c) If $0.8 \%$ of the fuses delivered to a factory are defective, find the probability that atmost 4 fuses will be defective in a random sample of 400 fuses.
Q. No

## Module 2

2(a) Find the correlation coefficient and the equations of regression lines for the following values of $x$ and $y$

| $x$ | 1 | 2 | 3 | 4 | 5 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $y$ | 2 | 5 | 3 | 8 | 7 |

Answer b or c
2(b) From a trivariate data set the following information is available 5

$$
\begin{array}{ccc}
\bar{X}_{1}=40 & \bar{X}_{2}=70 & \bar{X}_{3}=90 \\
S_{1}=3 & S_{2}=6 & S_{3}=7 \\
r_{12}=0.4 & r_{23}=0.5 & r_{13}=0.6
\end{array}
$$

Use Linear Regression Model to estimate $X_{3}$ when $X_{1}=30$ and $X_{2}=80$
2(c)
From a trivariate data set the following correlations are available

$$
\boldsymbol{r}_{12}=0.86, r_{12}=0.65, \boldsymbol{r}_{12}=0.72, \quad . \text { Find } \boldsymbol{R}_{1.23} \text { and } \boldsymbol{r}_{12.3}
$$

Q. No

## Module 3

3(a) Write a short note on (a) Maximum Likelyhood Estimation (b) Estimation by Method of Moments

## Answer b or c

3(b) Let $x_{1}, x_{2}, x_{3}, \ldots, x_{n}$ be a random sample taken from a normal population with mean $\mu$ and variance $\sigma^{2}$. Find the maximum likelyhood estimation of the mean and variance of the population

3(c) Let $x_{1}, x_{2}, x_{3}, \ldots, x_{n}$ be a random sample taken from a normal population with mean $\mu$ and variance $\sigma^{2}$. Find the estimation of mean and variance of the population by the method of moments

## Module 4

4(a) A tyre company claims that the average life of tyre is at least 28000 km . A random sample of 40 tyres were tested and it is found that the mean life is 27463 km with a standard deviation 1348 km . Test the claim of the claim at $1 \%$ level of significance

## Answer b or c

4(b) The following random samples are measurements of the heat-producing capacity (in millions of calories per ton) of specimen of coal from two mines

Mine 1: 8260
813
83508070
8340
Mine 2: $7950 \quad 7890 \quad 7900 \quad 8140 \quad 79207840$
Use 1\% level of significance to test whether the difference between the means of these two samples is significant.

4(c) It is desired to determine whether there is more variability in the silver plating samples of size 12 of the two companies work yield $S_{1}=0.035 \mathrm{mil}$ and $S_{2}=0.062 \mathrm{mil}$. Test whether the variability of company 1 is more than that of company 2 at $5 \%$ level of significance
Q. No

## Module 5

5(a) The following are the weight losses of a certain machine parts (in milligrams) due to friction when 3 different lubricants were used under controlled conditions.

Lubricant A: $12.211 .8 \quad 13.1 \quad 11.0 \quad 3.9 \quad 4.1 \quad 10.3 \quad 8.4$
$\begin{array}{llllllll}\text { Lubricant B: } 10.9 & 5.7 & 13.5 & 9.4 & 11.4 & 15.7 & 10.8 & 14.0\end{array}$
$\begin{array}{lllllllll}\text { Lubricant C: } & 12.7 & 19.9 & 13.6 & 11.7 & 18.3 & 14.3 & 22.8 & 20.4\end{array}$
Test at $1 \%$ level whether the difference among the means can be atributed to chance

## Answer b or c

5(b) A laboratory technician measures the breaking strength of each of 5 kinds of linen thread by means of 4 different instruments and obtains the following results

|  |  | Measuring instruments |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 11 | 12 | 13 | 14 |
|  | T1 | 20.6 | 20.7 | 20.0 | 21.4 |
|  | T2 | 24.7 | 26.5 | 27.1 | 24.3 |
|  | T3 | 25.2 | 23.4 | 21.6 | 23.9 |
|  | T4 | 24.5 | 21.5 | 23.6 | 25.2 |
|  | T5 | 19.3 | 21.5 | 22.2 | 20.6 |

Perform 2 way ANOVA to test whether the means between thread type and the mean between measuring instruments are significant or not at $1 \%$ level of significance

5(c) The following data resulted from an experiment to compare three burners $B_{1}$, $B_{2}$ and $B_{3}$. A Latin square design was used as the tests were made on 3 engines and were spread over 3 days.

|  | Engine1 | Engine2 | Engine3 |
| :--- | :--- | :--- | :--- |
| Day1 | $\mathrm{B}_{1}-16$ | $\mathrm{~B}_{2}-17$ | $\mathrm{~B}_{3}-20$ |
| Day2 | $\mathrm{B}_{2}-16$ | $\mathrm{~B}_{3}-21$ | $\mathrm{~B}_{1}-15$ |
| Day3 | $\mathrm{B}_{3}-15$ | $\mathrm{~B}_{1}-12$ | $\mathrm{~B}_{2}-13$ |

Test the hypothesis that there is no difference between the burners
Q. No

Module 6
6(a) Define multivariate analysis. Mention some basic concepts of multivariate analysis

## Answer b or c

6(b) What is the importance of factor analysis in modern research? What are the four issues to which factor analysis is keyed to meet its objectives? Explain data reduction.
6(c) What are the types of multivariate techniques? Explain any three of them.

