Con. 4151-10. (REVISED COURSE) BB-9242

(3 Hours) [Total Marks : 60

N.B. (1) **All** questions are **compulsory**.
(2) Use of **simple** calculators is **allowed**.
(3) **Figures** to the **right** indicate **marks**.
(4) Answers to the **three** sections should be written on **separate** answer books.

Section I

1. (a) Explain the circumstances under which only qualitative methods have to be used for forecasting. **10**
   (b) Describe the steps involved in the Delphi Method of forecasting and illustrate its use with the help of any real life situation known to you.

2. A fifty-year old paper manufacturing company wants to prepare a month-by-month business operations plan for the next year. To conduct this exercise, it needs a reliable sales forecast. Prepare a step-by-step systematic action plan to carry out the task of forecasting the company's monthly sales over the next twelve months. **10**

3. (a) Explain the difference between 'structured decisions' and 'unstructured decisions'. Give one example of each. **10**
   (b) What are the quantitative tools available for data-based decision making ? Briefly describe each of them.

Section II

4. Describe three techniques of inventory control with selective control. Explain ABC analysis and how it is useful in inventory management. **10**
   Give one example of ABC analysis.

5. An electrical appliance manufacturer wishes to know what the economic quantity should be for a plastic impeller when the following information is available; The average daily requirement is 120 units and the company has 250 working days a year so that the total yearly requirement is approximately 30000 units a year. The manufacturing cost is 50 paise per part. The sum of the annual rate for interest, taxes and so forth is 20% of the unit cost and the cost of preparation is Rs. 50 per lot. **10**

Section III

6. Build Auto Ltd. manufactures and sells three products to the automobile industry. All the products must pass through a machining process, the capacity of which is limited to 20,000 hours per annum both by equipment design and government regulation. **10**
   The following additional information is available :—

Particulars	Product X	Product Y	Product Z
Selling Price Rs./unit	1,900	2,400	4,000
Variable Cost Rs./unit	700	1,200	2,800
Machining requirement Hrs./units	3	2	1
Maximum Possible sales-Units	10,000	2,000	1,000

Required : Statement showing the best possible production mix, which would provide the maximum profit for Build Auto Ltd. together with supporting workings.

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N.B. : (1) Attempt **all** questions.
(2) **All** questions carry **equal** marks.
(3) Answer to **both** sections should be written in **separate** answer books.

Section I

Instructions:
1. Use Statistical Software & Excel along with six sigma excel template
2. Write down Null & Alternative hypothesis for the test with name/s of the test/s used, basis of test and conclusion along with output of session window

Q1. Explain in detail following
a. FMEA and it's significance in 6Sigma   b. 5 S, Kaizen & it's importance.
c. DMAIC Phases of 6 Sigma   d. Various charts of Gage R&R

Q2.
a) Mfg. Company wants to understand which M/C is better & reliable w.r.t. quality in order to mfg. their premium brand. (Higher the number – Bad the quality)

| M/C 4 | 155 | 145 | 140 | 134 | 149 | 150 | 162 | 157 | 139 | 142 | 156 | 143 |
| M/C 8 | 145 | 160 | 132 | 154 | 159 | 160 | 152 | 168 | 148 | 140 | 162 | 153 |

Decide which M/C is better based on above data.

b) Given below efficiency % of a large Manufacturing unit. Kindly help in setting improvement Target for their Project Team.

| Month | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar |
| Wastage % | 83.4 | 72.1 | 82.9 | 93.1 | 72.4 | 81.9 | 92.2 | 82.8 | 78.6 | 88.0 | 76.5 | 79.0 |

Q 3. Following 4 m/c factors determine the ceramic strength. Conduct the DOE with replication & write down the regression equation based on p-value.
F1 : Table Speed (slow (0.025 m/s) and fast (0.125 m/s))
F2 : Down Feed Rate (2 levels: slow (0.05 mm) and fast (0.125 mm))
F3 : Wheel Grit (2 levels: 140/170 and 80/100)
F4 : Batch (2 levels: 1 and 2)

Run	F1	F2	F3	F4	Ceramic Strength	Random Order	Run	F1	F2	F3	F4	Ceramic Strength	Random Order
1	-1	-1	-1	-1	530.45	17	17	-1	-1	-1	-1	457.34	12
2	1	-1	-1	-1	572.48	30	18	1	-1	-1	-1	470.80	1
3	-1	1	-1	-1	552.14	14	19	-1	1	-1	-1	460.55	4
4	1	1	-1	-1	516.93	8	20	1	1	-1	-1	488.04	23
5	-1	-1	1	-1	553.67	32	21	-1	-1	1	-1	435.19	2
6	1	-1	1	-1	492.14	20	22	1	-1	1	-1	436.17	28
7	-1	1	1	-1	542.98	26	23	-1	1	1	-1	451.67	11
8	1	1	1	-1	519.26	24	24	1	1	1	-1	458.31	9
9	-1	-1	-1	1	341.58	10	25	-1	-1	-1	1	292.90	25
10	1	-1	-1	1	325.52	16	26	1	-1	-1	1	284.41	21
11	-1	1	-1	1	328.76	27	27	-1	1	-1	1	267.66	6
12	1	1	-1	1	418.23	18	28	1	1	-1	1	360.84	7
13	-1	-1	1	1	294.72	3	29	-1	-1	1	1	242.11	5
14	1	-1	1	1	260.37	19	30	1	-1	1	1	193.22	13
15	-1	1	1	1	278.51	31	31	-1	1	1	1	235.52	22
16	1	1	1	1	341.47	15	32	1	1	1	1	296.73	29

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Section II

4.   Suggest appropriate method that can be used against following problems

Sr.	Problem
1	To calculate the earliest date the project can be completed, and to find ways of changing this
2	The list on the left represents a problem (the 'what') and the list above represents a solution to that problem (the 'how')
3	When investigating a problem, to discover the detailed component parts of any complex topic
4	A group decision-making required to sort a large number of ideas
5	The current problem is perceived as being a symptom of a more important underlying problem

(5)

b.   Draw Control Chart for following data and suggest how many items are outside limit
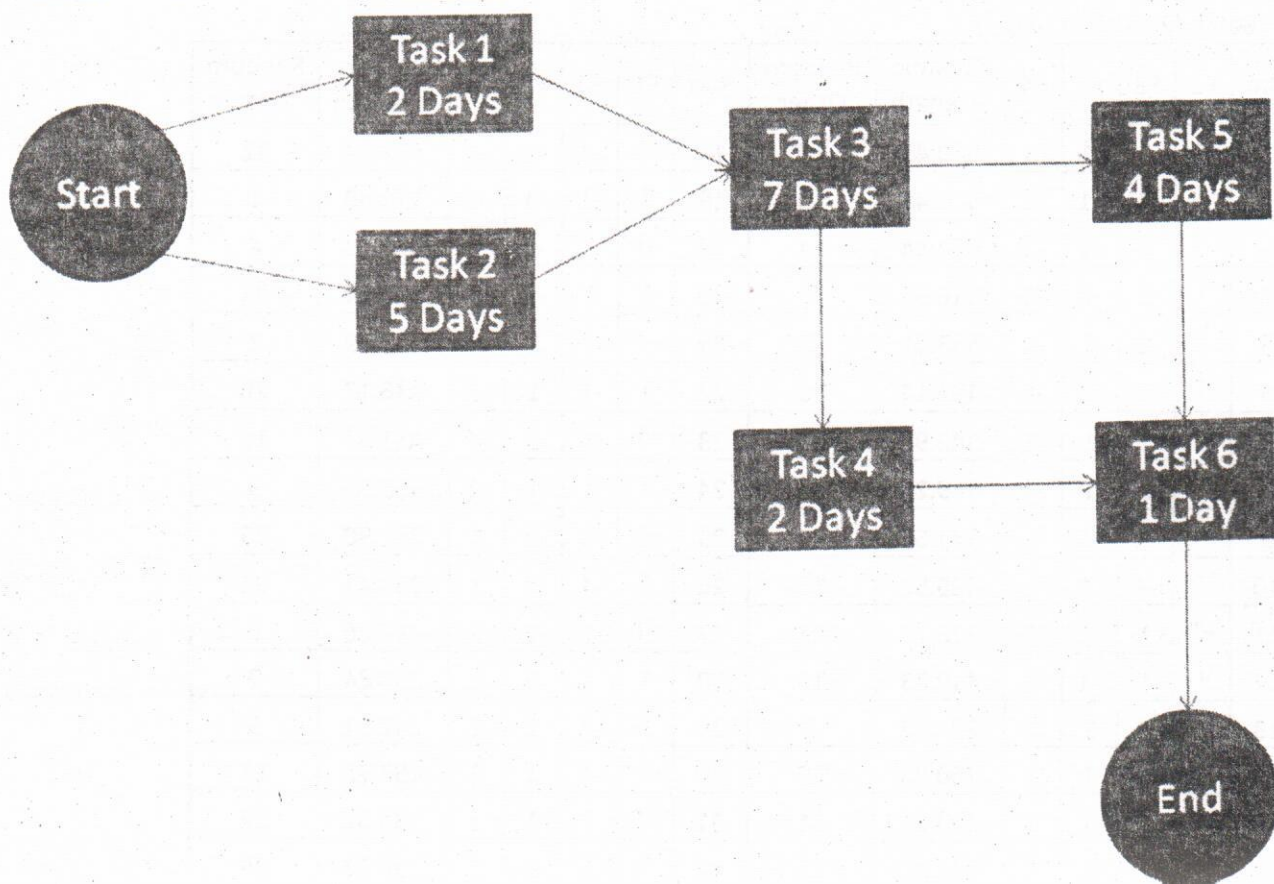
   • Average weight = 10 gm

   • Upper Limit = + 0.20 gm

   • Lower Limit = - 0.20 gm

Weight of sample items is as follows.

10.05, 10.10, 10.10, 9.95, 9.90, 10, 9.75, 9.95, 10, 10.05   (5)

Q.5 Following activity diagram represents project plan of road repairs to be done before monsoon. Answer following questions.

a.Calculate early start and finish time for each task

b. Calculate late start and finish time for each task

c. Identify Critical path

d. When the project must start if required to be completed on 31st May?

e. When can we start Task 4 (latest) without impacting overall schedule? (10)

Q. 6 Let us consider a case study that has one 2-level factor (A) and three 3-level factors (B, C and D). Calculate degrees of freedom. Which technique can be used to fit this case study with L9 orthogonal array? Explain your answer and draw a table of Experiment layout. (Refer following L9 orthogonal array)

Expt. No	Factors			
	A	B	C	D
1	1	1	1	1
2	1	2	2	2
3	1	3	3	3
4	2	1	2	3
5	2	2	3	1
6	2	3	1	2
7	3	1	3	2
8	3	2	1	3
9	3	3	2	1

(10)

1st-half-NK-10B 134

Con. 4154-10.

BB-5137

(3 Hours)

[**Total Marks : 60**

N.B. (1) **All** questions are **compulsory**.
(2) Use of **simple** calculator is **allowed**.
(3) **Figures** to the **right** indicate **full** marks.

1. Briefly explain the application of following tests/ methods in analysis of clinical **10** research data.
   - (a) ANOVA and Dunnett's test
   - (b) Wilcoxon rank sum test
   - (c) Linear regression
   - (d) Fisher's Exact Test
   - (e) Two way ANOVA.

2. Describe process flow of a Clinical trial and discuss the role of a statistician in **10** a clinical trial project.

3. Answer following questions :   **10**
   - (a) Explain P-value, confidence interval, type II error and power of a test
   - (b) Explain superiority and equivalence designs.

4. What are ICH guidelines ? Briefly discuss the purpose of E6 and ICH E3 guideline. **10**

5. Describe the various data gathered on a Case Report form [CRF} during the course **10** of a clinical trial. Briefly explain different datasets submitted to regulatory authorities as a part of CDISC submission.

6. Select the correct choice for the following questions. Each questions has one **10** correct choice.
   - (i) Identify the missing :
     Data exam;

     _____ exam;

     Where var1> var2;
     Run;

     - (a) Set
     - (b) Merge
     - (c) Freq
     - (d) subset

[**TURN OVER**

(ii) Which of the following program is the correct SAS statement that will subset a data set 'Test' having two variables x and y ?

    (a)   Data Test1;
             Set test;
             Where x = z
       run;

    (b)   data = xyz.test;
             set test1;
      where x = y;
      Run;

    (c)   data test1;
          set test;
      Run;

    (d)   data test1;
          set test;
           where x>y;
      Run;

(iii) All of the following statements about Proc Freq procedure are True, except.
    (a) Tables statement determines, for which variables, the frequency will be calculated.
    (b) Norow, nocol and nopercent are valid options in Tables statement.
    (c) 'Fisher' option in tables statement will calculate Fisher's exact test.
    (d) This procedure does not produce any visible output.

(iv) Identify the missing.

    Data exam;
        Number = roll/10;

    Run;

    Proc sort data = exam;

    _____ number;

    Run;
        e.   Set
        f.   Merge
        g.   Freq
        h.   By

(v) All of the following statements about Proc Report are True, except.
    e. Columns statement determines columns to be included in the output
    f. Across variable is used for sorting and grouping information for display purpose
    g. Nowindow (nowd) is a valid option in Proc report statement
    h. Formats can be applied to variables in Define statement.

_____

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BB–5140

(3 Hours)

[Total Marks : 60

N.B. : (1) **All** questions are **compulsory**.
    (2) **Figures** to the **right** indicate marks.
    (3) Answers to the **two** sections should be submitted **separately**.
    (4) **Calculators** are **allowed**.

Section I

1. (a) Describe how statistical data having multivariate observations can be summareged using (i) Descriptive Statistics (ii) Graphical method.   5

   (b) Consider a five variate random vector $X^1 = [X_1 \ X_2 \ X_3 \ X_4 \ X_5]$ with mean vector $\mu^1 = [1 \ 3 \ 5 \ 2 \ 4]$ and variance convariance matrix   5

$$\Sigma = \begin{bmatrix} 4 & 2 & 0 & 3 & 0 \\ 2 & 9 & 1 & 0 & 1 \\ 0 & 1 & 1 & 2 & 5 \\ 3 & 0 & 2 & 4 & -3 \\ 0 & 1 & 5 & -3 & 1 \end{bmatrix}$$

If $B = [1 \ -2 \ 1 \ 2 \ -1]$

      (i) Obtain mean and variance of B X
      (ii) Find correlation coefficients between
         (a) X_1 and (X_3, X_5) (b) X_3 and X_4.

2. (a) Let $X = \begin{bmatrix} 1 & 4 & 4 \\ 2 & 1 & 0 \\ 5 & 6 & 4 \end{bmatrix}$ 6

    Obtain : (a) Mean Vector
          (b) Variance – Covariance matrix (divisor)
          (c) Generalized sample variance and interpret it.

   (b) A random sample of 10 observations is selected from a trivariate normal distribution with mean vector $\mu_{3 \times 1}$ and variance-covariance matrix Σ. Obtain distributors of   4

    (i) $\bar{X}$ and   (ii) $\sum_{i=0}^{q} (10-i) \, X_{i+1}$.

[TURN OVER

3. (a) Let $\underline{X} \sim N_P(\mu, \Sigma)$. State p·d·f of X. Partition $\underline{X} = \begin{bmatrix} X_{(1)} \\ X_{(2)} \end{bmatrix}$; $\mu = \begin{bmatrix} \mu_{(1)} \\ \mu_{(2)} \end{bmatrix}$ and   6

$\Sigma = \begin{bmatrix} \Sigma_{11} & \Sigma_{12} \\ \Sigma_{21} & \Sigma_{22} \end{bmatrix}$ and $|\Sigma_{22}| > 0$. State conditional distribution of X_1 given $X_2 = X_2$.

If $X_1, X_2, ... X_n$ is a random sample selected from above population then obtain distribution of $a_1 X_1 + a_2 X_2 + ... + a_n X_n$.   4

   (b) Explain the method of χ^2 plots to test normality of given date.   6

4. (a) Explain the method of using T^2 – statistic for paired comparisons of two multivariate   6
means from multivariate normal distribution. Also obtain $100(1 - \alpha)\%$ simultaneous
confidence intervates for the industrial mean difference (δ_i).   4

   (b) Explain the regression method of modelling relationship between 'm' response   4
variables $Y_1 Y_2 ..... Y_m$ and single set of predictor variables $X_1, X_2, ..., X_r$.

Section II

5. (a) Define first two principal components Y_1 and Y_2 of a covariance matrix Σ.   2
   (b) Obtain the covariance between Y_1 and Y_2.   3
   (c) Describe scree plot and explain its use.   2
   (d) Describe the different stages used in factor analysis.   3

6. (a) Describe canonical correlation analysis and explain how to obtain the first canonical   3
correlation.

   (b) Consider the two data sets from populations π_1 and π_2 respectively.   5

$X_1 = \begin{bmatrix} 3 & 7 \\ 2 & 4 \\ 4 & 7 \end{bmatrix} \qquad X_2 = \begin{bmatrix} 6 & 9 \\ 5 & 7 \\ 4 & 8 \end{bmatrix}$

   (i) Calculate Fisher's discriminant function

   (ii) Classify $X_0^1 = [4 \quad 8]$ as belonging to π_1 or π_2.

   (c) Describe MDS (Multi Dimensional Scaling).   2