Department of Mechanical Engineering
Birla Institute of Technology and Science, Pilani, Pilani campus
MF F220: Metrology and Quality Assurance
Comprehensive Examination (12/05/2022)
Time: <u>180 min</u>; Max. Marks: <u>35</u>

Note to Students:

1. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.
2. This is an OPEN BOOK test.
3. However, you are <u>NOT ALLOWED</u> to bring photocopies of handwritten notes.
4. Assumptions made if any, should be stated clearly at the beginning of your answer.

1. Delay time during manufacturing of components is a critical issue. A company wanted to check the average delay times in manufacturing of a particular component. Table below shows the data for average and range of delay times (in minutes), each chosen from a sample size of 5. Construct appropriate control charts and comment on the performance level. Considering that lower delay times are preferred, construct revised control charts if required.

10+5 = 15

Observation	Average Delay	Range
1	6.5	2.1
2	11.1	3.8
3	15.8	4.6
4	10.9	4.2
5	11.2	4
6	5.6	3.5
7	10.4	4.1
8	9.8	2
9	7.7	3.2
10	8.6	3.8
11	10.5	4.2
12	10.2	3.8
13	10.5	4
14	9.2	3.5
15	7.8	2.2
16	10.6	4.1
17	10.7	4.2
18	8.8	3.8
19	9.8	3.6
20	10.2	3.6
21	9	4.2
22	8.5	3.3
23	9.8	4
24	7.7	2.8
25	10.5	3.2

2. A production manager tracked the incidences of lost time on the production floor over a period of 1 week. Table below shows the various causes, with unit cost (in INR) for rectifying each cause.

(a) Construct a Pareto chart and discuss the results.

(b) If the manager has a monthly allocation of INR 18,000, which areas should he/she tackle?

10+5 = 15

Cause	Incidences of lost time	Unit costs (Rs.)
Work instructions	4000	0.2
Bill of Materials	3500	0.5
Work Orders	80	50
Wrong Parts or Material	100	30
Lack of proper tools	120	100
Bad assembly outlines	50	50

3. What is DMAIC? With a suitable case study/example, explain the various phases of DMAIC.

1+4 = 5

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