Fourth term end term exam 2011 (1)

Fourth term End term exam 2011 (1) Section B 2. b From a factory producing metal sheet, following defective were analyses in every lot size. Prepare relevant chart only UCL and LCL. Lot Size | 100 | 125 | 90 | 120 | 110 | Defective | 6 | 7 | 4 | 8 | 10 | Solution Since the Lot size are different we have to use ‘ u’ chart. Sample NO | LOT Size | Defective | Proportion of defective | UCL | LCL | 1 | 100 | 6 | 0. 06 | 0. 140245 | -0. 0118 | 2 | 125 | 7 | 0. 056 | 0. 06422 | -0. 00378 | 3 | 90 | 4 | 0. 04 | 0. 144358 | -0. 01592 | 4 | 120 | 8 | 0. 066666667 | 0. 133621 | -0. 00518 | 5 | 110 | 10 | 0. 090909091 | 0. 136707 | -0. 00827 | Total | 545 | 35 | | | | u = sum of defects in all lots / total number of items in all lots = 35/545 = 0. 064 UCL = u + 3âˆš(u/ni) LCL = u - 3âˆš(u/ni) UCL always <1. 0 And LCL always > 0 Since here all the LCL value <0 we have to ignore LCL values. Proportion of Defective Proportion of Defective Lot Lot Center Line (u) Center Line (u) 4. a) Topaz Industries manufactures Z brand radar scanner used to detect speed traps. The printed circuit boards in the scanners are purchased from an outside vendor. The vendor produces the boards to an AQL of 2% defective and is willing to run 5% risk(alpha) of having lots of this level or fewer defectives rejected. Topaz’s consider lot of 8% or more defective lot tolerance unacceptable and time. A large shipment has just been delivered. what values of n and c should be selected to determine the quality of this lot? Solution: The negotiated consumer’s and producer’s risks, corresponding to LTPD 8% and AQL of 2%, are 10% and 5% each. Therefore P0. 10/P0. 95 = 0. 08/0. 02 = 4 Therefore c = 4 gives the best fit. Now as per the table, the sample size can be calculated at the producer’s risk point : np0. 95 = 1. 970 n= 1. 970/0. 02 = 98. 5= 99 Therefore the sampling plan is (99, 4) 6) Elisa watches assemble four different types of watches on their assembly line. The assembly line in

done in batches. Given the following data, in what batch sizes should each type of watch be produced? The company has 300 working days in a year. Find economic batch quantity? Watch | Annual dd - Unit | Set up cost(Per set up) | Carrying cost per unit per yr | Assembling rate(no/day) | TAG-H | 9000 | 1000 | 40 | 100 | TITAN | 5000 | 1000 | 50 | 120 | GUCCI | 10000 | 1000 | 120 | 100 | FOSSIL | 3000 | 1000 | 30 | 90 | Solution: There are 300 working days in a year. Based on the above given information, following gives the rates of consumption of the products, the economic batch quantitates for each watch, the days for which a manufactured batch will last at the given consumption rate and the individual production times for each batch of product (along with the total time for production for a batch-each of the entire range of products). I | II | III | IV | V | VI | VII | VIII | Watch | Annual dd | Assembling rate(unit/day) | Daily consumption rate(unit/day) | Economic Batch Quantity | No of days required to produce a batch quantity | No of days required to manufacture annual requirements | No of days taken to consume a batch quantity | TAG-H | 9000 | 100 | 30 | 670. 8204 | 6. 708 | 90 | 22. 36 | TITAN | 5000 | 120 | 16. 6666 | 447. 2136 | 3. 726 | 41. 66 | 26. 83 | GUCCI | 10000 | 100 | 33. 33333 | 408. 2483 | 4. 08 | 100 | 12. 24 | FOSSIL | 3000 | 90 | 10 | 447. 2136 | 4. 96 | 33. 33 | 44. 72 | Total | 19. 48 | 265 | | Calculation of Daily consumption rate by the formula Column II / 300 Calculation of EBQ = âˆš(2 X Annual dd X Setup Cost) / Carrying cost Calculation of No of days required to produce a batch quantity = Column V/ Column III Calculation of No of days required to manufacture annual requirements = Column II/ Column III Calculation of No of days taken to consume a batch quantity = Column V/ Column IV Above table gives the total production days required to manufacture the entire annual requirement of all 4 watches as 26, whereas

the total number of production days available are 300. Therefore the aggregate capacity seems to be sufficient for the manufacture of the annual requirement of all the watches. But, the total number of production days required, if an economic batch quantity of each of the products was produced, is 19. 48 days. In other words, 19. 48 days of the production cycle are required if each of the products is produced once in the amount as required by the economic batch quantity formula. We observe in the above table that, for watch GUCCI the number of days to consume such as EBQ is less than 19. 48. That means in a situation when a batch of the entire range of watches is to be manufactured the watch GUCCI will experience shortage because it will have been consumes fully much before the completion of the 19. 48 days. PGP/FW/2009-11 FOURTH TRIMESTER END TERM EXAMINATION 2011 (2) Question 2(b) A continuous time study was made of a job that was broken down in to live elements with the following results (times are in minutes). The allowance factor is 10% (i) What is the standard time to do the job (ii) what is the per piece rate in case the worker is paid Rs200 per day:- Element | Cycle | Performance Rating (%) | | 1 | 2 | 3 | 4 | 5 | | A | 0. 16 | 1. 37 | 2. 10 | 2. 80 | 4. 00 | 80 | B | 0. 37 | 1. 58 | 2. 33 | 3. 00 | 4. 22 | 90 | C | 0. 57 | 1. 80 | 2. 51 | 3. 20 | 4. 42 | 110 | D | 1. 20 | 1. 93 | 2. 65 | 3. 84 | 4. 85 | 100 | Solution: Element | Cycle | Performance Rating (%) | Arithmetic Average | Normal Time for Element Minutes | | 1 | 2 | 3 | 4 | 5 | | | | A | 0. 16 | 1. 37 | 2. 10 | 2. 80 | 4. 00 | 80 | 2. 086 | 1. 6688 | B | 0. 37 | 1. 58 | 2. 33 | 3. 00 | 4. 22 | 90 | 2. 3 | 2. 07 | C | 0. 57 | 1. 80 | 2. 51 | 3. 20 | 4. 42 | 110 | 2. 5 | 2. 75 | D | 1. 20 | 1. 93 | 2. 65 | 3. 84 | 4. 85 | 100 | 2. 894 | 2. 894 | Total | 9. 3828 | Normal time = (Arithmetic Average of the Recorded time X Performance Rating Expressed in percentage with 100% as the ‘ accepted’

performance) / 100 Standard Time = Normal Time / (1 — Total Allowance expressed as a fraction) Therefore Standard Time = 9. 38 / (1 — 0. 10) = 10. 425 minutes Working Time = 60 X 8 = 480 Minutes No of piece can be made 480 / 10. 425 = 46. 04 Daily payment = Rs 200 Per piece rate = 200 / 46. 04 = Rs 4. 34 Question 3(a) You are given the values of sample means (X bar) and the ranges (R) for the ten samples of size 5 each. Sample | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | X | : | 43 | 49 | 37 | 44 | 45 | 37 | 51 | 46 | 43 | 47 | R | : | 5 | 6 | 5 | 7 | 7 | 4 | 8 | 6 | 4 | 6 | Calculate the LCL, UCL and CL for the Mean chart and the Range Chart without drawing a graph comment if the process is in control. Further given that for N= 5 | A2= 0. 577 | c2= 0. 8407 | d2= 2. 326 | d3= 0. 864 | D3= 0 | D4= 2. 115 | Solution: Sample | Total | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | X | : | 43 | 49 | 37 | 44 | 45 | 37 | 51 | 46 | 43 | 47 | âˆ‘ X = 442 | R | : | 5 | 6 | 5 | 7 | 7 | 4 | 8 | 6 | 4 | 6 | âˆ‘ R = 58 | X = âˆ‘ X/10 = 442/10 = 44. 2 R = âˆ‘ Rn = 5810 = 5. 8 From the given table for a sample size 5, A2= 0. 58, D3= 0 D4= 2. 11 UCL for X = X + A2 R = 44. 2 +(0. 58*5. 8) = 47. 564 LCL for X = X - A2 R = 44. 2 - (0. 58*5. 8) = 40. 836 CL for X = 44. 2 CL for R = 5. 8 UCL for R = D4R = 2. 11 X 5. 8 = 12. 238 LCL for R = 0 According to above calculation are compared with these tentative limits. Sample 2 is above the UCL. This means that the process is not stable during the base period. Question 5(b) Use factor rating method to find the best location. The sites have been rated on a scale of 1 — 100 (100 being extremely good) | Factors | Importance Rating | Site 1 | Site 2 | Site 3 | 1 | Cost of Land | 4 | 50 | 80 | 90 | 2 | Closeness to customers with in Paris | 2 | 90 | 70 | 20 | 3 | Access to Motorways | 1 | 90 | 70 | 50 | 4 | Access to Airport | 1 | 80 | 60 | 60 | 5 | Availability of Hotel Accommodation | 1 | 80 | 70 | 60 | 6 | Local Taxes | 1 | 20 | 60 | 90 | 7 | Expansion Possibilities | 1 | 50 | 70 | 90 |

Solution: | Factors | Rating(1) | Site 1 | Site 2 | Site 3 | | | (Rating)(2) | Total1 * 2 | Rating(3) | Total1 * 3 | Rating (4) | Total1 * 4 | 1 | Cost of land | 4 | 50 | 200 | 80 | 320 | 90 | 360 | 2 | Closeness to customers with in Paris | 2 | 90 | 180 | 70 | 140 | 20 | 40 | 3 | Access to Motorways | 1 | 90 | 90 | 70 | 70 | 50 | 70 | 4 | Access to Airport | 1 | 80 | 80 | 60 | 60 | 60 | 60 | 5 | Availability of Hotel Accommodation | 1 | 80 | 80 | 70 | 70 | 60 | 60 | 6 | Local Taxes | 1 | 20 | 20 | 60 | 60 | 90 | 90 | 7 | Expansion Possibilities | 1 | 50 | 50 | 70 | 70 | 90 | 90 | | | | | 700 | | 790 | | 770 | The total score for Site 2 is higher than that of Site 1 and Site 3. Hence Site 2, is the best choice. Question 7(a) The processing time and due dates for 5 jobs are given below Jobs | Processing times (Days) | Due Date (Days from present) | A | 20 | 100 | B | 28 | 70 | C | 12 | 52 | D | 36 | 110 | E | 8 | 58 | Find our average flow/wait and average delay by using the (i) Shortest processing(operating) time rule. (ii) Earliest due date rule. (iii) FCFS rule. Comment as to which rule is better. Solution: (i) The SPT rule results in the sequence B-D-A-C-E. Orders are sequenced according to processing time, with the highest priority given to shortest job. Jobs | Processing Time | Flow Time | Due Date | Delay | E | 8 | 8 | 58 | 0 | C | 12 | 20 | 52 | 0 | A | 20 | 40 | 100 | 0 | B | 28 | 68 | 70 | 0 | D | 36 | 104 | 110 | 0 | | 104 | 240 | | 0 | The Shortest Processing Time results in the following measures of effectiveness: Average flow time = 240/5= 48 days Average delay time 0/5 = 0 (ii) The EDD rule gives the sequence C-E-B-A-D. Note that jobs are ordered earliest due date first. Jobs | Processing Time | Flow Time | Due Date | Delay | C | 12 | 12 | 52 | 0 | E | 8 | 20 | 58 | 0 | B | 28 | 48 | 70 | 0 | A | 20 | 68 | 100 | 0 | D | 36 | 104 | 110 | 0 | | 104 | 252 | | 0 | The Earliest Due Date rule results in the following measures of effectiveness Average Flow time = Total flow time / no of jobs = 252/5 = 50. 4 Average job delays =

total delays days/ no of jobs = 0/5 = 0 (ii) The FCFS sequence is simply A-B-C-D-E. The " flow time" in the system for this sequence measures the time each jobs depends waiting plus being processed. Jobs | Processing Time | Flow Time | Due Date | Delay | A | 20 | 20 | 100 | 0 | B | 28 | 48 | 70 | 0 | C | 12 | 60 | 52 | 8 | D | 36 | 96 | 110 | 0 | E | 8 | 104 | 58 | 46 | | 104 | 328 | | 54 | (iii) The First Come First Serve rule (FCFS)results in the following measures of effectiveness: Average Flow time = Total Flow Time / No of Jobs = 328 days/5 = 65. 6 days Average delay = Total delays days / No of Jobs = 54/5 = 10. 8 days Shortest processing time is generally the best technique for minimizing job flow and minimizing the average number of jobs in the system. Its chief disadvantage is that long-duration jobs may be continuously pushed back in priority in favor of short-duration jobs. Customers may view this dimly, and a periodic adjustment for longer jobs has been made. Question 7(b) A TV manufacturing company produces 2000 TV sets in a year for which it needs an equal number of tubes of a certain type. Each tube costs Rs 10 and the cost to hold a tube in stock in a year is Rs 2. 40. Besides, the cost of placing an order is Rs150, which is not related to its size. i) Determine EOQ and total inventory cost. ii) If the demand increase by 25% what is the new EOQ and the new Total Cost. Solution: Consumption of Tube in a year = 2000 units = C Cost of placing an order = Rs 150 = O Purchase price per unit of Tube = Rs 10 Storage cost = Rs 2. 4 = S EOQ = âˆš{2CO/S} = âˆš{2*2000*150/2. 4} = 500 PGP/SS/2009-11 FOURTH TRIMESTER END TERM EXAM 2010 (3) Question 2 The measurement on diameter of bolts, as number of 0. 0001 cms above 1. 90cms, is given in the following table representing 10 samples with 5 observations in each sample. Prepare control charts for (i) mean, (ii) range. Determine whether the process is under

control in each case. (You don’t need to calculate revised limits or draw the revised graph) Sample No | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Measurement | 88 | 86 | 83 | 88 | 73 | 78 | 83 | 75 | 70 | 75 | | 78 | 91 | 65 | 88 | 80 | 86 | 80 | 88 | 80 | 75 | | 70 | 78 | 73 | 73 | 73 | 78 | 73 | 80 | 86 | 73 | | 88 | 86 | 63 | 88 | 70 | 80 | 65 | 60 | 73 | 86 | | 65 | 68 | 75 | 68 | 70 | 63 | 75 | 65 | 75 | 86 | Mean Value | 77. 8 | 81. 8 | 71. 8 | 81 | 73. 2 | 77 | 75. 2 | 73. 6 | 76. 8 | 79 | Range Value | 23 | 23 | 20 | 20 | 10 | 23 | 18 | 28 | 16 | 13 | Further given that for N= 5 | A1= 1. 596 | A2= 0. 577 | c2= 0. 8407 | d2= 2. 326 | d3= 0. 864 | D3= 0 | D4= 2. 115 | Solution: Sample | Total | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | X | : | 77. 8 | 81. 8 | 71. 8 | 81 | 73. 2 | 77 | 75. 2 | 73. 6 | 76. 8 | 79 | âˆ‘ X = 767. 2 | R | : | 23 | 23 | 20 | 20 | 10 | 23 | 18 | 28 | 16 | 13 | âˆ‘ R = 194 | X = âˆ‘ X/10 = 767. 2/10 = 76. 72 R = âˆ‘ Rn = 19410 = 19. 4 From the given table for a sample size 5, A2= 0. 58, D3= 0 D4= 2. 11 UCL for X = X + A2 R = 76. 72+(0. 58*19. 4) = 87. 97 LCL for X = X - A2 R = 76. 72 - (0. 58*19. 4) = 65. 46 CL for X = 76. 72 CL for R = 19. 4 UCL for R = D4R = 2. 11 X 19. 4 = 40. 93 LCL for R = 0 According to above calculation are compared with these tentative limits. Sample 1, Sample 2 and Sample 10 are above the UCL. This means that the process is not stable during the base period. Question 3 Ten samples of 15 parts each were taken from an ongoing process to establish a p-chart for control. The samples and the number of defectives in each are shown here:- Sample | n | Number of defectives in the sample | 1 | 15 | 3 | 2 | 15 | 1 | 3 | 15 | 0 | 4 | 15 | 0 | 5 | 15 | 0 | 6 | 15 | 2 | 7 | 15 | 0 | 8 | 15 | 3 | 9 | 15 | 1 | 10 | 15 | 0 | Plot the 10 samples and comment if the process is in control. Give appropriate reason for your comment. Solution: p-Chart | | | | | | | | | | Input: | | Output: | | | No. of samples | 10 | | p = | | 0. 07 | | Sample size | 15 | | UCL = | 0. 26 | | Sigma limits | 3 | | LCL = |

0. 00 | | | | | | | | | Calculations | | Number of | Proportion | | | | Sample | Defectives | Defective | p | | UCL | LCL | 1 | 3 | 0. 200 | 0. 07 | 0. 2599 | 0. 0000 | 2 | 1 | 0. 067 | 0. 07 | 0. 2599 | 0. 0000 | 3 | 0 | 0. 000 | 0. 07 | 0. 2599 | 0. 0000 | 4 | 0 | 0. 000 | 0. 07 | 0. 2599 | 0. 0000 | 5 | 0 | 0. 000 | 0. 07 | 0. 2599 | 0. 0000 | 6 | 2 | 0. 133 | 0. 07 | 0. 2599 | 0. 0000 | 7 | 0 | 0. 000 | 0. 07 | 0. 2599 | 0. 0000 | 8 | 3 | 0. 200 | 0. 07 | 0. 2599 | 0. 0000 | 9 | 1 | 0. 067 | 0. 07 | 0. 2599 | 0. 0000 | 10 | 0 | 0. 000 | 0. 07 | 0. 2599 | 0. 0000 | Total | 10 | | | | p-Chart Formulas | | | | | | | | | Question 6(b) A small manufacturing facility is being planned that will feed parts to three heavy manufacturing facilities. The location of the current plants with their coordinates and volume requirements are given in the following tables:- | | Co-Ordinates | Plant Location | Volume (Parts per year) | X | Y | Delhi | 2000 | 250 | 270 | Ahmedabad | 4000 | 325 | 420 | Bhopal | 1000 | 420 | 130 | Use the Center of Gravity Method (Centroid Method) to determine the best location for this new facility. Solution: X = (250 X 2000 + 325 X 4000 + 420 X 1000) / 2000+4000+1000 = 2220000/7000= 317. 14= 317 Y=(270 X 2000 + 420 X 4000 + 130 X 1000) / 2000+4000+1000 = 2350000/7000 = 335. 71 = 336 C C D D B B A A The best location for this new facility is the point D with co-ordinates(317, 336) Question 7 (b) An operation consists of three elements subjected to a stop watch time study. Theraw data are contained in the following table. The allowance for the operation is 20%. (i) What is the standard time for the operation? What should be the standard in hrs per 1000 units job? (ii) if the worker is paid Rs 150 per day then what is the per unit rate? Job Element | Performance Rating (%) | Observation sec/element | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 90 | 7 | 2 | 8 | 9 | 8 | 10 | 10 | 8 | 9 | 7 | 2 | 100 | 14 | 14 | 18 | 15 | 14 | 14 | 15 | 16 | 16 | 14 | 3 | 110 | 8 | 7 | 8 | 9 | 9

| 7 | 7 | 8 | 7 | 9 | Solution: Job Element | Performance Rating (%) | Observation sec/element | Arithmetic Average | Normal Time for Element Minutes | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 1 | 90 | 7 | 2 | 8 | 9 | 8 | 10 | 10 | 8 | 9 | 7 | 7. 8 | 7. 02 | 2 | 100 | 14 | 14 | 18 | 15 | 14 | 14 | 15 | 16 | 16 | 14 | 15 | 15 | 3 | 110 | 8 | 7 | 8 | 9 | 9 | 7 | 7 | 8 | 7 | 9 | 7. 9 | 8. 69 | TOTAL | 30. 71 | Normal time = (Arithmetic Average of the Recorded time X Performance Rating Expressed in percentage with 100% as the ‘ accepted’ performance) / 100 Standard Time = Normal Time / (1 — Total Allowance expressed as a fraction) Therefore Standard Time = 30. 71 / (1 — 0. 20) = 38. 38 minutes Working Time = 60 X 8 = 480 Minutes No of piece can be made 480 / 38. 38 = 12. 50 Daily payment = Rs 150 Per piece rate = 150 /12. 50 = Rs 12 PGP/FW/2008-10 FOURTH TRIMESTER END TERM EXAM 2010 ------4 Question 3. Enumerate various factors for location selection for a production unit. Using Bridgeman’s method, suggest the suitability of a location on the following data: Factor | Location A | Location B | Weightage | 1. Cost of the Plot | Rs 350 Lakhs | Rs 415 Lakhs | 3 | 2. Labour Cost | Rs 25 Lakhs | Rs23Lakhs | 2 | 3. Power Cost | Rs 375 Lakhs | Rs315lakhs | 3 | 4. Material Cost | Rs 215 Lakhs | Rs240Lakhs | 4 | 5. Infrastructure | Rs 1015 Lakhs | Rs 960 Lakhs | 3 | 6. Political Climate | 4 | 3 | 4 | 7. Union Attitude | 3 | 3 | 3 | 8. Labour Attitude | 2 | 4 | 2 | Solution: For selecting best site for plant locations by using Bridgement’s dimensional analysis. In this method we compare pair-wise location in ratio with each other. R12 = Preference for location 1 / Preference for location 2 R12 = X11X12W X X21X22W X X31X32W Now we compare Location A and location B R12 = (350/415)3 X (25/23)2 X (375/315)3 X (215/240)4 X (1015/960)3 X (4/3)4 X (3/3)3 X (2/4)2 = 0. 599 X 1. 18 X 1. 68 X 0. 644 X 1. 18 X 3. 16 X 1X 0. 25 = 0. 719 R12 <1

Therefore Location A is better than Location B. Question 4 (c) With routing as Machine I to Machine II, draw the bar chart of scheduling the following orders on this work center using Johnson’s rule for sequencing the jobs:- Processing time for | Job A | Job B | Job C | Job D | Job E | Machine I | 5 | 3 | 2 | 7 | 5 | Machine II | 7 | 2 | 7 | 1 | 9 | Solution: Set the sequence that will minimise the total processing time for the five jobs: Step 1 : The job with the shortest processing time is D, in Machine II (with a time of 1 hour). Because it is at the second centre, schedule A last. | | | | D | Step 2 : There is a tie(at 2) for the shortest remaining job. We can place C, which was on the Machine I, first. Then B is placed in the last sequencing position. C | B | A | E | D | Step 2 : There is again a tie(at 5) for the shortest remaining job. We can place A, which was on the Machine I, first. Then E is placed in the last sequencing position. The sequential times are: Job | C | B | A | E | D | Machine I | 2 | 3 | 5 | 5 | 7 | Machine II | 7 | 2 | 7 | 9 | 1 | The Time-phased flow of this job sequence is illustrated graphically as below 0 2 5 10 15 22 Machine 1 | C | B | A | E | D | Idle | Machine 2 | Idle | C | B | A | E | D | 2 9 11 18 27 28 Question 5 (b) With the help of following data, establish whether the process is in control or not (use Mean and Range chart for the purpose):- Dimension Measured (cm) Sample No | Product 1 | Product 2 | Product3 | Product 4 | 1 | 9. 61 | 9. 65 | 9. 55 | 9. 58 | 2 | 9. 70 | 9. 65 | 9. 57 | 9. 59 | 3 | 9. 80 | 9. 75 | 9. 81 | 9. 80 | 4 | 9. 75 | 9. 78 | 9. 82 | 9. 50 | 5 | 9. 65 | 9. 67 | 9. 80 | 9. 75 | Solution: Sample No | 1 | 2 | 3 | 4 | 5 | Total | Product 1 | 9. 61 | 9. 70 | 9. 80 | 9. 75 | 9. 65 | | Product 2 | 9. 65 | 9. 65 | 9. 75 | 9. 78 | 9. 67 | | Product 3 | 9. 55 | 9. 57 | 9. 81 | 9. 82 | 9. 80 | | Product 4 | 9. 58 | 9. 59 | 9. 80 | 9. 50 | 9. 75 | | X | 9. 59 | 9. 62 | 9. 79 | 9. 71 | 9. 71 | 48. 42 | R | 0. 1 | 0. 13 | 0. 06 | 0. 32 | 0. 15 | 0. 76 | X = âˆ‘ X/5 = 48. 425= 9. 68 R = âˆ‘ Rn = 0. 765 = 0. 152 From the

given table for a sample size 4, A2= 0. 729, D3= 0 D4= 2. 282 UCL for X = X + A2 R = 9. 68+(0. 729*0. 152) = 9. 79 LCL for X = X - A2 R = 9. 68 - (0. 729*0. 152) = 9. 56 CL for X = 9. 68 CL for R = 0. 152 UCL for R = D4R = 2. 282 X 0. 152 = 0. 346 LCL for R = 0 the process is not stable during the base period. Question6. (b) Decide on the A, B and C categories of products based on the following data: Product | Unit Cost (in Rs) | Annual Consumption(In Rs) | A | 4. 00 | 20000 | B | 3. 50 | 60500 | C | 0. 50 | 270300 | D | 175 | 150 | E | 215 | 450 | F | 7. 15 | 25700 | G | 22. 60 | 31500 | H | 11. 50 | 500 | I | 10. 00 | 2500 | J | 9. 70 | 15700 | K | 3000 | 700 | L | 5. 70 | 27500 | PGP/FW/2008-10 FOURTH TRIMESTER END TERM EXAMINATION 2010 5 Question1) Data for the number of defective electric fuses coming out from a plant are as follows. Develop a p-chart (OR) np chart a sample of size 100 SAMPLE | DEFECTIVES | SAMPLE | DEFECTIVES | 1 | 22 | 9 | 42 | 2 | 40 | 10 | 38 | 3 | 36 | 11 | 70 | 4 | 32 | 12 | 80 | 5 | 42 | 13 | 44 | 6 | 40 | 14 | 22 | 7 | 30 | 15 | 32 | 8 | 44 | | | Plot the 15 sample and comment if the process in in control. Solution: p-Chart | | | | | | | | | | Input: | | Output: | | | No. of samples | 15 | | p = | | 0. 41 | | Sample size | 100 | | UCL = | 0. 56 | | Sigma limits | 3 | | LCL = | 0. 26 | | | | | | | | | Calculations | | Number of | Proportion | | | | Sample | Defectives | Defective | p | | UCL | LCL | 1 | 22 | 0. 220 | 0. 41 | 0. 5568 | 0. 2618 | 2 | 40 | 0. 400 | 0. 41 | 0. 5568 | 0. 2618 | 3 | 36 | 0. 360 | 0. 41 | 0. 5568 | 0. 2618 | 4 | 32 | 0. 320 | 0. 41 | 0. 5568 | 0. 2618 | 5 | 42 | 0. 420 | 0. 41 | 0. 5568 | 0. 2618 | 6 | 40 | 0. 400 | 0. 41 | 0. 5568 | 0. 2618 | 7 | 30 | 0. 300 | 0. 41 | 0. 5568 | 0. 2618 | 8 | 44 | 0. 440 | 0. 41 | 0. 5568 | 0. 2618 | 9 | 42 | 0. 420 | 0. 41 | 0. 5568 | 0. 2618 | 10 | 38 | 0. 380 | 0. 41 | 0. 5568 | 0. 2618 | 11 | 70 | 0. 700 | 0. 41 | 0. 5568 | 0. 2618 | 12 | 80 | 0. 800 | 0. 41 | 0. 5568 | 0. 2618 | 13 | 44 | 0. 440 | 0. 41 | 0. 5568 | 0. 2618 | 14 | 22 | 0. 220 |

0. 41 | 0. 5568 | 0. 2618 | 15 | 32 | 0. 320 | 0. 41 | 0. 5568 | 0. 2618 | Total | 614 | 6. 140 | | | p-Chart Formulas | | | | | | | | | Question5. b) A continuous time study was made of a job that was broken down into live elements with the following results (time are in minutes):- Element | Cycle | Performance Rating(%) | | 1 | 2 | 3 | 4 | 5 | | A | 4. 16 | 4. 37 | 4. 10 | 4. 80 | 4. 00 | 120 | B | 2. 37 | 2. 58 | 2. 33 | 3. 00 | 2. 22 | 90 | C | 3. 57 | 3. 80 | 3. 51 | 3. 20 | 3. 42 | 110 | D | 1. 20 | 1. 93 | 1. 65 | 1. 84 | 1. 85 | 80 | Now calculate the standard time to do the job assuming an allowance factor of 10%. Solution: Element | Cycle | Performance Rating(%) | Arithmetic Average | Normal Time for Element Mints | | 1 | 2 | 3 | 4 | 5 | | | | A | 4. 16 | 4. 37 | 4. 10 | 4. 80 | 4. 00 | 120 | 4. 286 | 5. 1432 | B | 2. 37 | 2. 58 | 2. 33 | 3. 00 | 2. 22 | 90 | 2. 5 | 2. 25 | C | 3. 57 | 3. 80 | 3. 51 | 3. 20 | 3. 42 | 110 | 3. 5 | 3. 85 | D | 1. 20 | 1. 93 | 1. 65 | 1. 84 | 1. 85 | 80 | 1. 694 | 1. 3552 | Total | 12. 59 | Standard Time = 12. 59 / (1 — 0. 10) = 13. 98 minutes POST GRAGUATE PROGRAMME IN PLANNING AND ENTREPRENEURSHIP PGP/SS/2008-10 TRIMESTER EXAM 3. a) A hospital buys medical consumables from several suppliers. The bad quality of consumables sometimes affects the hospital operations critically. Therefore there is a quality control routine that the hospital follows. Based on a weekly analysis of the quality of cotton and dressing material used in large quantities in the surgery section of the hospital, the following causes of defects were found out Sl no | Description | Number of occurrences | 1 | Soiled and dirty | 23 | 2 | Cuts and discontinuities | 12 | 3 | Improper specifications | 19 | 4 | Weight Loss | 31 | 5 | Defective packing | 21 | (i) Draw a histogram of the above problem for further analysis. (ii) Draw a Pareto diagram of the above data. Based on the Pareto diagram what course of action would you recommend? Solution (i) (iii) Pareto Diagram Sl no |

Description | Number of Occurrences | Percentage | Cumulative percentage | 4 | Weight loss | 31 | 29. 24528302 | 29. 24528302 | 1 | Soiled and dirty | 23 | 21. 69811321 | 50. 94339623 | 5 | Defective packing | 21 | 19. 81132075 | 70. 75471698 | 3 | Improper specifications | 19 | 17. 9245283 | 88. 67924528 | 2 | Cuts and discontinuities | 12 | 11. 32075472 | 100 | | | 106 | | | 5. After the application of appropriate work simplification techniques, a direct time study of a simplified job was undertaken and the following time elements in minutes were obtained. Job Element | Cycles | 1 | 0. 16 | 0. 12 | 0. 33 | 0. 15 | 0. 24 | 2 | 0. 60 | 0. 60 | 0. 60 | 0. 60 | 0. 60 | 3 | 0. 33 | 0. 50 | 0. 35 | 0. 37 | 0. 35 | 4 | 0. 50 | 0. 50 | 0. 50 | 0. 50 | 0. 50 | 5 | 0. 24 | 0. 24 | 0. 25 | 0. 27 | 0. 25 | The following additional information was also determined about the jobs: a. Job elements 2 and 4 are machine controlled and cannot be speeded up by the operator. b. There were two irregular occurrences while timing i. e. jobs having more than 25% variation from average. c. He rated the operator at 110% when working d. Personal allowance 30 minutes a day. Unavoidable delay 20 minutes a day. Fatigue — 10% of the operators actual physical working time. e. A shift is 8 hours long. What should be the standard minutes per unit be for this job? What should be the shift output standard be? Solution: | | | Cycle | | | | | Job Element | | 1 | 2 | 3 | 4 | 5 | | 1 | | 0. 16 | 0. 12 | 0. 33 | 0. 15 | 0. 24 | | 2 | | 0. 6 | 0. 6 | 0. 6 | 0. 6 | 0. 6 | | 3 | | 0. 33 | 0. 5 | 0. 35 | 0. 37 | 0. 35 | | 4 | | 0. 5 | 0. 5 | 0. 5 | 0. 5 | 0. 5 | | 5 | | 0. 24 | 0. 24 | 0. 25 | 0. 27 | 0. 25 | | | Total | 1. 83 | 1. 96 | 2. 03 | 1. 89 | 1. 94 | | | Average Observed Time | 0. 366 | 0. 392 | 0. 406 | 0. 378 | 0. 388 | | | Normal Time = OTXOR/SR | 0. 4392 | 0. 4704 | 0. 4872 | 0. 4536 | 0. 4656 | 2. 316 | | | | | | | | | | | | | | | | | Normal Time for the Job = 2. 316 | | | | | | | Allowance = 50 Minutes % Allowance = 50/430X 100 = 11. 62% of normal time Standard

time / piece = 2. 316+11. 62%*2. 316 + 0. 1 = 2. 68 Fatigue 10% = 10/100 = . 1 Standard Production in 8 Hrs = 2. 316 X 60 / 2. 68 = 51. 850 units Q6 a) Consider a product, code named A, manufactured by a company. Product A is made of three sub-assemblies B, C and D. One unit of B, four units of C and two units of D are required for assembling one unit of product A. Sub-assembly C is made of two units of E and four units of D, whereas sub-assembly D is made of one unit of G and three units of H. (i) Develop a product structure for product A (ii) How many units of D are required to manufacture of 10 units of A? (iii) Will the answers change if there is already an inventory of 10 units each of C and D? Solution: Product Structure for Product A A B (1) C (4) D (2) G (1) F (4) E (2) D (4) E (2) H (3) A B (1) C (4) D (2) G (1) F (4) E (2) D (4) E (2) H (3) 1 unit of production of C is required 4 units of D, Therefore 4 units of production of C required 16 units of D. (ii) That means 1 unit of product A required 16 units of D, so 10 units of product A required 160 units of D. (iii) If there is already an inventory of 10 units each of C and D, then the product planning as follows. Total C required 40-10 = 30 units D = 160 — 10 = 150 units. Question 4. A manufacturing organization employs 220 people in the factory. The manufacturing is largely manual; therefore, man hours are a good measure of the capacity of the system. The factory currently works for a single shift of eight hours. The number of working days for the next six months is as follows: 24, 22, 25, 19, 21 and 23. The company uses this information to plan its capacities. The demand for its product during the next six months is such that with the current level of employment, the company will have 80 percent capacity utilization. During the next six months, the number of working days remains the same but the demand is likely to go up by 35 percent. Under these

circumstances, analyses the situation and answer the following questions: (i) What is the total capacity available in the factory as of now? (ii) The company is considering three options to meet the implementing demand for capacity? a. Introduce two hours of overtime for the next six months. b. Introduce one hours of overtime for the first three months and two hours of idle time thereafter. Solution: i) Calculation of factory capacity (in hours) : Total no of workers 220 Shift hours per day = 8 hours Daily factory capacity (in hours) = 220*8 hours = 1760 hours Month | No of working days | Factory Capacity (in hours) | 1 | 24 | 42240 | 2 | 22 | 38720 | 3 | 25 | 44000 | 4 | 19 | 33440 | 5 | 21 | 36960 | 6 | 23 | 40480 | | Total | 235840 | Total capacity available in the factory is 235840 X 80% = 188672hrs ii) a) Introduce two hours overtime for the next six months. Daily factory capacity(in hours) = 220*10 = 2200 Month | No of working days | Factory Capacity (in hours) | 1 | 24 | 52800 | 2 | 22 | 48400 | 3 | 25 | 55000 | 4 | 19 | 41800 | 5 | 21 | 46200 | 6 | 23 | 50600 | | Total | 294800 | Total capacity available in the factory is 294800 X 80% = 235840hrs b) Introduce one hour of overtime for next six months. Daily factory capacity(in hours) = 220*9 = 1980 Month | No of working days | Factory Capacity (in hours) | 1 | 24 | 47520 | 2 | 22 | 43560 | 3 | 25 | 49500 | 4 | 19 | 37620 | 5 | 21 | 41580 | 6 | 23 | 45540 | | Total | 265320 | Total capacity available in the factory is 265320 X 80% = 212256hrs c) Introduce two hours of overtime for the first three months and two hours of idle time therafter. Month | No of working days | Factory Capacity (in hours) | 1 | 24 | 52800 | 2 | 22 | 48400 | 3 | 25 | 55000 | 4 | 19 | 33440 | 5 | 21 | 36960 | 6 | 23 | 40480 | | Total | 267080 | Total capacity available in the factory is 267080 X 80% = 213664hrs