

Modified

CBCS SCHEME

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18ME56

Fifth Semester B.E. Degree Examination, Feb./Mar.2022

Operations Management

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain briefly with a schematic model the functions of business organization and operation management within them. (08 Marks)
- b. Define productivity and explain the factors that affect productivity. (06 Marks)
- c. Determine the productivity and multi factor productivity respectively for the cases:
- (i) Four workers installed 720 sq m of carpeting in 8 hours.
- (ii) For the combined input of labour and machine time using the following :
- Output : 7040 units
 Input : Labour : Rs. 1000.00
 Materials : Rs.520.00
 Overhead : Rs.2000.00 (06 Marks)

OR

- 2 a. What are models? Explain different types of models. (06 Marks)
- b. A firm produces two types of microcomputers. The following data is available:

Profit/Unit	Rs.6000.00	Rs.5000.00
Assembly time per unit	4 hours	10 hours
Inspection time per unit	2 hours	1 hour
Storage space per unit	3 cub ft	3 cub ft

The available resources :

Resource	Amount available
Assembly time	100 hours
Inspection time	22 hours
Storage space	39 cubic feet

Formulate as LPP and solve by graphical method to find quantities of Type 1 and Type 2.

(14 Marks)

Module-2

- 3 a. Explain the following forecasting methods :
- (i) Linear regression
- (ii) Exponential smoothing. (08 Marks)
- b. Given the following data:

Period	Number of complaints
1	60
2	65
3	55
4	58
5	64

Prepare a forecast using each of these approaches:

- (i) A three period moving average.
- (ii) A weighted average using weights of 0.5 (most recent), 0.30 and 0.2.
- (iii) Exponential smoothing with a smoothing constant of 0.40.

(12 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

OR

- 4 a. Explain the steps in the forecasting process. (06 Marks)
 b. What is Delphi method? Brief. (04 Marks)
 c. The mobile phone sales for a company over the last 10 weeks are shown in below table. Plot the data and visually check to see if a linear trend line would be appropriate. Then determine the equation of the trend line and predict sales for weeks 11 and 12.

Week	Unit sales	Week	Unit sales
1	700	6	742
2	724	7	756
3	720	8	750
4	726	9	770
5	738	10	780

(10 Marks)

Module-3

- 5 a. List the factors that determine effective capacity and explain any four. (06 Marks)
 b. Explain bottle neck operation with a neat diagram. (06 Marks)
 c. A small firm produces and sells automotive items in a five state area. The firm experts to consolidate assembly of its battery chargers line at a single location. Currently operations are in three widely scattered locations. The leading candidate for location will have a monthly fixed cost of Rs.42 lakhs and variable cost of Rs.200/charger. Chargers sell for Rs.700 per charger. Prepare a table that shows total profits, fixed costs variable costs, and revenues for monthly volumes of 10,000, 12,000 and 15,000 units. What is the break even point? Determine the profit when volume equals 22000 units. (08 Marks)

OR

- 6 a. What are factors that affect location decision? Explain. (10 Marks)
 b. Fixed and variable costs for four potential plant locations are shown below:

Location	Fixed cost/year	Variable cost/unit
A	Rs.2,50,000.00	Rs.110.00
B	Rs.1,00,000.00	Rs.300.00
C	Rs.1,50,000.00	Rs.200.00
D	Rs.2,00,000.00	Rs.350.00

- (i) Plot the total cost lines for these locations on a single graph.
 (ii) Identify the range of output for which each alternative is superior.
 (iii) If expected output at the selected location is to be 8000 units/year, which location would provide the lowest total cost? (10 Marks)

Module-4

- 7 a. Briefly explain the aggregate planning with the help of a flow chart. (06 Marks)
 b. Given the following information setup the problem in a transportation table and solve for the minimum cost plan by least cost method.

	Period		
	1	2	3
Demand	500	700	750
Regular	500	500	500
Capacity over time	50	50	50
Sub contract	120	120	100

Costs : Initial Inventory : 100

Regular time : Rs. 60/unit

Sub contracting : Rs. 90/unit

Inventory carrying cost : Rs.1/unit/month

Back order cost : Rs.3/unit/month

(14 Marks)

OR

- 8 a. Explain master scheduling process with the help of a flow chart. (08 Marks)
 b. Determine : the projected on hand inventory, the master production schedule and the uncommitted inventory (ATP – Available To Promise) for the following data and production capacity is 70 pumps. Forecast are shown in table.

Beginning Inventory 64	June (weeks)				July (weeks)			
Week	1	2	3	4	5	6	7	8
Forecast	30	30	30	30	40	40	40	40
Customer orders (committed)	33	20	10	4	2	-	-	-

(12 Marks)

Module-5

- 9 a. Explain with schematic model an overview of MRP. (10 Marks)
 b. The Fig.Q9 (b) shows product structure tree for end Item X i.e.Chairs

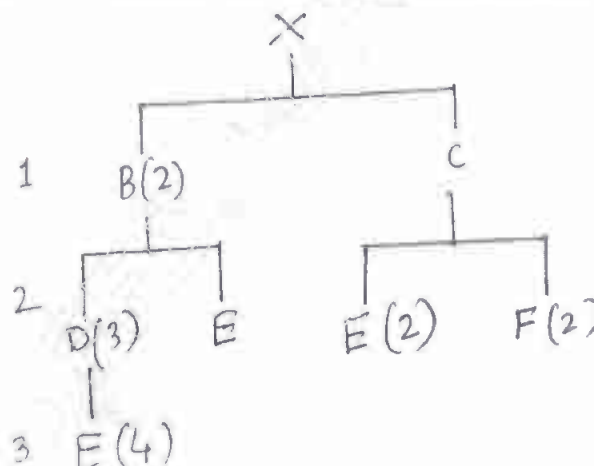


Fig. Q9 (b)

- (i) Determine the quantities of B, C, D, E and F needed to assemble one X.
 (ii) Determine the quantities of these components that will be required to assemble 10Xs, taking into account the quantities on hand (i.e. an inventory) of various components:

Component	On Hand
B	4
C	10
D	8
E	60

(10 Marks)

OR

- 10 a. What is supply chain? Explain supply chain management with a schematic model. (10 Marks)
 b. Describe Bull whip effect with a diagram. (05 Marks)
 c. Briefly explain elements of supply chain management. (05 Marks)

Re: Sir, regarding Modification of Scheme and solution

"Dr M S Govinde Gowda" <msggowda1964@gmail.com>

March 21, 2022 1:01 PM

To: boe@vtu.ac.in

Dear Sir,

PFA for the corrected and approved scheme and solution of 18ME56-Operations Management for your kind notice and for the further needful from your end.

It is to note that the representation given by the colleges for Qn.7(b) in which the data is missing, is considered. There is also data missing even in the Qn.6(b), the due consideration to be given is also mentioned.

With regards

Dr. M.S.Govinde Gowda

**Chairman, BOE, Mechanical Board, VTU
and**

Dean(Academics)

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On Thu, Mar 17, 2022 at 5:07 PM <boe@vtu.ac.in> wrote:

"APPROVED"
Ray → *BE*
Registrar (Evaluation)
Visvesvaraya Technological University
BELAGAVI - 590018
(M)

OR



201218ME 6.1055

Visvesvaraya Technological University
Belagavi, Karnataka - 590 018.

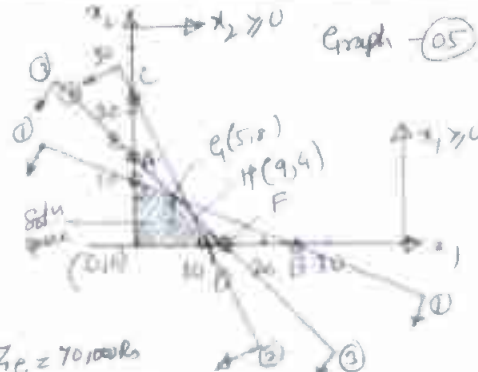
Scheme & Solutions

Signature of Scrutinizer

Subject Title: Operations Management

Subject Code: 18ME56

Question Number	Solution	Marks Allocated
Q1(a)	<p>Model 1 3 Basic Functions of Business organization</p> <p>Model 2 Operation Function involves conversion of I/P into O/P.</p> <p>Explanation of Terms</p> <p>(b) Defⁿ: Productivity is an index that measures of (goods and services) relative to the input (labour, material, energy and other resources) used to produce them $\text{productivity} = \frac{\text{O/P}}{\text{I/P}}$ Factors: Standardizing processes, Quality, use of internet, computer viruses, searching for lost or misplaced items, scrap rates, New workers, safety, A shortage of information technology to workers & other technical workers, Layoffs, labour turnover, Design of the workspace, Incentive plans</p> <p>(c) i) Productivity = $\frac{720 \text{ Sqm}}{4 \times 8} = 22.5 \text{ Sqm/hour}$ ii) Multifactor Productivity = $\frac{\text{O/P}}{L+M+O} = 2 \text{ units/RS I/P}$</p>	02+02 04 08M 02 04 08M 02 04 08M
Q2(a)	<p>A model is an abstraction of reality, a simplified representation of something. ex A child's toy car is a model of a real automobile. Types: Physical, Schematic, Mathematical models & Explanatory</p>	02 05 08M
(b)	<p>Formulation of the Problem:</p> $\text{Max } Z = \text{Rs } 6000x_1 + 5000x_2$ $\text{s.t. } 4x_1 + 10x_2 \leq 100$ $2x_1 + x_2 \leq 22$ $3x_1 + 3x_2 \leq 39$ $x_1, x_2 \geq 0$	05

Question Number	Solution	Marks Allocated																								
<p>Q2(b) (Cont'd)</p>	<p><u>Graphical Soln</u> Eqn ① $4x_1 + 10x_2 \leq 160$ $A(0,16) B(25,0)$ Eqn ② $2x_1 + x_2 \leq 22$ $C(0,22), D(11,0)$ Eqn ③ $x_1 + x_2 \leq 13$ $E(0,13) F(13,0)$ <u>Find G (5,8), H</u> $Z_{(0,0)} = 0, Z_A = ₹ 50000, Z_G = ₹ 70,000$ $Z_H = ₹ 74,000, Z_D = ₹ 66,000$ H is the Max. $x_1 = 9, x_2 = 4, Profit = ₹ 74,000/-$</p>  <p>Graph (05)</p>	<p>05</p> <p>(14) M</p>																								
<p>Q3(a)</p>	<p><u>Linear Regression Module 2</u> 1) $F_t = a + bt$, Fore cast for period $t = F_t$, $a =$ Value of F_t at $t=0$ $b =$ Slope of the line $t =$ specified no of time periods from $t=0$ $b = \frac{n \sum ty - \sum t \sum y}{n \sum t^2 - (\sum t)^2}$ $a = \frac{\sum y - b \sum t}{n}$ or $\bar{y} - b \bar{x}$ where $n =$ no of periods / no of paired obs. $y =$ Value of the time series with sept. 2) <u>Exponential Smoothing</u> $F_{t+1} = \alpha D_t + \alpha(1-\alpha)D_{t-1} + \alpha(1-\alpha)^2 D_{t-2} + \dots + \alpha(1-\alpha)^{t-1} D_1 + (1-\alpha)^t F_t$ ———— Spt. Explanation. ————</p> <p>(b) i) $MA_3 = \frac{55+58+64}{3} = 59$ ii) $F = 0.20(55) + 0.30(58) + 0.50(64) = 60.4$ iii) <u>Exponential Smoothing, $\alpha = 0.4$</u></p> <table border="1" data-bbox="446 1411 1181 1657"> <thead> <tr> <th>Period</th> <th>No. of Complaints</th> <th>Fore Cast</th> <th>Calculations</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>60</td> <td>60</td> <td></td> </tr> <tr> <td>2</td> <td>65</td> <td>62</td> <td>$0.4 + 0.6(60) = 62$</td> </tr> <tr> <td>3</td> <td>52</td> <td>57.2</td> <td>$0.4 + 0.6(62) = 57.2$</td> </tr> <tr> <td>4</td> <td>58</td> <td>58.72</td> <td>$0.4 + 0.6(57.2) = 58.72$</td> </tr> <tr> <td>5</td> <td>60</td> <td>60.87</td> <td>$0.4 + 0.6(58.72) = 60.87$</td> </tr> </tbody> </table>	Period	No. of Complaints	Fore Cast	Calculations	1	60	60		2	65	62	$0.4 + 0.6(60) = 62$	3	52	57.2	$0.4 + 0.6(62) = 57.2$	4	58	58.72	$0.4 + 0.6(57.2) = 58.72$	5	60	60.87	$0.4 + 0.6(58.72) = 60.87$	<p>04</p> <p>04</p> <p>05 M</p> <p>02</p> <p>02</p> <p>04</p> <p>05 M</p>
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5	60	60.87	$0.4 + 0.6(58.72) = 60.87$																							
<p>Q4 (a)</p>	<p><u>Steps</u> 1. Determine the purpose of FC ⑤ Make the FC 2. Establish a time horizon ⑥ Monitor the FC 3. Select a forecasting technique 4. Obtain, clean and analyze appropriate data & Explanation</p>	<p>06 M</p> <p>Each 1 mark</p>																								

Question Number	Solution	Marks Allocated																																	
Q4(b)	<p><u>Delphi Method</u> An iterative process in which managers and staff complete a series of questionnaires, each developed from the previous one, to achieve a consensus forecast. Details of Explanation</p>	(04) M																																	
(c)	<p><u>Plot of Data</u></p> <p>Table</p> <table border="1"> <thead> <tr> <th>Week (t)</th> <th>y</th> <th>t²</th> </tr> </thead> <tbody> <tr><td>1</td><td>700</td><td>700</td></tr> <tr><td>2</td><td>724</td><td>1448</td></tr> <tr><td>3</td><td>720</td><td>2160</td></tr> <tr><td>4</td><td>726</td><td>2904</td></tr> <tr><td>5</td><td>738</td><td>3690</td></tr> <tr><td>6</td><td>742</td><td>4452</td></tr> <tr><td>7</td><td>756</td><td>5292</td></tr> <tr><td>8</td><td>750</td><td>6000</td></tr> <tr><td>9</td><td>770</td><td>6930</td></tr> <tr><td>10</td><td>780</td><td>7800</td></tr> </tbody> </table> <p>$\Sigma y = 7406$ $\Sigma t^2 = 41376$</p> <p>A plot suggests that a linear trend line would be appropriate</p> <p>Now $n = 10$, $\Sigma t = 55$, $\Sigma t^2 = 385$</p> $b = \frac{n \Sigma ty - \Sigma t \cdot \Sigma y}{n \Sigma t^2 - (\Sigma t)^2} = \frac{10 \times 41376 - (55 \times 7406)}{10 \times 385 - (55)^2} = 7.794$ $a = \frac{\Sigma y - b \Sigma t}{n} = \frac{7406 - 7.794 \times 55}{10} = 697.73$ <p>The trend line is $F_t = 697.73 + 7.794t$</p> <p>$F_{11} = 783.464$ $F_{12} = 791.258$</p> <p>Note: The assumption for x or t may be different, but the final answers remain same and hence marks to be awarded for steps</p>	Week (t)	y	t ²	1	700	700	2	724	1448	3	720	2160	4	726	2904	5	738	3690	6	742	4452	7	756	5292	8	750	6000	9	770	6930	10	780	7800	<p>plot 02</p> <p>Table 03</p> <p>02</p> <p>01</p> <p>01</p> <p>01</p> <p>(10) M</p>
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9	770	6930																																	
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Q5(a)	<p>Module - 3</p> <p>Listing Factors - related to Facilities, Product & Service factors, Process factors, Human factors, Policy factors, Supply chain factors, External factors</p>	02																																	
(b)	<p>Bottle neck operation is an operation in a sequence of operations whose capacity is lower than that of the other operations</p> <p>Explanation of any 4 x 01</p> <p>Sketch 02</p> <p>Explanation 02</p> <p>Give an example 01</p>	<p>04</p> <p>(06) M</p> <p>01</p> <p>02</p> <p>02</p> <p>01</p> <p>(06) M</p>																																	

Question Number	Solution	Marks Allocated																								
Q5(c)	<table border="1"> <thead> <tr> <th>Volume</th> <th>Total Revenue</th> <th>Total V.C</th> <th>F.C</th> <th>Total Cost</th> <th>Total Profit</th> </tr> </thead> <tbody> <tr> <td>10,000</td> <td>70 lakhs</td> <td>20 lakhs</td> <td>42 lakhs</td> <td>62 lakhs</td> <td>8 lakhs</td> </tr> <tr> <td>12,000</td> <td>84 lakhs</td> <td>24 lakhs</td> <td>42 lakhs</td> <td>66 lakhs</td> <td>18 lakhs</td> </tr> <tr> <td>15,000</td> <td>105 lakhs</td> <td>30 lakhs</td> <td>42 lakhs</td> <td>72 lakhs</td> <td>33 lakhs</td> </tr> </tbody> </table> <p> $R = Rs 700/\text{unit}$, $V = V.C = 200/\text{unit}$, $F.C = Rs 42 \text{ lakhs}$ Total Revenue = QR Total V.C = QV $Q_{BEP} = \frac{F.C}{R-V} = \frac{42,00,000}{700-200} = 8400 \text{ units}$ Profit for $Q = 22,000 \text{ units}$ $\text{Profit} = Q(R-V) - F.C = 22,000(700-200) - 42,00,000 = 68 \text{ lakhs}$ </p>	Volume	Total Revenue	Total V.C	F.C	Total Cost	Total Profit	10,000	70 lakhs	20 lakhs	42 lakhs	62 lakhs	8 lakhs	12,000	84 lakhs	24 lakhs	42 lakhs	66 lakhs	18 lakhs	15,000	105 lakhs	30 lakhs	42 lakhs	72 lakhs	33 lakhs	04 02 02 <u>08 M</u>
Volume	Total Revenue	Total V.C	F.C	Total Cost	Total Profit																					
10,000	70 lakhs	20 lakhs	42 lakhs	62 lakhs	8 lakhs																					
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Q6(a)	<p><u>Regional</u>: Factors are Location of Raw materials or supplies Location of Markets Labour</p> <p><u>Community</u>: Quality of Life, Services, Attitudes, Taxes Environmental Regulations, Utilities, Development Support</p> <p><u>Site</u>: Land, Transportation, Environmental/Legal</p> <p>Brief Explanation above:</p>	03 04 03 <u>10 Marks</u>																								
(b)	<p>(i) Table $Q = 10,000 \text{ units}$ ← Not given in Question paper Total Cost = $FC + VC$</p> <table border="1"> <thead> <tr> <th></th> <th>FC</th> <th>V.C</th> <th>Total Cost</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>2,50,000</td> <td>1,10,000</td> <td>3,60,000</td> </tr> <tr> <td>B</td> <td>1,00,000</td> <td>2,00,000</td> <td>3,00,000</td> </tr> <tr> <td>C</td> <td>1,50,000</td> <td>2,00,000</td> <td>3,50,000</td> </tr> <tr> <td>D</td> <td>2,00,000</td> <td>3,50,000</td> <td>5,50,000</td> </tr> </tbody> </table> <p>Note: As Q is not given, for any assumed value the final result will not be unique and hence the marks shall be awarded for steps. If students have attempted then appropriate marks are also to be awarded.</p> <p>Table</p>		FC	V.C	Total Cost	A	2,50,000	1,10,000	3,60,000	B	1,00,000	2,00,000	3,00,000	C	1,50,000	2,00,000	3,50,000	D	2,00,000	3,50,000	5,50,000	03 03				
	FC	V.C	Total Cost																							
A	2,50,000	1,10,000	3,60,000																							
B	1,00,000	2,00,000	3,00,000																							
C	1,50,000	2,00,000	3,50,000																							
D	2,00,000	3,50,000	5,50,000																							

Question Number	Solution	Marks Allocated
<p>Q6(b) (Continued)</p>	<p>ii) Ranges of various alternatives will yield the lowest cost. D is never superior Exact ranges (Find o/level) B & C interest C & A interest o/p level Let total cost eqn. Equal & solve for Q $1,00,000 + 300Q = 150,000 + 200Q$ $Q = 5000 \text{ units/year}$ For C & A $150,000 + 200Q = 250,000 + 110Q$ $Q = 11,111 \text{ units/year}$ (iii) From the graphs: For 8000 units/year, location C provides the lowest total cost.</p>	<p>01 01 02 <u>(04)</u></p>
<p>Q7(a)</p>	<p>Module 4 Finchard</p> <pre> graph TD A((Corporate Strategies & Policies)) --> B[Business Plan] C((Economic, competitive, & Political conditions)) --> B D((Aggregate Demand Forecasts)) --> B B --> E[Establishes Operations & Capacity Strategies] B --> F[Aggregate plan] F --> G[Established operations capacity] F --> H[Master schedule] H --> I[Establishes Schedules for specific products] </pre> <p>Aggregate planning - Explanation / with examples overview</p>	<p>03 <u>(03)</u> 01 01 <u>(02)</u></p>
	<p>(b) Formulation of the problem: Solution to the problem by least cost method or VAM. Note: (i) Overtime cost is not given in the question paper. (ii) Paper setter is given the solution assuming Rs 80/ as the OT Conclusion: As cost of OT is not given, for any kind of attempt or the solution obtained for any assumed value of cost of OT, the full marks to be awarded. However marks not to be awarded for just writing question number.</p>	

Question Number: Solution Marks Allocated

Q7(b)

Supply from	Demand for				Supply
	Period 1	Period 2	Period 3	Dummy	
Reg. Inv.	100	1	12	0	100
Reg.	60	61	62	0	500
O.T.	50	51	52	0	50
Sub-cont.	10	11	12	90	120
Reg.	63	64	65	0	500
O.T.	51	52	53	0	50
Sub-cont.	11	12	13	0	120
Reg.	64	65	66	0	500
O.T.	52	53	54	0	50
Sub-cont.	12	13	14	0	120
Demand	550	700	750	90	2090

Transportation Model Soln

06
08

14

Table 1 - 06
Table 2 - 06
(Attachment)

$Z_{min} = \text{Min Cost} = \text{Rs } 124730.00$

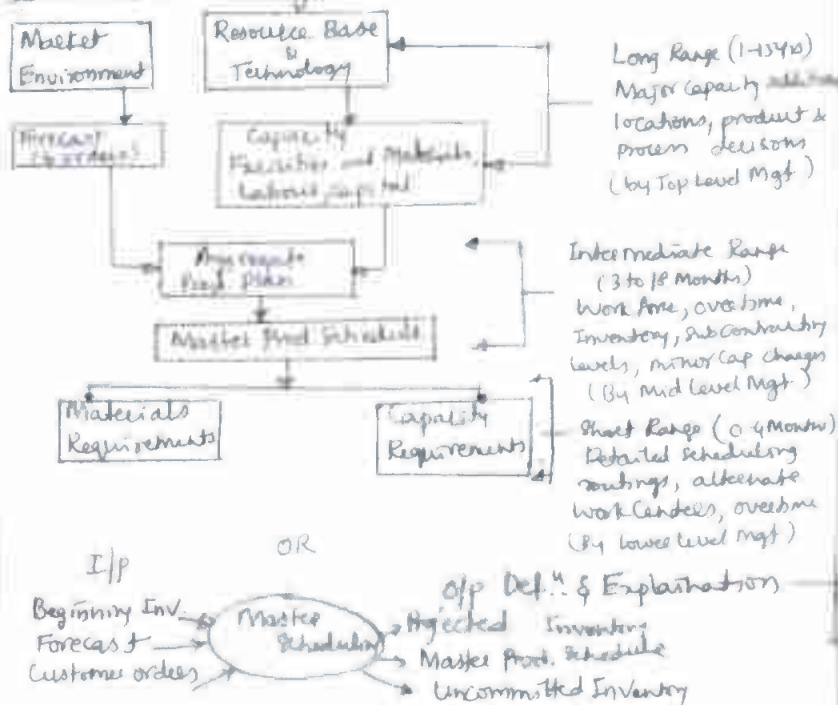
Assignment done with least cost method
Many alternative solutions are possible

Q8(a)

Master scheduling process:

Flowchart

04



04

OPM

Question Number	Solution	Marks Allocated
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Q8(b)

Soln

Beginn Inventory	June (weeks)				July (weeks)			
	1	2	3	4	5	6	7	8
Forecast	30	38	30	30	40	40	40	40
Customer Orders	33	20	10	4	2			
Projected Inventory	31	1	41	11	41	2	31	61
MPS			20		70		70	70
ATP Inv (Customer Order)	11		56		68		76	70

Projected on hand Inv = Inv from previous stock - current week's req. + current week's forecast - orders / requirements of Customers Committed

For week 1, Amount that is available to promise (ATP) = $64 + 0 - (33 + 20) = 11$

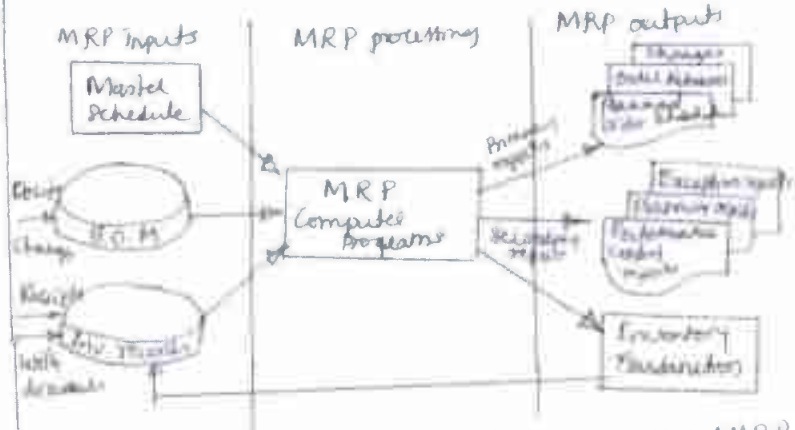
For week 3, ATP = $70 - (10 + 4) = 56$ & so on

05
05

(10)

Q9(a)

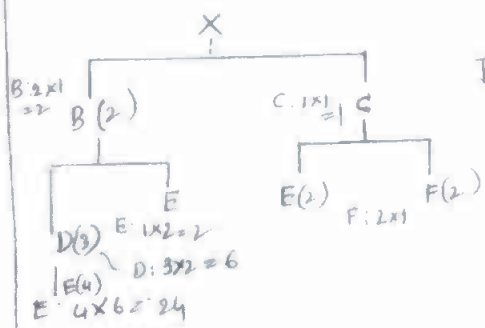
Module 5
Schematic Model
Overview - Explanation



Schematic Model of overview of MRP



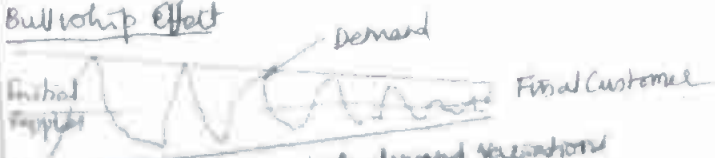
05
05
(10)

(b)



Thus, one X will require
B: 2, C: 1
D: 6, E: 28
F: 2.

(05)

Question Number	Solution	Marks Allocated
Q9 (b) (cont'd)	<p>units 10 x</p> <p>B: $2 \times 10 = \frac{20}{16}$ C: $1 \times 10 = \frac{10}{8}$</p> <p>D: $3 \times 16 = \frac{48}{40}$ E: $1 \times 16 = 16$</p> <p>E: $4 \times 40 = \frac{160}{60}$</p> <p>Thus, given the amounts of on hand inventory, $B=16, C=0, D=40, E=16, F=0$</p> <p>No lower level components required</p>	<p>(05)</p> <p>(10M)</p>
Q10 (a)	<p>Supply chain: A sequence of organizations, their facilities, functions and activities - that are involved in producing and delivering a product or service</p>  <p>Approved by  Dr. M.S. Govinde Gowda Chairman, BOE, Mechanical Board, VTU.</p>	<p>01</p> <p>03</p>
(b)	<p><u>Bullwhip Effect</u></p>  <p>The bullwhip effect demand variations</p> <p>Cash flow - CCW, Goods flow - CW Explanation</p>	<p>06</p> <p>(10)</p> <p>02</p> <p>02</p> <p>(05M)</p>
(c)	<p><u>Elements of Supply Chain</u>: Customer, Design, Capacity, Planning, Processing, Inventory, Purchasing, Supplier, Location, Logistics.</p> <p>Benefiting of these</p>	<p>(05)</p> <p>Marks</p>