

PAPER – 5 : ADVANCED MANAGEMENT ACCOUNTING

QUESTIONS

Developments in the Business Environment: JIT, Total Quality Management

1. (i) X Video Company sells package of blank video tapes to its customer. It purchases video tapes from Y Tape Company @ Rs140 a packet. Y Tape Company pays all freight to X Video Company. No incoming inspection is necessary because Y Tape Company has a superb reputation for delivery of quality merchandise. Annual demand of X Video Company is 13,000 packages. X Video Co. requires 15% annual return on investment. The purchase order lead time is two weeks. The purchase order is passed through Internet and it costs Rs2 per order. The relevant insurance, material handling etc Rs3.10 per package per year. X Video Company has to decide whether or not to shift to JIT purchasing. Y Tape Company agrees to deliver 100 packages of video tapes 130 times per year (5 times every two weeks) instead of existing delivery system of 1,000 packages 13 times a year with additional amount of Rs0.02 per package. X Video Co. incurs no stock out under its current purchasing policy. It is estimated X Video Co. incurs stock out cost on 50 video tape packages under a JIT purchasing policy. In the event of a stock out, X Video Co. has to rush order tape packages which costs Rs4 per package. Comment whether X Video Company should implement JIT purchasing system.

Z Co. also supplies video tapes. It agrees to supply @ Rs13.60 per package under JIT delivery system. If video tape purchased from Z Co., relevant carrying cost would be Rs3 per package against Rs3.10 in case of purchasing from Y Tape Co. However Z Co. doesn't enjoy so sterling a reputation for quality. X Video Co. anticipates following negative aspects of purchasing tapes from Z Co.

- (a) To incur additional inspection cost of 5 paisa per package.

Average stock out of 360 tapes packages per year would occur, largely resulting from late deliveries. Z Co. cannot rush order at short notice. X Video Co. anticipates lost contribution margin per package of Rs8 from stock out.

- (b) Customer would likely return 2% of all packages due to poor quality of the tape and to handle this return an additional cost of Rs25 per package.

Comment whether X Video Co places order to Z Co

Developments in the Business Environment: Total Quality Management

- (ii) Carlon Ltd. makes and sells a single product; the unit specifications are as follows:

Direct Materials X	:	8 sq. metre at Rs 40 per square metre
Machine Time	:	0.6 Running hours
Machine cost per gross hour	:	Rs. 400
Selling price	:	Rs. 1,000

Carlton Ltd. requires to fulfil orders for 5,000 product units per period. There are no stock of product units at the beginning or end of the period under review. The stock level of material X remains unchanged throughout the period.

Carlton Ltd. is planning to implement a Quality Management Programme (QPM). The following additional information regarding costs and revenues are given as of now and after implementation of Quality Management Programme.

Before the implementation of QMP		After the implementation	
1.	5% of incoming material from suppliers scrapped due to poor receipt and storage organisation.	1.	Reduced to 3%.
2.	4% of material X input to the machine process is wasted due to processing problems.	2.	Reduced to 2.5%
3.	Inspection and storage of Material X costs Re. 1 per square metre purchased.	3.	No change in the unit rate
4.	Inspection during the production cycle, calibration checks on inspection equipment vendor rating and other checks cost Rs. 2,50,000 per period	4.	Reduction of 40% of the existing cost.
5.	Production Qty. is increased to allow for the downgrading of 12.5% of the production units at the final inspection stage. Down graded units are sold as seconds at a discount of 30% of the standard selling price.	5.	Reduction to 7.5%
6.	Production Quantity is increased to allow for return from customers (these are replaced free of charge) due to specification failure and account for 5% of units actually delivered to customer.	6.	Reduction to 2.5%
7.	Product liability and other claims by customers is estimated at 3% of sales revenue from standard product sale.	7.	Reduction to 1%.
8.	Machine idle time is 20% of Gross machine hrs used (i.e. running hour = 80% of gross/hrs.).	8.	Reduction to 12.5%.

- | | |
|--|--------------------------------------|
| 9. Sundry costs of Administration, Selling and Distribution total – Rs. 6,00,000 per period. | 9. Reduction by 10% of the existing. |
| 10. Prevention programme costs Rs. 2,00,000 | 10. Increase to Rs. 6,00,000. |

The Total Quality Management Programme will have a reduction in Machine Run Time required per product unit to 0.5 hr.

Required:

- (a) Prepare summaries showing the calculation of (i) Total production units (pre inspection), (ii) Purchase of Materials X (square metres), (iii) Gross Machine Hours.
- (b) 'In each case, the figures are required for the situation both before and after the implementation of the Quality Management Programme so that orders for 5,000 product units can be fulfilled.

Prepare Profit and Loss Account for Carlon Ltd. for the period showing the profit earned both before and after the implementation of the Total Quality Programme.

Developments in the Business Environment: Activity Based Cost Management

2. Tropicana Ltd. has decided to increase the size of its store. It wants information about the profitability of individual product lines: Orange Juice, Apple Juice and Mango Juice. Tropicana Ltd provides the following data for 2008 for each product line:

	Orange Juice	Apple Juice	Mango Juice
Revenues	Rs.3,17,400	Rs.8,40,240	Rs.4,83,960
Cost of goods sold	Rs.2,40,000	Rs.6,00,000	Rs.3,60,000
Cost of bottles returned	Rs.4,800	Rs.0	Rs.0
Number of purchase orders placed	144	336	144
Number of deliveries received	120	876	264
Hours of shelf-stocking time	216	2,160	1,080
Items sold	50,400	4,41,600	1,22,400

Tropicana Ltd also provides the following information for 2008.

Activity (1)	Description of Activity (2)	Total Costs (3)	Cost-Allocation Base (4)
1. Bottle returns	Returning of empty bottles to store	Rs.4,800	Direct tracing to soft-drink line

2.	Ordering	Placing of orders for purchases	Rs.62,400	624 purchase orders
3.	Delivery	Physical delivery and receipts of merchandise	Rs.1,00,800	1,260 deliveries
4.	Shelf-stocking	Stocking of merchandise on store shelves and ongoing restocking	Rs.69,120	3,456 hours of shelf-stocking time
5.	Customer support	Assistance provided to customers, including checkout and bagging	Rs.1,22,880	6,14,400 items sold
Total			<u>Rs.3,60,00</u>	

Required

- Tropicana Ltd currently allocates store support costs (all costs other than cost of goods sold) to product lines on the basis of cost of goods sold of each product line. Calculate the operating income and operating income as a percentage of revenues for each product line.
- If Tropicana Ltd allocates store support costs (all costs other than cost of goods sold) to product lines using an ABC system, calculate the operating income and operating income as a percentage of revenues for each product line.
- Compare both the system.

Developments in the Business Environment: Activity Based Cost Management

- ABC electronics makes audio player model 'AB 100'. It has 80 components. ABC sells 10,000 units each month at Rs.3,000 per unit. The cost of manufacturing is Rs.2,000 per unit or Rs.200 lakhs per month for the production of 10,000 units. Monthly manufacturing costs incurred are as follows:

	(Rs. Lakhs)
Direct material costs	100.00
Direct manufacturing labour costs	20.00
Machining costs	20.00
Testing costs	25.00
Rework costs	15.00
Ordering costs	0.20
Engineering costs	<u>19.80</u>
	<u>200.00</u>

Labour is paid on piece rate basis. Therefore, ABC considers direct manufacturing labour cost as variable cost.

The following additional information is available for 'AB 100'

- (i) Testing and inspection time per unit is 2 hours.
- (ii) 10 per cent of 'AB 100' manufactured are reworked.
- (iii) It currently takes 1 hour to manufacture each unit of 'AB 100'
- (iv) ABC places two orders per month for each component. A different supplier supplies each component.

ABC has identified activity cost pools and cost drivers for each activity. The cost per unit of the cost driver for each activity cost pool is follows:

Manufacturing Activity	Description of activity	Cost driver	Cost per unit of cost driver
1. Machine costs	Machining components	Machine hours of capacity	Rs.200
2. Testing costs	Testing components and finished products. (Each unit of 'AB 100' is tested individually)	Testing hours	Rs.125
3. Rework costs	Correcting and fixing errors and defects	Units of 'AB 100' reworked	Rs.1,500 per unit
4. Ordering costs	Ordering of components	Number of orders	Rs.125 per order
5. Engineering costs	Designing and managing of products and processes	Engineering hours	Rs.1,980 per engineering hour

Over a long-run horizon, each of the overhead costs described above vary with chosen cost drivers. In response to competitive pressure ABC must reduce the price of its product to Rs.600 and to reduce the cost by at least Rs.400 per unit. ABC does not anticipate increase in sales due to price reduction. However, if it does not reduce price it will not be able to maintain the current sales level.

Cost reduction on the existing model is almost impossible. Therefore, ABC has decided to replace 'AB 100' by a new model 'AB 200', which is a modified versions of 'AB 100'. The expected effect of design modifications are as follows:

- (i) The member of components will be reduced to 50.
- (ii) Direct material costs to be lower by Rs.200 per unit.

- (iii) Direct manufacturing labour costs to be lower by Rs.20 per unit.
- (iv) Machining time required to be lower by 20 per unit.
- (v) Testing time required to be lower by 20 per cent.
- (vi) Rework to decline to 5 per cent.
- (vii) Machining capacity and engineering hours capacity to remain the same.

ABC currently out sources the rework on defective units.

Required:

- (i) Compare the manufacturing cost per unit of 'AB 100' and 'AB 200'.
- (ii) Determine the immediate effect of design change and pricing decision on the operating to apply to 'AB 200'.

Ignore income tax, Assume that the cost per unit of each cost driver for 'AB 100' continues to apply to 'AB 200'

CVP Analysis & Decision Making

4. A Co. Ltd. manufactures several different styles of jewellery cases. Management estimates that during the third quarter, the company will be operating at 80 percent of the normal capacity. Because the company desires a higher utilisation of plant capacity, the company will consider a special order.

The company has received special order inquiries from two companies. The first order is from JCP Co. Ltd., which would like to market a jewellery case similar to one of A Co. Ltd.'s jewellery cases. JCP jewellery case would be marketed under JCP's own label. JCP Co. Ltd. has offered A Co. Ltd. Rs.57.50 per jewellery case for 20,000 cases to be shipped by the last date of the quarter. The cost data for A Co. Ltd. jewellery case that would be similar to the specifications of JCP special order are as follows:

	Rs.
Regular selling price per unit	90
Cost per unit	
Raw Materials	25
Direct Labour 0.5 hour @ Rs.60	30
Overhead 9.25 machine hour @ Rs.40	<u>10</u>
Total Costs	<u>65</u>

According to the specifications provided by JCP Co., the special order case requires less expensive raw materials. Consequently the raw materials will only cost Rs.22.50 per case. Management has estimated that the remaining costs, labour time and machine time will be the same as for A Co. Ltd. jewellery case.

The second special order was submitted by K Co. Ltd. for 7,500 jewellery cases at Rs.75 per case. These jewellery cases, like the JCP cases, would be marketed under K label and have to be shipped by the last date of the quarter. However, the K Jewellery case is different from any jewellery case in the A Co. Ltd. line. The estimated per unit cost of this case are as follows:

	Rs.
Raw Materials	32.50
Direct Labour 0.5 hour @ Rs.60	30.00
Overhead 0.5 machine hour @ Rs.40	20
Total Costs	92.50

In addition, A Co. Ltd will incur Rs.15,000 in additional setup costs and will have to purchase a Rs.25,000 special device to manufacture these cases, this device will be discarded once the special order is completed.

The A Co. Ltd.'s manufacturing capabilities are limited to the total machine hours available. The plant capacity under normal operations is 90,000 machine hours per year or 7,500 machine hours per month. The budgeted fixed overhead for the Current year amounts to Rs.21,60,000. All manufacturing overhead costs are applied to production on the basis of machine hours at Rs.40 per hour.

A Co. Ltd. will have the entire quarter to work on the special orders. Management does not expect any repeat sales to be generated from either special order. Company practice precludes from subcontracting any portion of an order, when special orders are not expected to generate repeat sales.

Required: Should A Co. Ltd. accept either special order? Justify your answer and show the calculations.

CVP Analysis & Decision Making

5. X Ltd. has incurred losses during the past five years. Its projection for the year 2010 is also not very encouraging. The management is seriously considering the closure of the only manufacturing unit. However, it is quite open to getting the products on a sub-contracting basis and to continue its administrative and marketing functions. Currently, four products are being manufactured and sold by catering to different markets. The management is also willing to sacrifice any of these products to ensure survival.

The projections for the four products for 2010 are:

	(Rs. in crores)			
	A (Rs.)	B (Rs.)	C (Rs.)	D (Rs.)
Sales	72.0	54.0	84.0	60.0
Costs:				
Material	48.0	30.0	54.0	36.0

Labour	18.0	12.0	30.0	30.0
Allocated Overheads:				
Manufacturing	6.0	4.8	7.2	4.8
Admin. & Selling	2.4	1.2	3.6	2.4
Total Cost	74.4	48.0	94.8	73.2
Profit / Loss)	(2.4)	6.0	(10.8)	(13.2)

The projected volume and sub-contracting charges are:

	A	B	C	D
Volume ('000 nos.)	2,000	1,500	3,000	2,000
Sub-contracting charges / unit (Rs.)	80	70	90	130

Manufacturing, administrative and selling overheads consists of staff salaries, rent, essential maintenance and tax payable to the local authorities.

In case the management decides to discontinue the manufacturing operations a minimum notice period of 3 months will be required to be given to the staff as well as to the landlords of the manufacturing unit and offices. You may assume that both the manufacturing as well as the administrative and selling overheads are fixed in nature, and that in the notice period mentioned above, these expenses would continue to be incurred.

- Assume that labour costs are related to the volume of operations and do not involve any notice period for discontinuance;
- Assume that the costs are incurred and revenues earned evenly in each of the calendar months.

Based on the above, you are required to advise the management on the best option out of the options under its consideration, viz.:

- (i) Issue notices to the staff, the landlords of manufacturing unit and offices on the first day of the year and discontinue all the operations on that very day.
- (ii) Issue notices as above on the first day of the year and continue the operations till the end of the notice period (only profitable products need to be continued).
- (iii) Issues notices to the staff and the landlord, only in the manufacturing unit, resort to sub-contracting and to continue the administrative and marketing functions. (Sub-contracting is needed to be done on profitable products only).

CVP Analysis & Decision Making

6. An FMCG company launched a product "Ging" in April, 2009 with an investment of Rs 12 crores..

The product is packaged in plastic bags of 100 gms and 50 bags are put in a box for distribution and sale. Following are the results of first two quarters :

	Quarter ending 31.03.09	Quarter ending 30.06.09
Sale – No of boxes	15,000	25,000
		Rs Lakhs
Sale values	75.00	125.00
Cost	45.00	65.00
Selling & distribution Exp	25	35

- (i) Management desires 15% post tax return on total sales during last two quarters. (tax rate 50%).
- (ii) In 2010, the company anticipates 10% increase in variable cost of production and plan to come to agreement for distribution so as to reduce variable cost of sales & distribution by 5%.
- (iii) It is estimated that 5% reduction in selling price may increase sales volume by 10%.

You are required to calculate :

- (a) Sales volume during the last quarters of 2009.
- (b) Sales volume of 2010 under condition given in (ii) (rounded to thousand boxes)
- (c) Impact on profitability taking into consideration of both (ii) & (iii).

Pricing Decisions

7. The Directors of Domestic Ltd. are considering a new type of Kitchen Gadget which their Research Department has developed. The expenditure so far on research has been Rs. 40,000 and a Consultant's report has been prepared at a cost of Rs. 7,500. The report provides the following information:

A. Cost of Production per unit	Rs.
Materials	22.50
Labour	37.50
Fixed overheads (based on company's normal allocation rates)	<u>10.00</u>
	<u>70.00</u>

- B. Anticipated additional fixed costs:

Rent for additional space Rs. 75,000 per annum.

Other additional Fixed costs Rs. 37,500 per annum.

A new machine will be built with the available facilities at a cost of Rs. 60,000 (Materials Rs. 50,000 and Labour Rs. 10,000). The materials are readily available in stores, which are regularly used. However, these are to be immediately replenished. The prices of these materials have since risen by 40%. Scrap value of

the machine at the end of 10th year is 10,000. The product scraps generated can be disposed off at the end of year 10 for a price of Rs. 71,920.

The estimated demand for product is as follows:

Year 1-5		Year 6-10	
Demand (units)	Probability	Demand (units)	Probability
20,000	0.10	12,000	0.2
10,000	0.65	8,000	0.5
6,000	0.25	2,000	0.3

It is expected that the commercial life of the Gadget will be no longer than 10 years and the after tax cost of Capital is 10%. The full cost of the machine will be depreciated on straight-line basis, which is allowed for taxation also, over a period of 10 years. Tax rate is 40%. DCF Factors

1-5 Years (cumulative)	3.79
6-10 Years (cumulative)	2.355
10th Year	0.386

Compute Minimum Selling Price of the Gadget.

Pricing Decisions

8. A Company X supplies parts to an Air Craft Company Y. The production capacity facilitates production of one part for a particular period of time. The following is the cost and other information for production of two different parts : part A and Part B.

Per Unit	Part A	Part B
Alloy usage	1.6 kg	1.6 kg
Machine Time : for Machine S	0.6 hour	0.25 hours
Machine Time : for Machine T	0.5 hour	0.55 hour
Target Price	Rs 145	Rs 115

- (i) Total Hours available : Machine S : 4000 hrs & Machine T : 4500
- (ii) Alloy available is 13,000 kgs @ Rs 12.50 per kg.
- (iii) Variable overheads per Machine Hour : Machine S : Rs 80.00 & Machine T : Rs 100
 - (a) You are required to identify the part which will optimize contribution at offered price.
 - (b) If company Y offers target price is reduced by 10% plus Rs. 60 per hour for unutilized machine hour, what should be decision of company X ?

Budget & Budgetary Control

9. A single product company having a normal capacity of 8,00,000 units per annum has prepared the following cost sheet:

	Rs. per unit
Direct materials	5
Direct labour	2
Factory overheads (50% fixed)	4
Selling & Administrative overheads (1/3 variable)	3
Selling price	18

The Company achieved a sales volume of 6,00,000 units during the last year. During the current year, since the market is buoyant the company has launched an expansion programme. The proposed operational details for the current year are as under:

- The capacity will be increased to 12,00,000 units.
- The additional fixed overheads will amount of Rs.8 lacs upto 10,00,000 units and will increase by Rs.4 lacs more beyond 10 lac unit level.
- The expansion scheme involving a capital cost of Rs.20 lacs will be financed through borrowings at an interest rate of 15% per annum.
- Depreciation on new investment is 20% on straight line basis.

The company has two proposals for operating the expanded plant during current year as under:

- (i) Sales can be increased to 10 lac units by spending Rs.2, 00,000 on special advertisement; or
- (ii) Sales can be increased to 12 lac units subject to the following:
 - by an overall price reduction of Rs.2/- per unit on all units sold.
 - by increasing the variable selling and administrative expenses by Rs.1,00,000.
 - by a reduction in direct material cost by 5% due to bulk buying discount.

Required:

- (i) Construct a flexible budget at 6 lacs, 10 lacs and 12 lacs units of production.
- (ii) Advise which level of output should be chosen by the company.

Budget & Budgetary Control

10. The sales manager of XYZ Ltd based his sales budget for 2009 on sales of 10,000 tons of castings at Rs 2,500 per ton and submits it to you, in your capacity as CFO of the company. The production manager, however, tells you that his normal capacity is for 8,000 tons only.

Data for the 2009-operating budget for 8,000 tons have been prepared as follows:

	Rs	Rs
Sales 8,000 tons @Rs 2,500 per ton		2,00,00,000
Expenses		
Raw materials(all variable)	30,00,000	
Direct wages(all variable) 15,00,000 hours@ Rs 8 per hour	1,20,00,000	
Production overheads(50% fixed)	14,00,000	
Administrative overheads(all fixed)	6,00,000	
Selling and distribution(80% fixed)	10,00,000	1,80,00,000
Sales less Expenses		20,00,000

The production manager suggests three ways in which production could be increased to 10,000 tons:

1. subcontracting the production of 2,000 tons to a competitor whose price would be Rs 2,050 per ton;
2. introduction of an additional shift, providing 4,00,000 extra direct labour hours at an estimated cost of Rs 10 per hour, without increase in fixed production overhead costs;
3. the provision of additional plant to increase normal working capacity , which would involve an increase of Rs 2,70,000 in fixed production overheads for the year but no alteration to the variable expense rate per ton.

In each instance there would arise additional non production fixed overhead costs in respect of :

Administration	Rs 1,00,000
Selling and distribution	Rs 2,00,000

Required

- (a) Prepare a statement of sales, costs and profit to be expected from each of the three ways of increasing production.
- (b) Prepare a revised operating budget, in final form for presentation to management, based on your choice of action.

Budget & Budgetary Control

11. The following information is available for Crestmont Stores.

Budgeted sales for January, 2009	Rs.2,00,000
Budgeted sales for February, 2009	Rs.2,40,000

Cost data:

Purchase price of product	60%	of selling price
Commission to sales people	10%	of sales
Depreciation	Rs.2,000	per month
Other operating expenses	Rs.42,000	per month, including Rs.2,000 depreciation

Crestmont Stores, Balance Sheet at December 31, 2008

Assets		Equities	
Cash	Rs.70,000	Accounts payable (for	
Accounts receivable	1,10,000	merchandise)	Rs.80,000
Inventory	1,50,000	Common stock	3,00,000
Building and equipment, net	<u>2,00,000</u>	Retained earnings	<u>1,00,000</u>
Total	<u>Rs.4,80,000</u>	Total	<u>Rs.4,80,000</u>

- (a) Crestmont maintains inventory at 150% of the coming month's sales requirements.
- (b) Sales are collected 40% in the month of sale, 60% in the following month.
- (c) Purchases are paid 30% in the month of purchase, 70% in the following month.
- (d) All other expenses requiring cash are paid in the month incurred.
- (e) The board of directors plans to declare a Rs.3,000 dividend of January 10, payable on January 25.

Required:

- (a) Prepare a budgeted income statement for January.
- (b) Prepare a purchases budget for January.
- (c) Prepare a cash receipts budget for January.
- (d) Prepare a cash disbursements budget for January.
- (e) Prepare a cash budget for January.
- (f) Prepare a pro forma balance sheet as of January 31.

Standard Costing

12. Super Computers manufactures and sells three related PC models:

- (1) PC = Sold mostly to college students.
- (2) Portable PC = Smaller version of PC positioned as home computer
- (3) Super PC = Sold mostly to business executives.

Budgeted and actual data for 2009 is as follows:

Budget for 2009

	Selling Price per Unit	Variable Cost per Unit	Contribution margin per Unit	Sales Volume in Units
	Rs.	Rs.	Rs.	Rs.
PC	24,000	14,000	10,000	7,000
Portable PC	16,000	10,000	6,000	1,000
Super PC	1,00,000	60,000	40,000	2,000
				10,000

Actual for 2009

	Selling Price per Unit	Variable Cost per Unit	Contribution margin per Unit	Sales Volume in Units
	Rs.	Rs.	Rs.	Rs.
PC	22,000	10,000	12,000	8,250
Portable PC	13,000	8,000	5,000	1,650
Super PC	70,000	50,000	20,000	1,100
				11,000

Super computers derived its total unit sales budget for 2009 from the internal management estimate of a 20% market share and an industry sales forecast by computer manufactures association of 50,000 units. At the end of the year the association reported actual industry sales of 68,750 units.

Required:

- (i) Compute the individual product and total sales volume variance.
- (ii) Compute total sales quantity variance.
- (iii) Compute the market size and market share variance.
- (iv) Compute individual product and total sales mix variances.
- (v) Comment on your results.

Standard Costing

13. Reconciliation of budgeted and actual profits

The Bootland Co. Ltd. manufactures a variety of products of basically similar composition. Production is carried out by subjecting the various raw materials to a number of standardized operations, each major series of operations being carried out in a different department. All products are subjected to the same initial processing which is carried out in departments A, B and C; the order and extent of further processing then depending upon the type of end product to be produced.

It has been decided that a standard costing system could be usefully employed within Bootland and a pilot scheme is to be operated for six months based initially only on department B, the second department in the initial common series of operations. If the pilot scheme produces useful results then a management accountant will be employed and the system would be incorporated as appropriate throughout the whole firm.

The standard cost per unit of output of department B is:

	Rs.	Rs.
Direct labour (14 hours at Rs.2 per hour)		28
Direct materials:		
(i) output of department A (3 kg at Rs.9 per kg)	27	
(ii) acquired by and directly input to department B material X (4 kg at Rs.5 per kg)	<u>20</u>	47
Variable overhead (at Rs.1 per direct labour hour worked)		14
Fixed production overheads		
(i) directly incurred by department B (note 1) Manufacturing overhead (per unit)	3	
(ii) allocated department B general factory overhead (per unit)	<u>8</u>	<u>11</u>
Standard cost per unit		<u>Rs.100</u>

In the first month of operation of the pilot study (month 7 of the financial year), department B had no work in progress at the beginning and the end of the month. The actual costs allocated to department B in the first month of operation were:

	Rs.	Rs.
Direct labour (6,500 hours)		14,000
Direct materials:		
(i) output of department A (1400 kg) (note 2)	21,000	
(ii) material X (1900 kg)	11,500	32,500
Variable overhead		8,000
Fixed overheads:		
(i) directly incurred manufacturing overhead	1,600	
(ii) allocated to department (note 3)	<u>2,900</u>	<u>4,500</u>
		<u>Rs.59,000</u>

The production manager feels that the actual costs of Rs.59,000 for production of 500 units indicates considerable inefficiency on the part of department B. He says, 'I was right to request that the pilot standard costing system be carried out in department B as I have suspected that they are inefficient and careless – this overspending of Rs.9,000 proves I am right.'

Required:

- (a) Prepare a brief statement which clearly indicates the reasons for the performance of department B and the extent to which that performance is attributable to department B. The statement should utilize variance analysis to the extent it is applicable and relevant.
- (b) Comment on the way the pilot standard costing system is currently being operated.

Note 1 Based on normal monthly production of 400 units.

Note 2 Actual cost of output of department A.

Note 3 Based on the actual expenditure on joint manufacturing overheads and allocated to departments in accordance with labour hours worked.

Costing of Service Sector

14. An airline company operates a single aircraft from station A to Station B. It is licensed to operate 3 flights in a week each way thereby making a total of 312 flights in a year. While the seating capacity of the aircraft is 160 passengers, the average number of passengers actually carried per flight is 120 only. The fare charged per passenger for one way flight is Rs.8000. The cost data are as under:

- Variable fuel costs per flight Rs.1,60,000
- Food served on board the flight (not charged to passengers) Rs.200 per passenger
- Commission paid to travel agents (if on an average 80% of the seats are booked through travel agents) 5% of fare
- Fixed annual lease costs allocated to each flight Rs. 400000 per flight
- Fixed ground and landing charges Rs.1 00000 per flight
- Fixed salaries of flight crew allocated to each flight Rs. 60000 per flight

Required:

- (i) Compute the operating income on each one-way flight between stations A and B.
- (ii) The company has been advised that in case the fare is reduced to Rs.7500 per flight per passenger, the average number of passengers per flight will increase to 132. Should this proposal be implemented? Show your calculations.

Costing of Service Sector

15. Hotel Galaxy analysed previous 5 years data for preparation of budget for year 2009

Average occupancy during off-season i.e Nov to April remains below 60%.

Revenue Contribution from 3 profit centres : Accommodation : 50%, Restaurant : 30%, Bar 20%

The three Profit Centres have the following pattern of contribution %:

	Accommodation	Restaurant	Bar
Revenue	100	100	100
Wages	25	20	15
Direct Cost	15	50	45
Contribution	60	30	40

Estimated Revenue for the current year is Rs 60 lakhs, Fixed cost Rs 10.00 lakhs.

To improve Return on Capital Employed of 110 lakhs, following two suggestions have been made :

- A. An offer of two-nights reduced price @ Rs 1600 during off-season (Nov – April). It is expected that occupants under this offer will spend 30% of accommodation charge in restaurant and 15% in the bar.
- B. To increase restaurant & bar prices by 15% and also increase the room rent (assuming that there will be no change in occupancy).

You are required to calculate the following (before tax) :

- (i) Expected Return on Capital Employed under the budget
- (ii) How many two-night offers are to be sold as in proposal A to increase ROCE by 4%.
- (iii) How much increase in room rent is required under proposal B to get same ROCE as in (ii).

Transfer Pricing

16. Company has two manufacturing divisions A and B. Division A has a capacity of 96,000 hours per annum. It manufactures two products X and Y as per the following details:

	X	Y
Direct materials	Rs.300	60
Variable costs @ 80 per hour	Rs.320	80
Selling price	Rs.800	160
Maximum sales units	15,000	unlimited

Division B produces product Z whose particulars are as under:

	Rs.
Imported component	800
Direct materials	120
Variable costs @ Rs.40 per hour	400
Selling price	1450

The fixed overheads amount to Rs.30 lacs and Rs.5 lacs per annum respectively for Division A and B. With a view to minimizing the dependence on imported component, the company explored the possibility of the Division B using the product X as substitute for imported component. This is possible provided Division B spends two machine hour entailing an additional expenditure of Rs.80 per component on modification of the product X to fit into the product Z. The production of Z in Division B is 5000 units per annum. Division B seeks a discount of Rs.80 so that the transfer price of product X can be set at Rs.720 each.

You are required to present division wise profitability and the profitability of the company as a whole on the basis of the following conditions:

- (i) Division B imports its requirement of components.
- (ii) Division B stops importing the component and obtains 5000 units of product X for being used as substitute from Division A at the latter's usual market price of Rs.800 per unit.
- (iii) Same condition as (ii) above but Division B gets a relief of Rs.80 per unit of product X in that the transfer price has been set by Division A at Rs.720 per unit.

Transfer Pricing

17. A Company has two divisions whose activities and related cost are given below :

Division A :

Products	X	Y	Z
Capacity of production (units)	8000	5000	3000
Machine Hour/ unit	3	4	2
Selling Price/ Unit (Rs)	480	460	400
Variable Cost/ Unit (Rs)	330	240	280

Division B : has a capacity to produce 3000 units of FINY taking input Product Y from division A. It has also option to buy the similar product as Y from the market. The cost and selling price per unit are as given below :

	Material cost	Direct Wages	Variable Production Overheads	Variable Selling Overheads	Selling Price
If process with product Y from Division A	At Transfer price	200	Rs 150	Rs 100	Rs 1200
If processed with similar product from the market	Rs 400	180	Rs 150	Rs 110	Rs 1100

There is capacity constraints of Division A in terms of Machine hour of 38000 hours. Fixed Cost of Division A is Rs 10.0 lakhs and that of Division B is Rs 5.00 lakhs each.

You are required to

- calculate profitability of the company if the transfer price of Y from Div A to Div B is fixed at Rs 400 on the basis of market price of similar product.
- Give comments of fixing the transfer price based on market price
- Calculate the impact on profitability if capacity of Division B is enhanced to 5000 units by making capital expenditure of Rs 6.00 lakhs at 15% cost of capital and transfer price is true market price i.e Rs 460.

Uniform Costing

- Define uniform costing. What are the essential requisites for the installation of a uniform costing system?
 - What are the pre-requisites of an inter firm comparison system?

The Transportation Problem

- A company has four factories situated in four different locations in the country and four sales agencies located in four other locations in the country. The cost of production (Rs. per unit), the sale price (Rs. per unit), shipping cost (Rs. per unit) in the cells of matrix, monthly capacities and monthly requirements are given below:

Factory	Sales Agency				Monthly Capacity (Units)	Cost of Production
	1	2	3	4		
A	7	5	6	4	10	10
B	3	5	4	2	15	15
C	4	6	4	5	20	16
D	8	7	6	5	15	15

Monthly Requirements (Units)	8	12	18	22
Sales Price	20	22	25	18

Find the monthly production and distribution schedule which will maximize profit.

The Assignment Problem

- 20 Welldone company has taken the third floor of a multi-storeyed building for rent with a view to locate one of their zonal offices. There are five main rooms in this floor to be assigned to the managers. Each room has its own advantages and disadvantages. Some have windows, some are closer to the washrooms or to the canteen or secretarial pool. The rooms are of all different sizes and shapes. Each of the five managers was asked to rank their room preferences amongst the rooms 301, 302, 303, 304 and 305. Their preferences were recorded in a table as indicated below:

Manager				
M ₁	M ₂	M ₃	M ₄	M ₅
302	302	303	302	301
303	304	301	305	302
304	305	304	304	304
	301	305	303	
		302		

Most of the managers did not list all the five rooms since they were not satisfied with some of these rooms and they have left off these from the list. Assuming that their preferences can be quantified by numbers, find out as to which manager should be assigned to which rooms so that their total preference ranking is a minimum.

Program Evaluation and Review Technique

21. The Production Manager at Gemini Machines Limited has been asked to present information about the times and costs for the development of a new machine that the company may choose to manufacture. The Managing Director requires accurate time and cost estimates since the project will involve a fixed-fee contract offering no provisions for later re-negotiation, even in the event of modifications.

Activity		Preceding activities	Duration (weeks)	Cost (Rs. '000)
A	Obtain engineering quotes	I	1	4
B	Sub-contract specifications	A, J	4	8
C	Purchase of raw materials	—	3	24
D	Construct prototype	I	5	15
E	Final drawings	I	2	6

F	Fabrication	H	6	30
G	Special machine study	—	4	12
H	Sub-contract work	B, E	8	40
I	Preliminary design	G	2	8
J	Vendor evaluation	C, D	3	3

The Production Manager has been asked to identify the critical activities, to determine the shortest project duration and to provide a week-by-week cost schedule.

Required:

- Draw a network to represent the inter-relationships between the activities indicated, and insert earliest and latest event times throughout.
- Determine the critical path and the shortest possible duration of the project.
- Assuming each activity commences at the earliest start date, and that for each activity the cost is incurred evenly over its duration, construct a week-by-week schedule of cash flows.

The project is to be financed by Rs. 50,000 available initially, a further Rs. 50,000 available at the start of week 9 and the final Rs. 50,000 available from week 20.

Identify any particular problems and suggest solutions.

CPM

- The time and cost estimates and precedence relationship of the different activities constituting a project are given below

Activity	Predecessor Activity	Time (in weeks)		Cost(in Rupees)	
		Normal	Crash	Normal	Crash
A	None	3	2	8000	9000
B	None	8	6	600	1000
C	B	6	4	10000	12000
D	B	5	2	4000	10000
E	A	13	10	3000	9000
F	A	4	4	5000	5000
G	F	2	1	1200	1400
H	C,E,H	6	4	3500	4500
I	F	2	1	700	8000

- Draw a project net work diagram and find the critical path.
- If a dead line of 17 weeks is imposed for completion of the project, what activities will be crashed?

Simulation

23. The occurrence of the rain in a day is dependent upon whether it rained on the previous day. If it rained on the previous day the rain distribution is given by

Event	Probability
No rain	.50
1 cm rain	.25
2 cm rain	.15
3 cm rain	.05
4 cm rain	.03
5 cm rain	.02

If it did not rain on the previous day the rain distribution is given by

Event	Probability
No rain	.75
1 cm rain	.15
2 cm rain	.06
3 cm rain	.04

Simulate the city's weather for 10 days and determine by simulation the total days without rain as well as the total rain fall during the period. Use the following random numbers

76 78 84 75 02 86 02 78 07 63

For simulation, assume that for the first day of the simulation it had not rained before.

Learning Curve Theory

24. An electronics firm which has developed a new type of fire-alarm system has been asked to quote for a prospective contract. The customer requires separate price quotations for each of the following possible orders:

Order	Number of fire-alarm systems
First	100
Second	60
Third	40

The firm estimates the following cost per unit for the first order:

Direct materials	Rs. 500
Direct labour	
Deptt. A (Highly automatic) 20 hours at Rs. 10 per hour	

Deptt. B (Skilled labour) 40 hours at Rs. 15 per hour

Variable overheads 20% of direct labour

Fixed overheads absorbed:

Deptt. A Rs. 8 per hour

Deptt. B Rs. 5 per hour

Determine a price per unit for each of the three orders, assuming the firm uses a mark up of 25% on total costs and allows for an 80% learning curve. Extract from 80% Learning curve table:

X	1.0	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
Y%	100.0	91.7	89.5	87.6	86.1	84.4	83.0	81.5	80.0

X represents the cumulative total volume produced to date expressed as a multiple of the initial order.

Y is the learning curve factor, for a given X value, expressed as a percentage of the cost of the initial order.

Linear Programming;

25. A leading Chartered Accountant is attempting to determine a "best" investment portfolio and is considering six alternative investment proposals. The following table indicates point estimates for the price per share, the annual dividend per share, the annual dividend per share and a measure of risk associated with each investment.

Portfolio Data

Shares under consideration						
	A	B	C	D	E	F
Current Price Per share(Rs.)	80	100	160	120	150	200
Projected Annual Growth Rate	0.08	0.07	0.10	0.12	0.09	0.15
Projected Annual Dividend per share	4.00	4.50	7.50	5.50	5.75	0.00
Projected Risk in Return	0.05	0.03	0.10	0.20	0.06	0.08

The total amount available for investment is Rs.25 lakhs and the following conditions are required to satisfied.

- The maximum rupee amount to be invested in alternative F is Rs.250, 000.
- No more than Rs.500,000 should be invested in alternative A and B combined.

(iii) Total weighted risk should not be greater than 0.10 where

$$\text{Total weighted Risk} = \frac{(\text{Amount Invested in Alternative } j)(\text{Risk of alternative } j)}{(\text{Total Amount Invested in all the Alternatives})}$$

- (i) For the sake of diversity, atleast 100 shares of each stock should be purchased.
- (ii) Atleast 10 per cent of the total investment should be alternatives A and B.
- (iii) Dividends for the year should be atleast Rs.10,000.

Rupee return per share of stock is defined as price per share one year hence less current price per share plus dividend per share. If the objective is to maximize total rupee return, formulate the linear programming model for determining the optimal number of shares to be purchased in each of the shares under consideration. You may assume that the time horizon for investment is one year > the formulated LP problem is not required to be solved.

SUGGESTED ANSWERS

Developments in the Business Environment: JIT

1. (i) (a) Comparative Statement of cost for purchasing from Y Co Ltd under current policy & JIT

Particulars	Current Policy Rs	JIT Rs
Purchasing cost	18,20,000 (13,000 × 140)	18,20,260 (13,000 × 140.02)
Ordering cost	26.00(2×13 orders)	260.00(2×130 orders)
Opportunity carrying cost	10,500.00 (1/2×1000×140×15%)	1,050.15 (1/2×100×140.02×15%)
Other carrying cost (Insurance, material handling etc)	1,550.00(1/2×1000×3.10)	155.00
Stock out cost		200(4 × 50)
Total relevant cost	18,32,076	18,21,925.15

Comments: As may be seen from above, the relevant cost under the JIT purchasing policy is lower than the cost incurred under the existing system. Hence, a JIT purchasing policy should be adopted by the company.

(b) Statement of cost for purchasing from Z Co Ltd.

Particulars	Rs.
Purchasing cost	1,76,800 (13,000x13.60)
Ordering Cost	260.00 (2x130 orders)
Opportunity Carrying Cost	102.00
Cost	(1/2×100×13.60× 15%)
Other Carrying Cost	150.00 (1/2×100×3.00)
Stock out Cost	2,880 (8x360)
Inspection Cost	650.00 (13,000 x .05)
Customer Return Cost	6,500.00 (13,000 x 2% x 25)
Total Relevant Cost	1,87,342

Comments : The comparative costs are as follows,

Under current policy	Rs 18,32,076.00
Under purchase under JIT	Rs 18,21,925.10
Under purchase from Z Co Ltd	Rs 1,87,342.00

Packages should be bought from Z Co as it is the cheapest.

Developments in the Business Environment: Total Quality Management

(ii) (a)

	Existing	After TQM Programme
i. Total production units (Preinspection)		
Total sales requirements	5,000	5,000
Specification losses	250	125
	(5% of 250)	(2.5% of 125)
	5,250	5,125
Downgrading at inspection	750	416
	$\frac{12.5}{87.5} \times 5,250$	$\frac{7.5}{92.5} \times 5,125$
Total units before inspection	6,000	5,541

ii	Purchase of material 'X'(Sq Mtr)		
	Material required to meet pre inspection production requirement	48,000	44,328
		$(6,000 \times 8 \text{ SqMtr})$	$(5,541 \times 8 \text{ SqMtr})$
	Processing loss		1,137
		2,000	
		$\left(\frac{4}{96} \times 48,000\right)$	$\left(\frac{2.5}{97.5} \times 44,328\right)$
	Input to the process	50,000	45,465
	Scrapped material	2,632	1,406
		$\left(\frac{5}{95} \times 50,000\right)$	$\left(\frac{3}{97} \times 45,465\right)$
	Total purchases	52,632	46,871
iii	Gross Machine Hours		
	Initial requirements	3,600	2,771
		$(6,000 \times 0.6)$	$(5,541 \times 0.5)$
	Idle time	900	396
		$\left(\frac{20}{80} \times 3,600\right)$	$\left(\frac{12.5}{87.5} \times 2,771\right)$
	Gross time	4,500	3,167

(b)

Profit and loss statement

		Rs		Rs
Sales revenue	5,000 Units× Rs 1,000	50,00,000		50,00,000
Sales downgraded	750 Units×Rs 700	5,25,000	416 Units × Rs 700	2,91,200
		55,25,000		52,91,200
Costs:				
Material	52,632 Sq Mtr ×Rs 40	21,05,280	46,871Sq Mtr × Rs 40	18,74,840

Inspection and storage costs	52,632 Sq Mtr × Re 1	52,632	46,871Sq Mtr × Re 1	46,871
Machine cost	4,500 Hrs × Rs 400	18,00,000	3,167 Hrs× Rs 400	12,66,800
Inspection and other cost		2,50,000	2,50,000 × 60%	1,50,000
Product liability	(3% × 50,00,000)	1,50,000	1% × 50,00,000	50,000
Sundry cost of selling, distribution and administration.		6,00,000	6,00,000 × 90%	5,40,000
Preventive programme cost		2,00,000		6,00,000
		51,57,912		45,28,511
Net profit		3,67,088		7,62,689

Developments in the Business Environment: Activity Based Cost Management

2. (a) The following table shows the operating income and operating income as a percentage of revenues for each product line. All store support costs (all costs other than cost of goods sold) are allocated to product lines using cost of goods sold of each product line as the cost-allocation base. Total store support costs equal Rs.3,60,000 (cost of bottles returned, Rs.4,800 + cost of purchase orders, Rs.62,400 + cost of deliveries, Rs.1,00,800 + cost of self-stocking, Rs.69,120 + cost of customer support, Rs.1,22,880). The allocation rate for store support costs = $\text{Rs.3,60,000} \div \text{Rs.12,00,000} = 30\%$ of cost of goods sold. To allocate support costs to each product line, Tropicana multiplies the cost of goods sold of each product line by 0.30.

	Orange Juice	Apple Juice	Mango Juice	Total
Revenues	<u>Rs.3,17,400</u>	<u>Rs.8,40,240</u>	<u>Rs.4,83,960</u>	<u>Rs.16,41,600</u>
Cost of goods sold	2,40,000	6,00,000	3,60,000	12,00,000
Store support cost (Rs.2,40,000; Rs.6,00,000; Rs.3,60,000) × 0.30	<u>72,000</u>	<u>180,000</u>	<u>1,08,000</u>	<u>3,60,000</u>
Total cost s	<u>3,12,000</u>	<u>7,80,000</u>	<u>4,68,000</u>	<u>15,60,000</u>
Operating income	Rs.5,400	Rs.60,240	Rs.15,960	Rs.81,600
Operating income ÷ Revenues	1.70%	7.17%	3.30%	4.97%

- (b) Under An ABC system, Tropicana Ltd identifies bottle return costs as a direct cost because these costs can be traced to the soft drink product line. Tropicana Ltd then calculates cost allocation rates for each activity area. The activity rates are as follows:

Activity (1)	Cost Hierarchy (2)	Total Costs (3)	Quantity of Cost Allocation Base (4)	Overhead Allocation Rate (5) = (3) ÷ (4)
Ordering	Batch-level	Rs.62,480	624 purchase orders	Rs.100 per purchase order
Delivery	Batch-level	Rs.1,00,800	1,260 deliveries	Rs.80 per delivery
Shelf-stocking	Output unit-level	Rs.69,120	3,456 shelf-stocking-hours	Rs.20 per stocking-hour
Customer support	Output unit-level	Rs.1,22,880	6,14,400 items sold	Rs.0.20 per item sold

Store support costs for each product line by activity are obtained by multiplying the total quantity of the cost-allocation base for each product line by the activity cost rate. Operating income and operating income as a percentage of revenues for each product line are as follows:

	Orange Juice	Apple Juice	Mango Juice	Total
Revenues	Rs.3,17,400	Rs.8,40,240	Rs.4,83,960	Rs.16,41,600
Cost of goods sold	2,40,000	6,00,000	3,60,000	12,00,000
Bottle-return costs	4,800	0	0	4,800
Ordering costs (144; 336; 144) purchases orders × Rs.100	14,400	33,600	14,400	62,400
Delivery costs (120; 876; 264) deliveries × Rs.80	9,600	70,080	21,120	1,00,800
Shelf-stocking costs (216; 2,160; 1,080) stocking hours × Rs.20	4,320	43,200	21,600	69,120
Customer support costs (50,400 4,41,600; 1,22,400) items sold × Rs.0.20	<u>10,080</u>	<u>88,320</u>	<u>24,480</u>	<u>1,22,880</u>
Total costs	<u>2,83,200</u>	<u>8,35,200</u>	<u>4,41,600</u>	<u>15,60,000</u>
Operating income	<u>Rs.34,200</u>	<u>Rs.5,040</u>	<u>Rs.42,360</u>	<u>Rs.81,600</u>
Operating income ÷ Revenues	10.78%	0.60%	8.75%	4.97%

- (c) Managers believe the ABC system is more credible than the simple costing system. The ABC system distinguishes the different types of activities at Tropicana Ltd more precisely. It also tracks more accurately how individual product lines use resources.

Rankings of relative profitability – of the three product lines under the simple costing system and under the ABC system are:

Simple Costing System		ABC System	
1. Fresh Produce	7.17%	1. Soft drinks	10.78%
2. Packaged food	3.30%	2. Packaged food	8.75%
3. Soft drinks	1.70%	3. Fresh produce	0.60%

The percentage of revenues, cost of goods sold, and activity costs for each product line are as follows:

	Orange Juice	Apple Juice	Mango Juice
Revenues	19.34%	51.18%	29.49%
Cost of goods sold	20.00	50.00	30.00
Bottle returns	100.00	0	0
Activity areas:			
Ordering	23.08	53.84	23.08
Delivery	9.53	69.52	20.95
Shelf-stocking	6.25	62.50	31.25
Customer support	8.20	71.88	19.92

Developments in the Business Environment: Activity Based Cost Management

3. (i) Comparison of manufacturing cost per unit.

	Audio Player Model	
	'AB 100'	'AB 200'
	Rs.	Rs.
Direct material cost	1,000.00	800.00
Direct manufacturing labour cost	200.00	180.00
Machining costs	200.00	160.00
Testing costs	250.00	200.00
Rework costs	150.00	75.00
Ordering costs	2.00	1.25
Engineering costs	<u>198.00</u>	<u>198.00</u>
Total manufacturing cost per unit	<u>2,000.00</u>	<u>1,614.25</u>

Working notes for audio player model 'AB 200'

- (i) Machining hours and cost: Machining hours = (1 hour – 0.20 hours) or 0.80 hours)

Machining cost is 0.80 hours × Rs.200 or Rs.160

- (ii) Testing hours and cost: Testing hours = 2 hours × (1 hour – 0.20) or 1.60 hours.

Testing cost is 1.60 hours × Rs.125 or Rs.200

- (iii) Rework cost per unit:

Rework units = 5% × 10,000 units or 500 units. Rework cost = 500 units × Rs.1,500 or Rs.7,50,000. Rework cost per unit Rs.7,50,000 / 10,000 units or Rs.75 per unit.

- (iv) Ordering cost:

No. of orders per month 50 components × 2 orders = 100

Ordering cost per month 100 orders × Rs.125 per order = Rs.12,500

Ordering cost per unit = Rs.12,500 / 10,000 units = Rs.1.25 per unit.

- (v) It is assumed that total available engineering hours will be used for manufacturing 'AB 200' model of audio player.

- (ii) Effect of design change and pricing decision on operating income of ABC.

(Rs. Lakhs)

Revenue loss on 10,000 units (40)

(Rs.10,000 units × Rs.400)

Saving in cost:

Direct material costs 20.00

(Rs.200 × 10,000 units)

Direct manufacturing labour costs 2.00

(Rs.20 × 10,000 units)

Rework costs 7.50 29.50

(5% × 10,000 units × Rs.1,500)

Net effect on operating income (10.50)

Conclusion:

Operating income per month will be reduced by Rs. 10.50 Lakhs.

Effects of reduction in components, machining time, and testing time will not have any immediate effect, because it is difficult to adjust the available facilities in ordering department, machining department and testing department.

CVP Analysis & Decision Making

4. Statement showing profits on the acceptance of special orders in 4,500 unutilised hours
(Refer to working note 1)

Alternatives	I	II
	JCP Co. Ltd.	K. Co. Ltd.
Units made	18,000	7,500
	Rs.	Rs.
Selling price per unit	57.50	75.00
Less: Cost per unit	56.50	70.50
(Refer to working note 2)		
Profit per unit	1.00	4.50
Total profit	18,000	33,750
	(18,000 units × Re.1)	(7,500 units × Rs.4.50)
Less: Costs of set up and special device	NIL	40,000
Net Profit / (Loss)	18,000	(6,250)

Note: For special orders allocation of fixed overhead costs are not relevant.

Decision:

- (i) If special order of JCP Co. Ltd. can be bifurcated, the company can supply 18,000 units of jewellery cases and can earn additional profit of Rs.18,000. The remaining 2,000 units of order cannot be met due to capacity constraint.
- (ii) The special order from K. Co. Ltd. is not acceptable as it results into loss to the extent of Rs.6,250.

Working Notes:

1. Total unutilized hours during the third quarter

Total hours of third quarter	22,500
(7,500 hours × 3 months)	
Hours utilized for 80% operating level	16,000
(22,500 hours × 80%)	
Total unutilized hours during the third quarter	4,500
2. Computation of fixed and variable overhead rate

Fixed overheads per annum (Rs.)	21,60,000
---------------------------------	-----------

Normal capacity hours	90,000
Fixed overheads rate per hour (Rs.)	24
(Rs.21,60,000 / 90,000 hours)	
Manufacturing overhead application rate per hour (Rs.)	40
Therefore, variable overhead rate per hour Rs.	16
(Rs.40 – Rs.24)	

3. Cost per unit of the order form JCP Col Ltd. and K. Co. Ltd.

	JCP Co. Ltd.	K. Co. Ltd.
	Rs.	Rs.
Raw materials cost per unit	22.50	32.50
Direct Labour	30.00	30.00
Variable overheads	4.00	8.00
	(0.25 hours × Rs.16)	(0.5 hours × Rs.16)
Total cost per unit	56.50	70.50

CVP Analysis & Decision Making

5. (i) Option

Statement of Profit (Loss)

(if the firm discontinue all the operations during notice period of 3 months)

	(Rs. Crores)				
Products	A	B	C	D	Total
Sales*	-	-	-	-	-
Costs:					
Material & Labour	-	-	-	-	-
Allocated overheads:					
Manufacturing	1.5	1.2	1.8	1.2	5.7
Admin. & Selling	<u>0.6</u>	<u>0.3</u>	<u>0.9</u>	<u>0.6</u>	<u>2.4</u>
Total allocated overheads during notice period of 3 months	<u>2.1</u>	<u>1.5</u>	<u>2.7</u>	<u>1.8</u>	<u>8.1</u>
Profit / (Loss)	(2.1)	(1.5)	(2.7)	(1.8)	(8.1)

*The option (i) would not yield any revenue.

Conclusion: The option (i) will result in a loss of Rs.8.1 crores due to the committed costs account of 3 months notice period.

(ii) Option

Working note:

Ascertaining profitable products (if their production is continued during 3 months of notice period)

(Rs. Crores)				
Products	A	B	C	D
Sales (X)	18	13.5	21	15
Variable cost:				
Materials	12.0	7.5	13.5	9.0
Labour	4.5	3.0	7.5	7.5
Total variable costs: (Y)	16.5	10.5	21.0	16.5
Contribution: (X – Y)	1.5	3.0	-	(1.5)

A review of contribution figures in the above statement of four products A, B, C and D clearly reveals that products A and B are only profitable.

Statement of Profit (Loss)

(If the firm continues the operations of profitable products A and B during 3 months of notice period)

(Rs. Crores)			
Products	A	B	Total
Contribution (Refer to above working note)	1.5	3.0	4.5
Less: total manufacturing administrative & selling overheads (Refer to part (i) above)			<u>8.1</u>
Profit / (Loss)			<u>(3.6)</u>

Conclusion: Under this option the total loss is (Rs.3.6) crores which is less than the loss of option (i).

(iii) Option

Working Note:

Ascertaining profitable products (when notices are issued to the staff and the landlord – only in the manufacturing unit, resort to subcontracting only on profitable products)

(Rs. Crores)				
Products	A	B	C	D
Sales: (X)	72.0	54.0	84.0	60.0
Variable Cost:				

Materials	48.0	30.0	54.0	36.0
Sub-contracting charges	16.0	10.5	27.0	26.0
	(20 lacs × <u>Rs.80</u>)	(15 lacs × <u>Rs.70</u>)	(30 lacs × <u>Rs.90</u>)	(20 lacs × <u>Rs.130</u>)
Total variable costs : (Y)	<u>64.0</u>	<u>40.5</u>	<u>81.0</u>	<u>62.0</u>
Contribution: (X – Y)	8.0	13.5	3.0	(2.0)

A review of contribution figures in the above statement clearly shows that products A, Band C are only profitable.

Statement of Profit / (Loss)

(If the firm resorts to manufacturing of profitable products by sub-contracting)

				(Rs. Crores)
	Product			Total
	A	B	C	
Contribution: (X)	8.0	13.5	3.0	24.5
(Refer to above working note)				
Total manufacturing overheads of 3 months notice period : (Y)				5.7
(Refer to option (i) above)				
Total administrative & Selling overheads: (Z)				<u>9.6</u>
Profit/(Loss): {X – (Y+Z)}				<u>9.2</u>

Decision:

Out of the three options the option (iii) is the most viable one. Not only it will help the company with a turn around, but from the year 2002, the company can look forward to even higher profitability, since the manufacturing overhead would no longer be incurred thereafter.

CVP Analysis & Decision Making

6. (a) Variable cost of production per box = (65 -45) lakhs / 10,000 = Rs 200

Variable cost of selling & distribution = 10 lakhs / 10,000 = Rs 100

Fixed cost of production per Quarter = Rs 15 lakhs.

Fixed cost of selling & distribution per quarters = Rs 10 lakhs.

Return expected during two quarters = 12 croes x 15 /2 = 90 lakhs

Profit (pre –tax) = 180 lakhs.

Sales price per box =Rs 500

Let sales volume during two quarters in box = x lakhs.

Thus, we have :

Sales value = 500 X lakh rupees

Total variable cost = (200+100) X lakh rupees

Total Fixed Cost in two quarters = 2 (15+10) = 50 lakhs rupees

Thus, we get $500 X - 300 X - 50 = 180$

Or $200 X = 130$

Or $X = 0.65$ lakhs = 65,000 boxes.

(b) In 2010,

Variable cost per box = Rs 220.

Variable cost of selling & distribution per box = Rs 95.

Total Variable cost per box = Rs 315

Let required Sales for 2010 in lakh box = Y

Then we have, $500 Y - 315 Y - 100 = 360$

Or $185 Y = 460$

Or $Y = 2.50$ lakhs approx = 250 thousand boxes.

(c) Price per box = Rs 475

Sales Volume = 2.75 lakhs.

Profit = Rs $(475 - 315) \times 2.75 - 100$ Lakhs

= Rs $(440 - 100)$ lakhs

= Rs 340 lakhs.

ROI (post tax) = $(340 \times 0.5) / 1200 = 14.17 \%$

Return on capital employed is reduced by 0.93% .

Pricing Decision

7.

Particulars	Year	Year	Year	Year
	0	1-5	6-10	10
Outflow	80,000			
(Refer to working note 1)				
Inflow				
Sales volume (units)		10,000	7,000	
(Refer to working note2)				
Selling price (Rs.)		x	x	

Total sales revenue :				
(Rs.) (A)		10,000x		7,000x
Cost				
Materials and labour cost (Rs.)		6,00,000		4,20,000
Incremental fixed overhead		1,12,500		1,12,500
Depreciation of machine		<u>8,000</u>		<u>8,000</u>
Total cost: (Rs.) (B)		<u>7,20,500</u>		<u>5,40,500</u>
Profit before tax :				
(Rs.) (A) – (B)		(10,000 x – 7,20,500)		(7,000 x – 5,40,500)
Less : Tax @ 40%		(4000 x – 2,88,200)		(2800 x – 2,16,200)
Profit after tax before depreciation		(6000 x –4,24,300)		(4200 x –3,16,300)
Salvage / Scrap (Rs.)				6,000
Values net of tax				43,152
Net Flows : (C)	(80000)	(6000 x – 424300)	(4200 x – 316300)	(6,000 + 43,152)
DCF Factors: (D)		3.79	2.355	0.386
Discounted Value of				
Cash Inflows: (C) × (D)	(80,000)	(6000 x – 424300)x 3.79	(4200 x – 316300) x 2,355	(6,000 + 43,152) x 0.386

Sum of the discounted inflows :
 $[22740 \times 0.386 + 9891 \times 0.386] - [16,08,097 + 744887] + [2316 + 16657]$
 $= [32631 \times 0.386 - 23,34,011]$

Sum of the discounted cash outflows = Rs.80,000

Net cash inflows:

= Rs.32,631 x 0.386 – Rs.23,34,011 – Rs.80,000

Minimum selling price: For determining minimum selling price of the gadget the net cash inflows should be zero i.e.,

$32,631 \times x = Rs.24,14,011$

or $x = Rs.73.98$ or (Rs.74)

Notes :

1. (i) Expenditure on R & D and consulting reports are treated as sunk costs.
 (ii) Relevant cost of the machine is based on replenished purchased materials
 = Rs.50,000 + 40% Rs.50,000 (increase) + labour cost
 = Rs.70,000 + Rs.10,000 = Rs. 80,000
2. Expected sales volume
 1-5 yrs = $(20000 \times 0.1) + (10,000 \times 0.65) + (6000 \times 0.25) = 10,000$ units
 6-10 yrs = $[12000 \times 0.2] + [8000 \times 0.5] + [2000 \times 0.3] = 7000$ units

Pricing Decisions

8. (a) Number of parts to be manufactured :

	Part A	Part B
Machine S (4000 hours)	6666	1600
Machine T (4500 hours)	9000	8181
Alloy Available 13000 kg	8125	8125
Maximum No of parts to be manufactured	6666	8125
Cost Per unit	Rs	Rs
Material (12.5 x 1.6)	20.00	20.00
Variable O/H : Machine S	48.00	20.00
Variable O/H : Machine T	50.00	55.00
Total Variable Cost per unit	118.00	95.00
Price offered	145.00	115.00
Contribution per unit	27.00	20.00
Total Contribution for unit produced (I)	179982	162500
Thus, Part A should be manufactured.		

- (b)

	Part A	Part B
Parts to be manufactured numbers	6666	8125
Machine S : to be used	4000	2031
Machine T : to be used	3333	4468
Underutilized Machine Hour	1167	2001
Compensation for unutilized machine hour (Rs) (II)	70020	120060
Reduction Price by 10% (III) (Rs)	96657	93437
Total Contribution (I + II – III) (Rs)	153345	189123
In this case, Part B should be manufactured.		

Budgets & Budgetary control

9. (i) Flexible Budget:

Units	(Fig' lacs of Rs.)		
	6,00,000	10,00,000	12,00,000
	Rs.	Rs.	Rs.
Sales revenue: (A)	108	180	192
Direct materials	30	50	57
Direct wages	12	20	24
Variable factory overheads	12	20	24
Selling & Administration overheads	<u>6</u>	<u>10</u>	<u>13</u>
Total variable costs: (B)	<u>60</u>	<u>100</u>	<u>118</u>
Contribution : {(A) – (B)}	<u>48</u>	<u>80</u>	<u>74</u>
Less: Fixed factory overheads	16	16	16
Less: Fixed selling and administrative overheads	16	16	16
Less: Additional fixed overheads	—	8	12
Less: Interest cost	—	3	3
Less: Depreciation	—	4	4
Less: Special advertisement	<u>—</u>	<u>2</u>	<u>—</u>
Profit	<u>16</u>	<u>31</u>	<u>23</u>

- (ii) Advise: The company should choose 10 lacs level of output to arrive at optimum profit.

Budget & Budgetary Control

10. (a) Statement of sales, costs and profit expected from alternative ways of increasing production

	Subcontract	Additional shift	Additional plant
	Rs	Rs	Rs
Additional sales (2,000 tons)	50,00,000	50,00,000	50,00,000
Cost increases:			
Materials		7,50,000	7,50,000
(Rs 30,00,000/8000=Rs 375per ton)			

Direct wages		40,00,000	30,00,000
Subcontractor	41,00,000		
Production variable overhead (Rs 7,00,000/8,000=Rs 87.5 per ton)		1,75,000	1,75,000
Production fixed overhead			2,70,000
Distribution variable overhead (Rs 2,00,000/8,000= Rs 25 per ton)	50,000	50,000	50,000
Administration overhead	1,00,000	1,00,000	1,00,000
Selling and distribution overhead	2,00,000	2,00,000	2,00,000
	44,50,000	52,75,000	45,45,000
Additional profit/ loss	5,50,000	(2,75,000)	4,55,000
Original budgeted profit	20,00,000	20,00,000	20,00,000
(b) Revised operating budget based on subcontract :			

	Rs' 000	Rs '000
Sales:10,000 tons @Rs 2,500 per ton		2,500
Variable costs		
Materials	300	
Direct wages	1,200	
Subcontract	410	
Production overhead 50% variable	70	
Total production variable cost	1,980	
Distribution – 20% variable	<u>25</u>	<u>2,005</u>
Contribution		495
Fixed costs		
Production	70	
Administration	70	
Selling and distribution	<u>100</u>	<u>240</u>
Profit		255

Budget & Budgetary Control

11. (a) Crestmont Stores, Budgeted Income Statement for January 2009.

Sales	Rs.2,00,000
Cost of sales	<u>1,20,000</u>

Gross profit		80,000
Other variable costs, commissions (10% × Rs.2,00,000)		<u>20,000</u>
Contribution margin		<u>60,000</u>
Fixed costs:		
Depreciation	Rs.2,000	
Other operating expenses	<u>40,000</u>	<u>42,000</u>
Income		<u>Rs.18,000</u>

(b) Crestmont Store, Purchases Budget for January 2009

Cost of Sales (Rs.2,00,000 × 60%)	Rs.1,20,000
Desired ending inventory (Rs.2,40,000 × 60% × 150%)	<u>2,16,000</u>
Total requirements	3,36,000
Beginning inventory, from beginning balance sheet	<u>1,50,000</u>
Purchases	<u>Rs.1,86,000</u>

(c) Crestmont Stores, Cash Receipts budget for January 2009

Collections from December sales, December 31 receivables	Rs.1,10,000
Collections from January sales (Rs.2,00,000 × 40%)	<u>80,000</u>
Total	<u>Rs.1,90,000</u>

Because sales are collected in full by the end of the month following sale, all accounts receivable at the end of a month are expected to be collected in the coming month.

(d) Crestmont Stores, Cash Disbursements Budget for January 2009

Merchandise [Rs.1,86,000 × 30%] + Rs.80,000]	Rs.1,35,000
Commissions (Rs.2,00,000 × 10%)	<u>20,000</u>
Fixed operating expenses	40,000
Dividend	<u>3,000</u>
Total	<u>Rs.1,98,800</u>

Notice that depreciation is not a cash disbursement.

(e) Crestmont Stores, Cash Budget for January 2009

Beginning balance	Rs.20,000
Receipts (see above)	<u>1,90,000</u>
Cash available	2,10,000
Disbursements	<u>1,98,000</u>

Ending Balance Rs.11,200

(f) Crestmont Stores, Pro Forma Balance Sheet as of January 31, 2009

Assets		Equities	
Cash (Cash Budget)	Rs.11,200	Accounts payable ^c	Rs.1,30,200
Accounts receivable ^a	1,20,000	Common stock	3,00,000
Inventory (purchases budget)	2,16,000	Retained earnings ^d	1,15,000
Building and equipment ^b	<u>1,98,000</u>		<u> .</u>
Total	Rs.5,45,200	Total	Rs.5,45,200

(a) 60% of January sales of Rs.2,00,000 (40% was collected in January)

(b) Rs.2,00,000 beginning balance less Rs.2,000 depreciation expenses.

(c) 70% of January purchases of Rs.1,86,000 (30% was paid in January)

(d) Beginning balance of Rs.1,00,000 plus budgeted income of Rs.18,000 minus dividend of Rs.3,000

Notice that cash declined by Rs.8,800 (from Rs.20,000 to Rs.11,200) even though income was Rs.18,000. If Crestmont's managers believe that budgeted cash balance of Rs.11,200 is too low, they might begin to seek ways to increase that balance (e.g., a short-term bank loan).

Standard Costing

12. Working Notes:

1. Statement of budgeted average contribution margin per unit for the year 2009:

Product different models	Budgeted contribution margin per unit of each product	Budgeted sales volume	Total budgeted contribution margin
	(Rs.)	(Units)	(Rs.)
PC	10,000	7,000	7,00,00,000
Portable PC	6,000	1,000	60,00,000
Super PC	40,000	2,000	8,00,00,000
		10,000	15,60,00,000

$$\text{Budgeted average contribution margin per unit} = \frac{\text{Rs.15,60,00,000}}{10,000 \text{ units}}$$

$$= \text{Rs.15,600}$$

$$\begin{aligned} 2. \quad \text{Actual market share percentage} &= \frac{\text{Actual sales of 3 PC models}}{\text{Actual industry sales}} \times 100 \\ &= \frac{11,000 \text{ units}}{68,750 \text{ units}} \times 100 \\ &= 16 \end{aligned}$$

$$3. \quad \text{Actual sales mix percentage of product} = \frac{\text{Actual sales of Product}}{\text{Total Actual sale of 3 PC models}} \times 100$$

$$\text{Actual sales mix percentage of product PC} = \frac{8,250 \text{ units}}{11,000 \text{ units}} \times 100 = 75$$

$$\text{Actual sales mix \%age of product Portable PC} = \frac{1,650 \text{ units}}{11,000 \text{ units}} \times 100 = 15$$

$$\text{Actual sales mix \%age of product Super PC} = \frac{1,100 \text{ units}}{11,000 \text{ units}} \times 100 = 10$$

(i) Computation of individual product and total sales volume variance

$$\text{Sales} = \left[\begin{array}{cc} \text{Actual} & \text{Budgeted} \\ \text{Sales} & \text{Sales} \\ \text{Volume} & \text{Volume} \\ \text{in units} & \text{in units} \end{array} \right] \times \begin{array}{l} \text{Budgeted} \\ \text{contribution} \\ \text{margin per} \\ \text{unit} \end{array}$$

Individual product sales volume variance:

$$\text{PC} = (8,250 \text{ units} - 7,000 \text{ units}) \times \text{Rs.10,000} = \text{Rs.1,25,00,000 (Fav.)}$$

$$\text{Portable PC} = (1,650 \text{ units} - 1,000 \text{ units}) \times \text{Rs.6,000} = \text{Rs.39,00,000 (Fav.)}$$

$$\text{Super PC} = (1,100 \text{ units} - 2,000 \text{ units}) \times \text{Rs.40,000} = \text{Rs.3,60,00,000 (Adv.)}$$

$$\text{Total Sales Volume Variance} = \text{Rs.1,96,00,000 (Adv.)}$$

(ii) Computation of total sales quantity variance:

Total sales quantity variance =

$$\left[\begin{array}{cc} \text{Total actual} & \text{Total Budgeted} \\ \text{sales Unit} & \text{Sales units} \end{array} \right] \times \begin{array}{l} \text{Budgeted average} \\ \text{contribution margin} \\ \text{per unit} \end{array}$$

$$= (11,000 \text{ units} - 10,000 \text{ units}) \times \text{Rs.15,600} = \text{Rs.1,56,00,000 (Fav.)}$$

(iii) Computation of the market size and market share variance

1. Market size variance:

Budgeted market Share %age x

$$\left[\frac{\text{Actual Industry Sales in units}}{\text{Budgeted Industry Sales in units}} - \frac{\text{Budgeted Industry Sales in units}}{\text{Budgeted Industry Sales in units}} \right] \times \frac{\text{Budgeted average contribution margin per unit}}{\text{per unit}}$$

$$= 0.20 (68,750 \text{ units} - 50,000 \text{ units}) \times \text{Rs.15,600}$$

$$= \text{Rs.5,85,00,000 (Fav.)}$$

2. Market share variance:

$$= \left[\frac{\text{Actual market share percentage}}{\text{Budgeted market share percentage}} - \frac{\text{Budgeted market share percentage}}{\text{Budgeted market share percentage}} \right] \times \left[\frac{\text{Actual Total Sales Volume in units}}{\text{in units}} \right] \times \left[\frac{\text{Budgeted average Contribution margin per unit}}{\text{per unit}} \right]$$

$$= (0.16 - 0.20) \times 68,750 \text{ units} \times \text{Rs.15,600}$$

$$= \text{Rs.4,29,00,000 (Adv.)}$$

(iv) Computation of individual product and total sales mix variances

1. Individual product and total sales mix variance:

Sales mix variance:

$$\left[\frac{\text{Actual sales mix \%age of product}}{\text{Budgeted sales mix \%age of product}} - \frac{\text{Budgeted sales mix \%age of product}}{\text{Budgeted sales mix \%age of product}} \right] \times \left[\frac{\text{Actual Total Sales Volume in units}}{\text{in units}} \right] \times \left[\frac{\text{Budgeted Individual Contribution margin} - \text{Budgeted average contribution margin}}{\text{margin}} \right]$$

$$\text{PC***} = (0.75 - 0.70) \times 11,000 \text{ units} \times (\text{Rs.10,000} - \text{Rs.15,600})$$

$$= \text{Rs.30,80,000 (Adv.)}$$

$$\text{Portable PC} = (.15 - .10) \times 11,000 \text{ units} \times (\text{Rs. 6,000} - \text{Rs.15,600})$$

$$= 32,80,000 \text{ (Adv.)}$$

$$\text{Super PC****} = (0.10 - 0.20) \times 11,000 \text{ units} \times (\text{Rs.40,000} - \text{Rs.15,600})$$

$$= \text{Rs.2,68,40,000 (Adv.)}$$

2. Total sales mix variance = Rs.3,52,00,000 (Adv.)

* Refer to working note 1.

**Refer to working note 2.

***Refer to working note 3.

Note: Sales variances can also be calculated by using sales value approach.

(v) Comment on above results:

1. Favourable sales quantity variance of Rs.1.56 crores was because of growth in industry as a whole. However the firm could not retain the budgeted market share of 20%. As a result the benefit of increased market size i.e. Rs.5.85 crores is partly offset by loss due to fall in market share i.e. Rs.4.29 crores.
2. Increase in the percentage sale of computers below-average budgeted margins and a decrease in the percentage sale of computers above-average budgeted margins had resulted in the reduction of operating profit by Rs.3.52 crores.
3. As a result of above, the operating profit of 'Super Computers' had been adversely affected by Rs.1.96 crores due to sales variances.

Standard Costing

13. (a) The following variances can be calculated :

	(Rs.)
(i) Wage rate: (standard wage rate – actual wage rate) × actual hours [Rs.2 – (Rs.14,000 / 6500)] × 6500	= 1,000 A
(ii) Labour efficiency: (standard hours – actual hours) × standard rate [(500 × 14 = 7,000) – 6,500] × Rs.2	= 1,000 F
(iii) Price variance: (standard price – actual price) × actual quantity (Output of Dept. A) [Rs.9 – (Rs.21,000/1,400)] × 1,400	= 8,400 A
(iv) Usage variance: (Standard quantity – actual quantity) × standard rate (Output of Dept. A) [(500 × 3 = 1,500) – 1,400] × Rs.9	= 900 F
(v) Price variance: (standard price – actual price) × actual quantity (Material X) [Rs.5 – (Rs.11,500/1,900)] × 1,900	= 2,000 A
(vi) Usage variance: (standard quantity – actual quantity) × standard (Material X) [(500 × 4 = 2,000) – 1900] × Rs.5	= 500 F

(vii)	Variable overhead : (fixed budget – actual variable overheads) Expenditure $(6,500 \times \text{Rs.1} = \text{Rs.6,500} - \text{Rs.8,000}$	= 1,500 A
(viii)	Variable overhead: (standard hours – actual hours) $\times$ variable overhead rate, Efficiency $(7,000 - 6,500) \times \text{Rs.1}$	= 500 F
(ix)	Fixed overhead expenditure: (budgeted fixed overhead $\times$ actual fixed overhead)	.
	Department B $(400 \times \text{Rs.3} = \text{Rs.1,200}) - \text{Rs.1,600}$	= 400 A
	Allocated $(400 \times \text{Rs.8} = \text{Rs.3,200}) - \text{Rs.2,900}$	= 300 F
(x)	Volume variance: actual production – budgeted production) $\times$ fixed rate	
	Department B $(500 - 400) \times \text{Rs.3}$	= 300 F
	Allocated $(500 - 400) \times \text{Rs.8}$	= 800 F
	Departmental standard cost for actual production $(500 \times \text{Rs.100})$	= 50,000
	Actual cost	<u>= 59,000</u>
	Total departmental variance	<u>9,000 A</u>

Variance (i) – (x) add to Rs.9,000 adverse. However, not all of the variances are within the control of department B. From the information given in the question, it is not possible to specify which variances are within the controllable and non-controllable by department B. The following are assumed to be non-controllable:

Wage rate: Assumed wage rates are set by the personnel department and that the correct grade of labour has been used.

Material price: Assumed that a central purchasing department exists and that the purchasing officer is responsible for the price variance of material X. The manager of department A is responsible for the price variance for the output of department A.

Allocated fixed overhead expenditure variance: This expenditure is controllable at the point where it is incurred. The actual spending on allocated fixed overheads is not determined by department B.

The following variances might be controllable by the manager of department B:

Labour efficiency

Material usage

Variable overhead efficiency

Fixed overhead volume

Fixed overhead expenditure

Fixed overhead volume might be due to a failure to achieve budgeted sales, or machine breakdowns may have occurred that are beyond the control of department B. Any meaningful analysis of the overhead expenditure variance requires a comparison of actual and budgeted expenditure for each individual item. Only by comparing individual items of expenditure and ascertaining the reasons for the variance can one determine whether the variances are controllable or non-controllable. The foregoing analysis assume the volume variance and overhead expenditure variances to be controllable by the manager of department B. The performance report should analyse variances into their controllable and non-controllable elements:

Department B performance report: Month 7

		(Rs.)	(Rs.)	(Rs.)
Standard cost for actual production				50,000
Controllable variances				
Labour efficiency			1,000 F	
Material usage:	Department A	900 F		
	Material X	<u>500 F</u>	1,400 F	
Overhead expenditure :	Fixed	400 A		
	Variable	<u>1,500 A</u>	1,900 A	
Variable overhead efficiency			500 F	
Volume variance :	Department B	300 F		
	Allocated	<u>800 F</u>	<u>1,100 F</u>	2,100 F
Non-controllable variances				
Wage rate			1,000 A	
Material price:	Department A	8,400 A		
	Material X	<u>2,000 A</u>	10,400 A	
Fixed overhead expenditure (allocated)			<u>300 F</u>	<u>11,100 A</u>
Actual cost				<u>59,000</u>

- (b) The standard costing system is not being operated effectively at present. The variances attributed to department B are not analysed into their controllable and non-controllable elements. In addition, the production manager appears to be using the system in an incorrect manner.

Costing of Service Sector

14. (i) Per flight basis:

	Rs
Fare collection	9,60,000
120 × Rs.8000	
Commission 80% of 9,60,000=7,68,000	
5% commission on	38,400
7,68,000	
Net fare	9,21,600
Expenses:	
Fuel	1,60,000
Food 120 × Rs.200	24000
Total variable	184000
Contribution	737600
Fixed costs	
Annual lease apportioned	4,00,000
Ground handling charges	1,00,000
Crew salaries	60,000
	5,60,000

(ii)

Operating income	1,77,600
Fare collections	9,90,000
132 × Rs.7,500	
Commission	39,600
5% of 80% of 9,90,000 = 7,92,000	
Net fare	9,50,400
Fuel	1,60,000
Food 132 × Rs.200	26,400
	1,86,400
Contribution	7,64,000
Fixed costs	5,60,000
Profit	2,04,000

Excess of income is 2,04,000 – 1,77,600 = Rs.26,400

Hence reduction in fare is recommended.

Costing of Service Sector

15. (i)

Profit Centre	Estimated Revenue		Contribution	
	%	Amount (Rs lakhs)	%	Amount (Rs lakhs)
Accommodation	50	30.00	60	18.00
Restaurant	30	18.00	30	5.40
Bar	20	12.00	40	4.80
Total	100	60.00		28.20
			Fixed Cost	10.00
			Gross profit	18.20

ROCE (before Tax) under the budget = $18.2/110 = 16.55 \%$

(ii) Extra Revenue to be earned from per occupancy of two-night offer :

	Amount (Rs)	%	Contribution Amount (RS)
Accommodation	1600	60	960
Restaurant	480	30	144
Bar	240	40	96
Total	2320		1200

ROCE (before tax) required = 20.55 %

Gross Profit required = Rs 110×0.2055 lakhs = Rs 22.60 lakhs approx.

Additional contribution required = Rs (22.60 – 18.20) = Rs 4.40 lakhs

No of two-nights offer at reduced price to be sold = $4.40 \text{ lakhs} / 1200 = 367$

(iii) We assume that contribution % of revenue will remain same after increase in price.

Increase in contribution from restaurant & bar by 15% increase in price =

= $(2.7) \times 0.3 + (1.8) \times 0.4 = \text{Rs } 1.53 \text{ lakhs}$

Additional contribution required from accommodation = Rs (4.40 – 1.53) lakhs

= Rs 2.87 lakhs

Required increase in revenue = Rs $2.87 / 0.60$ lakhs = Rs 4.78 lakhs

Required percentage increase in rent = $4.78 / 30 = 15.95 \%$ = 16% approx.

Transfer Pricing

16. Working note:

	Products		
	X	Y	Z
Selling price per unit : (Rs)	800	160	1,450
Less: Variable costs: (Rs)	620	140	1,320
Contribution per unit: (Rs)	180	20	130
Hours required per unit	4	1	—
Contribution per hour: (Rs.)	45	20	—
Demand in units	15,000	—	—
Hours required to meet the units demanded:	60,000	36,000	(Balance hours)

- (i) Division B's profitability and the profitability of the company as a whole, when division B imports its component requirements:

	Division A		Division B
	Rs.		Rs.
Contribution		Contribution	6,50,000
X — 15,000 units x Rs.180	27,00,000	(5,000 units x Rs.130)	
Y — 36,000 units x Rs. 20	<u>7,20,000</u>	Less: Fixed costs	5,00,000
Total contribution:	34,20,000		
Less: Fixed costs	<u>30,00,000</u>		
Profit	<u>4,20,000</u>	Profit	<u>1,50,000</u>

The profit of the Company as a whole is Rs.5,70,000

- (ii) When division B buys 5,000 units of product X at Rs.800 per unit:

	Division A		Division B
	Rs.		Rs.
Contribution		Sales revenue	72,50,000
X — 20,000 units x Rs.180	36,00,000	(5,000 units x 1,450)	
Y — 16,000 units x Rs.20	<u>3,20,000</u>	Less: Variable cost	66,00,000
Total contribution	39,20,000	(5,000 units x Rs.1,320)	
Less: Fixed costs	<u>30,00,000</u>	Less: Additional cost (5000 units x Rs.80)	<u>4,00,000</u>

Profit	<u>9,20,000</u>	Contribution	2,50,000
		Less: Fixed costs	<u>5,00,000</u>
		Loss	<u>(2,50,000)</u>

Profit of the company as a whole in this case would be Rs. 6,70,000

- (iii) Division B gets a discount of Rs.80 per unit on each unit of X, which they purchase from Division A.

Product Z	Cost per unit
	Rs.
Variable cost of material X	720
Direct materials	120
Variable overheads	400
Additional cost	80
Total cost : (A)	<u>1,320</u>
Selling price : (B)	<u>1,450</u>
Contribution (per unit) : {B-A}	<u>130</u>
Total contribution (5,000 units x Rs.130)	6,50,000
Less: Fixed costs	<u>5,00,000</u>
Profit of Division B	<u>1,50,000</u>

Profit of Division A

Contribution	Rs.
X – 15,000 units x Rs.180	27,00,000
X – 5,000 units x Rs.100 (For Division B)	5,00,000
Y –16,000 units x Rs.20	<u>3,20,000</u>
Total contribution	35,20,000
Less: Fixed costs	<u>30,00,000</u>
Profit	<u>5,20,000</u>

Total profit of the company as a whole is Rs.6,70,000

Transfer Pricing

17 (a) Profitability of Division B : 3000 units production (Rs lakhs)

	Product Y transfer from Div A	Input procured from market
Material (Rs)	12.00	12.00
Direct Wages (Rs)	6.00	5.40
Variable Overheads (Rs)	4.50	4.50
Variable Selling Overheads	3.00	3.30
Total Variable Cost	25.50	25.20
Fixed Overheads	5.00	5.00
Total Cost	30.50	30.20
Sales Value	36.00	33.00
Profit	5.50	2.80

Profitability of Division A :

Products	X	Y	Z	Total
		Sell in market	Transfer in div B	
Selling Price/ Unit (Rs)	480	460	400	400
Variable Cost/ Unit (Rs)	330	240	240	280
Contribution per unit (Rs)	150	220	160	120
Machine Hour per unit	3	4	4	2
Contribution per hour	50	55	40	60
Rank in terms of limiting factor	III	II	IV	I
In case of Transfer of Y to Div B				
Units to be manufactured	4000	2000	3000	3000
Machine Hour used	12000	8000	12000	6000
Contribution (Rs lakhs)	6.00	4.40	4.80	3.60
Fixed Cost (Rs lakhs)				10.00
Profit (Rs lakhs)				8.80
In case of No Transfer of Y to Div B				
Units to be manufactured	4000	5000		3000
Machine Hour used	12000	20000		6000
Contribution (Rs lakhs)	6.00	11.00		3.60
Fixed Cost (Rs lakhs)				10.00
Profit (Rs lakhs)				10.60

In case of Transfer from Division A :

Total Profit of the company = Rs (5.50+ 8.80) lakhs = Rs 14.30 lakhs

In case of procurement of input for division B from outside market ,

Profit = Rs (2.80 + 10.60) lakhs = Rs 13.40 lakhs

- (b) Thus, the transfer price of Rs 400 based on market price is beneficial to the company.
- (c) In case of enhancement of capacity of Division B to 5000 units & transfer of 5000 units of Y from Division A at transfer price of Rs 460,

	Rs lakhs
Profitability of Division A	10.60
Profitability of Division B :	
Sales Value (5000 x 1200)	60.00
Variable Cost (25.50 x 5000/3000) + 60 x 5000	45.50
Contribution	14.50
Fixed Cost + Capital Cost	5.90
Profit	8.60
Total profit of the company	19.20
Increase in profitability	4.90
i.e 34% approx.	

18. (i) Uniform Costing

Uniform Costing is not a distinct method of costing, Infact when several undertaking start using the same costing principles and / or practices, they are said to be following uniform costing. The basic idea behind uniform costing is that the different concerns in an industry should adopt a common method of costing and apply uniformly the same principles and techniques for better cost comparison and common good. The principles and methods of compilation, analysis, apportionment and absorption of overheads differ from one concern to the other in the same industry, but if a common or uniform pattern is adopted by all, it helps mutually in cost control and cost reduction.

The essential requisites for the installation of uniform costing system

A successful system of uniform costing requires the following essential requisites for its installation:

1. The firms in the industry should be willing to share /furnish relevant data /information.

2. A spirit of co-operation and mutual trust should prevail among the participating firms.
 3. Mutual exchange of ideas, methods used, special achievements made, research and know-how etc. should be frequent.
 4. Bigger firms should take the lead towards sharing their experience and know-how with the smaller firms to enable the latter to improve their performance.
 5. Uniformity must be established with regard to several points before the introduction of uniform costing in an industry. In fact, uniformity should be with regard to following points
 - (a) Size of the various units covered by uniform costing.
 - (b) Production methods.
 - (c) Accounting methods, principles and procedures used.
- (ii) Pre-requisites should be considered while installing a inter-firm comparison system:
1. Centre for Inter-firm Comparison: For collection and analysing data received from member units, for doing a comparative study and for dissemination of the results of study a Central body is necessary. The function of such a body may be:
 - (a) Collection of data and information from its members.
 - (b) Dissemination of results to its members.
 - (c) Undertaking research and development for common and individual benefit of its members.
 - (d) Organising training programmes and publishing magazines.
 2. Membership: Another requirement for the success of inter-firm comparison is that the firms of different sizes should become members of the Centre entrusted with the task of carrying out inter-firm comparison.
 3. Nature of information to be collected: Although there is no limit to information, yet the following information is useful to the management in general. It is collected by the centre for inter-firm comparison.
 - (a) Information regarding costs and cost structures.
 - (b) Raw material consumption.
 - (c) Stock of raw material, wastage of materials, etc.
 - (d) Labour efficiency and labour utilization.
 - (e) Machine utilization and machine efficiency.
 - (f) Capital employed and return on capital.
 - (g) Liquidity of the organisation.

- (h) Reserve and appropriation of profit.
 - (i) Creditors and debtors.
 - (j) Methods of production and technical aspects.
4. Method of collection and presentation of information: The centre collects information at fixed intervals in a prescribed form from its members. Sometimes a questionnaire is sent to each member; the replies of the questionnaire received by the centre constitute the information/data. The information is generally collected at the end of the year as it is mostly related with final accounts and balance sheet. The information supplied by firms is generally in the form of ratios and not in absolute figures. The information collected as above is stored and presented to its members in the form of a report. Such reports are not made available to non-members.

The Transportation Problem

19. The given information can be tabulated in following transportation problem

Profit Matrix

Factory	Sales Agency				Monthly Capacity (units)
	1	2	3	4	
A	3	7	9	4	10
B	2	2	6	1	15
C	0	0	5	-3	20
D	-3	0	4	-2	15
Monthly	8	12	18	22	

Requirements

Where entries in the cells of the above table indicate profit per unit received by selling one unit of item from factory i ($i=A, B, C, D$) to j^{th} sales agency ($j=1,2,3,4$). The profit per unit is calculated using the following formula:

$$\text{Profit} = \text{Sales Price} - (\text{Cost of Production} + \text{Shipping Cost})$$

The objective of the company is to maximise the profit. For achieving this objective, let us convert this maximisation problem into minimisation problem by subtracting all the elements of the above pay off matrix from the highest payoff i.e. Rs. 9.

Loss Matrix

Factory	Sales Agency				Monthly Capacity (units)
	1	2	3	4	
A	6	2	0	5	10

B	7	7	3	8	15
C	9	9	4	12	20
D	12	9	5	11	15
Monthly Requirements	8	12	18	22	

Now, let us apply Vogel's Approximation Method to the above matrix for finding the initial feasible solution.

Factory	Sales Agency				Monthly Capacity	Difference
	1	2	3	4		
A	6	10 2	0	5	10/0	2 3 --
B	7	7	3	15 8	15/0	4 0 0 -
C	2 9	9	18 4	12	20/2/0	5 0 0 0
D	6 12	2 9	5	7 11	15/13/6/0	4 2 2 2
Monthly requirement	8/6/0	12/2/0	18/0	22/7		
Difference	1 1 2 3	5 5 2 0	3 -- --	3 3 3 1		

The initial solution is as given below which is tested for optimality. There are $m+n-1=7$ independent allocations.

Let us introduce $u_i, v_j, i = (1,2,3,4); j = (1,2,3,4)$ such that $\Delta_{ij} = c_{ij} - (u_i + v_j)$ for allocated cells. We assume $u_4=0$ and remaining u_i 's, v_j 's and Δ_{ij} 's are calculated as below:

Factory	Sales Agency				u_i 's
	1	2	3	4	
A	1 6	10 2	0	1 5	-7
B	-2 7	1 7	-1 3	15 8	-3
C	2 9	+0 9	18 4	-0 12	-3
D	6 12	-0 9	-2 5	+0 11	0
	12	9	7	11	

Since some of the Δ_{ij} 's are negative, therefore, the above solution is not optimal. Introduce in the cell (D, 3) with the most negative Δ_{ij} , an assignment θ . The value of θ and the reallocated solution as obtained from above is given below. The values of u_i 's, v_j 's are also calculated. The solution satisfies the conditions of optimality. The condition $\Delta_{ij} = c_{ij} - (u_i + v_j) \geq 0$ for non allocated cells is also satisfied.

Factory	Sales Agency				u_i 's
	1	2	3	4	
A	3	10	2	1	-7
	6	2	0	5	
B	0	1	1	15	-3
	7	7	3	8	
C	8	1	12	2	-1
	9	9	4	12	
D	2	2	6	7	0
	12	9	5	11	
v_j 's	10	9	5	11	

Since all Δ_{ij} 's for non basic cells are positive, therefore the solution obtained above is an optimal one. The allocation of factories to sales agencies and their profit amount is given below:

Factory	Sales Agency	Profit	
A	2	$10 \times \text{Rs } 7$	= Rs. 70
B	4	$15 \times \text{Rs } 1$	= Rs. 15
C	1	$8 \times \text{Rs } 0$	= Rs. 0
C	3	$12 \times \text{Rs } 5$	= Rs. 60
D	2	$2 \times \text{Rs } 0$	= Rs. 0
D	3	$6 \times \text{Rs } 4$	= Rs. 24
D	4	$7 \times \text{Rs}(-2)$	= -Rs. 14
			= Rs. 155

Since one of the Δ_{ij} 's is zero, the optimal solution obtained above is not unique. Alternate solution also exists.

The Assignment Problem

20. Let us first tabulate the preference ranking of different managers.

Room No.	Managers				
	M ₁	M ₂	M ₃	M ₄	M ₅
301	-	4	2	-	1
302	1	1	5	1	2
303	2	-	1	4	-
304	3	2	3	3	3
305	-	3	4	2	-

We have to find an assignment so that total preference ranking is minimum. In a cell having (-) indicate that no assignment is to be made in that cell. Let us assign a very large value, say M, to all such cells. Now applying the assignment algorithm, we subtract from each row minimum element of that row from all the elements of that row to get the following matrix:

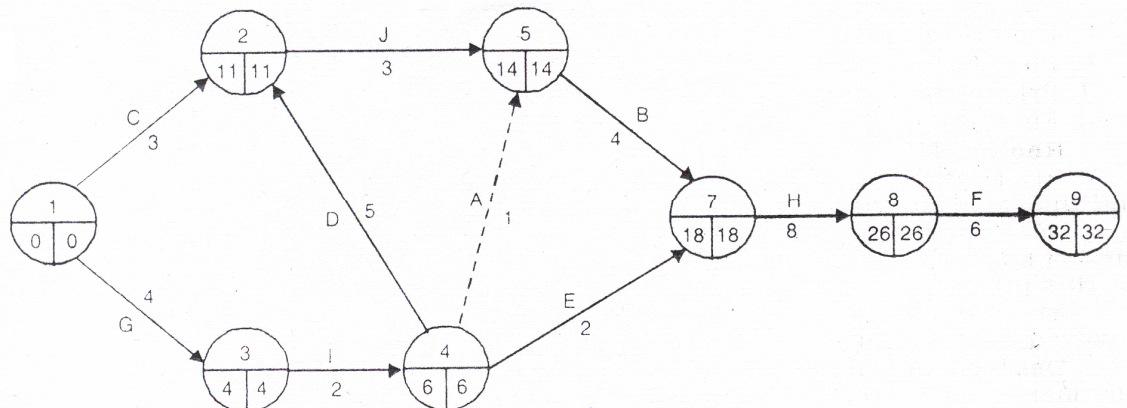
Room No.	Managers				
	M ₁	M ₂	M ₃	M ₄	M ₅
301	M	3	1	M	0
302	0	0	4	0	1
303	1	M	0	3	M
304	1	0	1	1	1
305	M	1	2	0	M

Thus, the assignment is as follows:

M₁→302, M₂→304, M₃→303, M₄→305, M₅→301 and the total minimum ranking = 1+2+1+2+1=7.

Program Evaluation and Review Technique

21. (a)



(b) Critical path = G→I→D→J→B→H→F

$$= 4 + 2 + 5 + 3 + 4 + 8 + 6 = 32 \text{ weeks}$$

(c) The start and finish time for each activity (assuming each starts at the EST) are:

Activity	Start	Finish	Cost/week Rs. ('000)
A	6	7	4
B	14	18	2
C	0	3	8
D	6	11	3
E	6	8	3
F	26	32	5
G	0	4	3
H	18	26	5
I	4	6	4
J	11	14	1

A week-by-week schedule is provided by:

Time	Activity	Cost/week Rs. ('000)
0–3	C, G	11
3–4	G	3
4–6	I	4
6–7	D, A, E	10
7–8	D, E	6
8–11	D	3
11–14	J	1
14–18	B	2
18–26	H	5
26–32	F	5

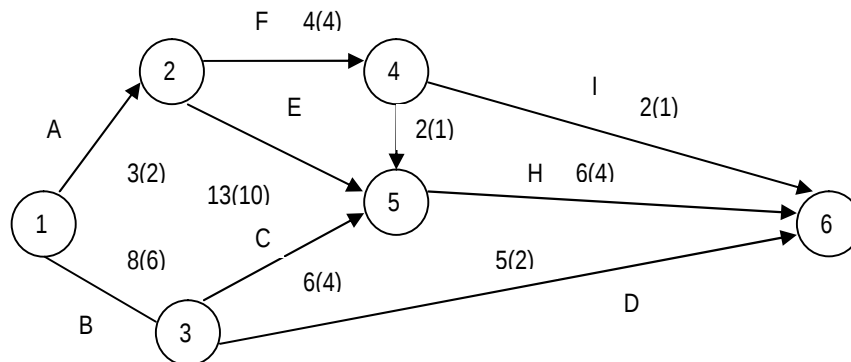
The cash outflows (in Rs. '000), week by week are shown in the following table:

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Cost	11	11	11	3	4	4	10	6	3	3	3	1	1	1	2	2
Week	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Cost	2	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5

The cash outflow in the first eight weeks amounts to Rs. 60,000, which is more than Rs. 50,000 available for these weeks, i.e., budget would have been exceeded in 7th week. However, it is possible to defer activities A and E until week 9 without prolonging the overall project duration. The final Rs. 50,000 available in week 20 in time for all subsequent cash outflows.

CPM

22. The net work with the normal shortest (crash) times for various activities is shown below:



- The critical path of the project is 1-2-5-6 (or A-E-H) with length of 22 weeks.
- to complete the project in the stipulated 17 weeks ,crashing would have to be done by determining the weekly crashing cost for each of the activities using the formula.

$$\text{Crashing cost per week} = \frac{\text{Crash cost} - \text{Normal cost}}{\text{Normal time} - \text{crash cost}}$$

Activity	A	B	C	D	E	F	G	H	I
Node	(1-2)	(1-3)	(3-5)	(3-6)	(2-5)	(2-4)	(4-5)*	(5-6)	(4-6)
Crashing Cost(Rs.)	1000	200	1000	2000	2000	-	200	500	1000

Activities to be crashed and the cost involved are shown in the blow table

Table:-Crashing schedule of the project:

Crashing	Alternative	cost	Decision	Duration	Critical path(s)
First	i) A(1-2)	1000	Crash(5-6)	21	1-2-5-6
	ii) E(2-5)	2000			
	iii) H(5-6)	500			
Second	i) A(1-2)	1000	Crash(5-6)	20	1-2-5-6
	ii) E(2-5)	2000			
	iii) H(5-6)	500			
Third	i) A(1-2)	1000	Crash(1-2)	19	1-2-5-6
	ii) E(2-5)	2000			
Fourth	i) E(2-5)	2000	Crash(2-5)	18	1-2-5-6
Fifth	i) E(2-5) B(1-3)	2200	Crash(2-5),(1-3)	17	1-3-5-6
	ii) E(2-5) C((3-5)	3000			1-2-5-6 1-3-5-6

(a) Activities to be crashed: A-one week, B-one week, E-two weeks and I –two weeks.

(b) Total cost of the project= Normal cost+ crashing cost

$$= (18,000+600+10000+4000+3000+15000+1200+3500+7000)+$$

$$(500+500+1000+2000+2200)$$

$$=Rs.68, 500$$

(c) Activities which are critical after crashing are A, B, C, E and H.

Simulation

23. The random number intervals are determined in the first place as shown in table 1 and 2

Table 1 Random Number Intervals (rained previously)

Event	Probability	Cum. Probability	Random Number Interval
No rain	.50	.5	00-49
1 cm rain	.25	.75	50-74
2 cm rain	.15	.90	75-89
3 cm rain	.05	.95	90-94
4 cm rain	.03	.98	95-97
5 cm rain	.02	1.00	98-99

Table 2 Random Number Intervals (No. Rain previously)

Event	Probability	Cum. Probability	Random Number Interval
No rain	.75	.75	00-74
1 cm rain	.15	.90	75-89
2 cm rain	.06	.96	90-95
3 cm rain	.04	1.00	96-99

The rainfall can now be predicted in accordance with the random number generated

Table 3: Simulation Worksheet

Day	Random Numbers	Rainfall (cm)	Table References
1	76	1	Table 2
2	78	2	Table 1
3	84	2	Table 1
4	75	2	Table 1
5	02	No rain	Table 1
6	86	1	Table 2
7	02	No rain	Table 1
8	78	1	Table 2
9	07	No rain	Table 1
10	63	No rain	Table 2

Total days without rain are 4 and total rain is 9 cm

Learning Curve Theory

24. (i) Price per unit for first order of 100 units

	Rs	Rs
Direct material		500.00
Direct labour	Dept A 20 Hrs @ 10 = 200 Dept B 40 Hrs @ 15 = 600	800.00
Variable Overhead	20% of Rs 800	160.00
Fixed Overhead	Dept A 20 Hrs @ 8 = 160 Dept B 40 Hrs @ 5 = 200	360.00
Total cost		1,820.00
Profit 25%		455.00
Selling price per unit		2,275.00

(ii) Price per unit for second order of 60 units

Learning will be applicable only in department B.

Cumulative output becomes 100 units + 60 units = 160 units i.e 1.6 times for which learning is 86.1 % from the tables.

Therefore Total Hrs for 160 units = $160 \text{ units} \times 40 \times .861 = 5,510.4 \text{ Hrs}$

Therefore Hrs for 60 units = Hrs for 160 units less Hrs for 100 units

Or $5510.4 \text{ less } 40 \times 100 = 1510.4 \text{ Hrs}$

Therefore Hrs per unit = $\frac{1510.4}{60} = 25.17$

Calculation of selling price per unit

		Rs
Direct materials		500.00
Direct labour	Dept A 20 Hrs @ 10 = 200	577.55
	Dept B 25.17 Hrs @ 15 = 377.55	
Variable Overhead	20% of 577.55	115.51
Fixed Overhead	Dept A 20 Hrs @ 8 = 160	285.85
	Dept B 25.17 Hrs @ 5 = 125.85	
Total cost		1,478.91
Profit 25%		369.73
Selling price per unit		1,848.64

(iii) Price per unit for third order of 40 units

Cumulative output becomes $100 + 60 + 40 = 200 \text{ units}$ i.e. 2 times for which learning is 80% from the table

Total Hrs for 200 units = $200 \times 40 \times .80 = 6,400 \text{ Hrs}$

Hrs for 40 units = Hrs for 200 units less Hrs for 160 units

Or $6,400 \text{ less } 5510.4 = 889.6 \text{ Hrs}$

Therefore Hrs per unit = $\frac{889.6}{40} = 22.24$

Calculation of selling price per unit

		Rs
Direct materials		500.00
Direct labour	Dept A 20 Hrs @ 10 = 200.00	533.60
	Dept B 22.24 @ 15 = 333.60	
Variable Overhead	20% of 533.60	106.72
Fixed Overhead	Dept A 20 Hrs @ 8 = 160	271.20
	Dept B 22.24 Hrs @ 5 = 111.20	
Total cost		1,411.52
Profit 25%		352.88
Selling price per unit		1,764.40

LPP

- 25 Let x_1, x_2, x_3, x_4, x_5 and x_6 be the number of shares of companies A, B, C, D, E and F respectively. The rupee return for various shares is shown below.

Shares under consideration						
	A	B	C	D	E	F
Projected growth per share(Rs.)	6.40	7.00	16.00	14.40	13.50	30.00
Projected dividend	4.00	4.50	7.50	5.50	5.75	0.00
Rupee-return per share	10.40	11.50	23.50	19.90	19.25	30.00

Accordingly, the objective function is:

$$\text{Maximize } Z = 10.40 x_1 + 11.50x_2 + 23.50x_3 + 19.90x_4 + 19.25x_5 + 30.00x_6$$

The constraints are as follows:

$$80x_1 + 100x_2 + 160x_3 + 120x_4 + 150x_5 + 200x_6 \leq 25,00,000 \text{ funds availability}$$

$$200x_6 \leq 250,000 \text{ condition (i)}$$

$$\text{Total weighted risk} = \frac{(80x_1)(0.05) + (100x_2)(0.03) + (160x_3)(0.10) + (120x_4)(0.20) + (150x_5)(0.06) + (200x_6)(0.08)}{80x_1 + 100x_2 + 160x_3 + 120x_4 + 150x_5 + 200x_6}$$

On simplification, it gives

$$-4x_1 - 7x_2 + 12x_4 - 6x_5 - 4x_6 \leq 0$$

From condition (iv), $x_i \geq 100$ for $i=1,2,3,4,5,6$

$$\text{Condition (v) requires } 80x_1 + 100x_2 \geq 0.10(80x_1 + 100x_2 + 160x_3 + 120x_4 + 150x_5 + 200x_6)$$

$$\text{This becomes, } 72x_1 + 90x_2 + 6x_3 - 12x_4 - 15x_5 + 200x_6 \geq 0$$

The dividend requirements states that

$$4x_1 + 4.50x_2 + 7.50x_3 + 5.50x_4 + 5.75x_5 \leq 10,000$$

Accordingly, the LPP may be stated as follows:

$$\text{Maximize } Z = 10.40 x_1 + 11.50x_2 + 23.50x_3 + 19.90x_4 + 19.25x_5 + 30.00x_6$$

Subject to

$$80x_1 + 100x_2 + 160x_3 + 120x_4 + 150x_5 + 200x_6 \leq 25,00,000$$

$$200x_6 \leq 250,000$$

$$180x_1 + 100x_2 \leq 5,00,000$$

$$-4x_1 - 7x_2 + 12x_4 - 6x_5 - 4x_6 \leq 0$$

$4x_1+4.50x_2+7.50x_3+5.50x_4+5.75x_5$	$\leq 10,000$
x_1	≥ 100
x_2	≥ 100
x_3	≥ 100
x_4	≥ 100
x_5	≥ 100
x_6	≥ 100