2. INVESTMENT DECISIONS

NO. OF PROBLEMS IN 40E OF CA INTER: CLASSROOM - 28, ASSIGNMENT - 30

NO. OF PROBLEMS IN 41E OF CA INTER: CLASSROOM - 28, ASSIGNMENT - 31

NO. OF PROBLEMS IN 42E OF CA INTER: CLASSROOM - 28, ASSIGNMENT - 28

MODEL - WISE ANALYSIS OF PREVIOUS EXAMINATIONS

No.	Model Name	N-09	M-10	N-10 TO M-11	N-11	M-12	N-12	M-13	N-13	M-14	N-14	M-15	N-15	M-16	N-16	M-17	N-17	M-18 (O)	M-18 (N)	N-18(O)	N18-(N)
1.	COMPUTATION OF CFAT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.	ACCOUNTING (BOOK) RATE OF RETURN / AVERAGE RATE OF RETURN METHOD (ARR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.	PAYBACK PERIOD METHOD	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-
4.	CALCULATION OF NPV UNDER DIFFERENT CONDITIONS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
5.	PROFITABILITY INDEX METHOD / DESIRABILITY FACTOR	8	-	-	8	-	-	-	-	8	-	-	-	-	-	-	-	-	-	8	-
6.	CALICULATION OF IRR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.	PAYBACK PERIOD RECIPROCAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.	DISCOUNTED PAY BACK PERIOD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.	CAPITAL RATIONING	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10.	FINDING OUT MISSING VALUES	-	-	-	-	8	-	9	-	-	-	8	-	8	-	-	-	8	-	-	-
11.	COMPREHENSIVE PROBLEMS	8	8	-	-	-	16	9	-	-	-	-	-	-	-	8	-	-	-	-	-

INTRODUCTION TO CAPITAL BUDGETING:

- Capital budgeting decisions are related to the **allocation of investible funds** to different **long term assets.**
- Capital budgeting decision denotes a decision situation where lump sum funds are invested in the **initial stages** of a project and the **returns** are expected **over a long period.** All investments requiring more than one year for their completion shall be considered as **long term investments.**
- Some of the **capital budgeting decisions** may be to **buy land, building or plants; or to** undertake a **program on research and development of a product**, to diversify into a new product line, promotional campaign etc.

EVALUATION OF LONG-TERM INVESTMENT

1) Estimation of **Cost - Benefits of an Investment proposal.**
2) Determining the **minimum required rate of return** (i.e. WACC) to be used as **Discount rate**
3) **Evaluate each alternative** using different **Capital budgeting techniques**.

ESTIMATION OF COST - BENEFITS OF AN INVESTMENT PROPOSAL

- The estimation of **cost & benefits** of the **investment proposal** is **the starting point** for investment decision.
- The term '**Cost**' refers to **investment required** for a project. It is always expressed in present terms.
- The term '**Benefit**' refers to **expected return** from the project **over its useful life.**
- Expected return is expressed as **Accounting profit** and **cash profit.**
  - **Accounting profit** refers to Profit determined in accordance with the Accounting principles. It is subject to discretionary accounting policies, non-cash expenses and based on accrual concept.
  - **Cash profit** is the profit recorded by the business that uses the cash basis of accounting. Under this method, revenues & expenses are recognised on cash basis.

Why should cash profit be preferred over accounting profit?

Investment is required to be made in cash. So, the cost - benefits related to investments must be expressed in cash terms. Accounting profit fails to reflect the cost - benefits of an investment in cash terms since it is subject to discretionary accounting policies, non-cash expenses and based on accrual concept. Hence accounting profits has shown in the records does not represents the real cash flow. Cash profit measures the profit on cash basis where revenue & all expenses recognised on cash basis. So, cash profit as shown in the records represents the real cash flow. Hence we prefer Cash profit over accounting profit.

COMPUTATION

ACCOUNTING PROFITS		CASH PROFIT	
Sales	**XXXX**	**Sales**	**XXXX**
Less: Variable cost	XXX	Less: Variable cost	XXX
Less: Fixed Cost	XXX	Less: Fixed Cost	XXX
EBDIT	**XXXX**	**EBDIT**	**XXXX**
Less: Interest **(Ignore Finance cost--SEE NOTE)**	XXX	Less: Interest **(Ignore Finance cost-SEE NOTE)**	XXX
EBDT = EBDIT	**XXXX**	**EBDT = EBDIT**	**XXXX**
Less: Depreciation	XXX	Less: Depreciation	XXX
EBT	**XXXX**	**EBT**	**XXXX**
Less: Tax	XXX	Less: Tax	XXX
EAT	**XXXX**	**EAT**	**XXXX**
		Add: Depreciation	XXX
		CFAT	**XXXX**

Why should Cash profits be considered after tax?

In investment decisions **cash profits** should be considered **after tax** because the **tax on earnings** is considered as **cash outflow** and the **tax saving on loss/ expenses** is considered as **Cash inflow.**

Why should depreciation added back to EAT?

Depreciation is an **allowable expenditure** as per **section 32** of the Income Tax Act. **Even though non cash, Investor gets tax benefit on depreciation.** To reflect the effect of tax savings on depreciation (being cash inflow), it is added back to EAT.

NOTE:

EXCLUSION OF FINANCING COSTS PRINCIPLE:

a) When **cash flows** relating to long-term funds are being defined, **financing costs of long-term funds** (interest on long-term debt and equity dividend) **should be excluded** from the analysis.

b) The exclusion of financing costs principle means that:

   i) The **interest** on long-term debt (or interest) is **ignored** while computing profits and taxes and;

   ii) **The expected dividends** are deemed **irrelevant** in cash flow analysis.

While computing the CFAT the following items to be taken into consideration:

1) **Depreciation**
2) **Opportunity Cost**
3) **Sunk Cost**
4) **Working Capital**
5) **Allocated Corporate Overheads**
6) **Additional Capital Investments**

PROBLEMS FOR CLASSROOM DISCUSSION

MODEL 1: COMPUTATION OF CFAT

PROBLEM 1: ABC Ltd. is evaluating the purchase of a new project with a depreciable base of Rs.1,00,000, expected economic life of 4 years and change in Earnings Before Taxes and Depreciation of Rs.45,000 in year 1, Rs.30,000 in year 2, Rs.25,000 in year 3 and Rs.35,000 in year 4. Assume straight-line depreciation and a 20% tax rate. You are required to compute relevant cash flows.

(A) (NEW SM) (ANS.:Y1- RS.41,000,Y2- RS.29,000, Y3- RS.25,000, Y4- RS.30,000)
(SOLVE PROBLEM NO.1 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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PROBLEM 2: A firm buys an asset costing Rs.1,00,000 and expects operating profits (before depreciation @ 20% WDV and tax @ 30%) of Rs.30,000 p.a. for the next four years after which the asset would be disposed off for Rs.45,000. Find out the cash flows for different years.

(B) (N 99) (ANS.: CASH FLOWS YEAR 1= RS. 27,000, YEAR 2 = RS. 25,800, YEAR 3 = RS. 24,840, YEAR 4 = RS. 24,072, TERMINAL CASH FLOWS= RS. 43,788)
(SOLVE PROBLEM NO.2 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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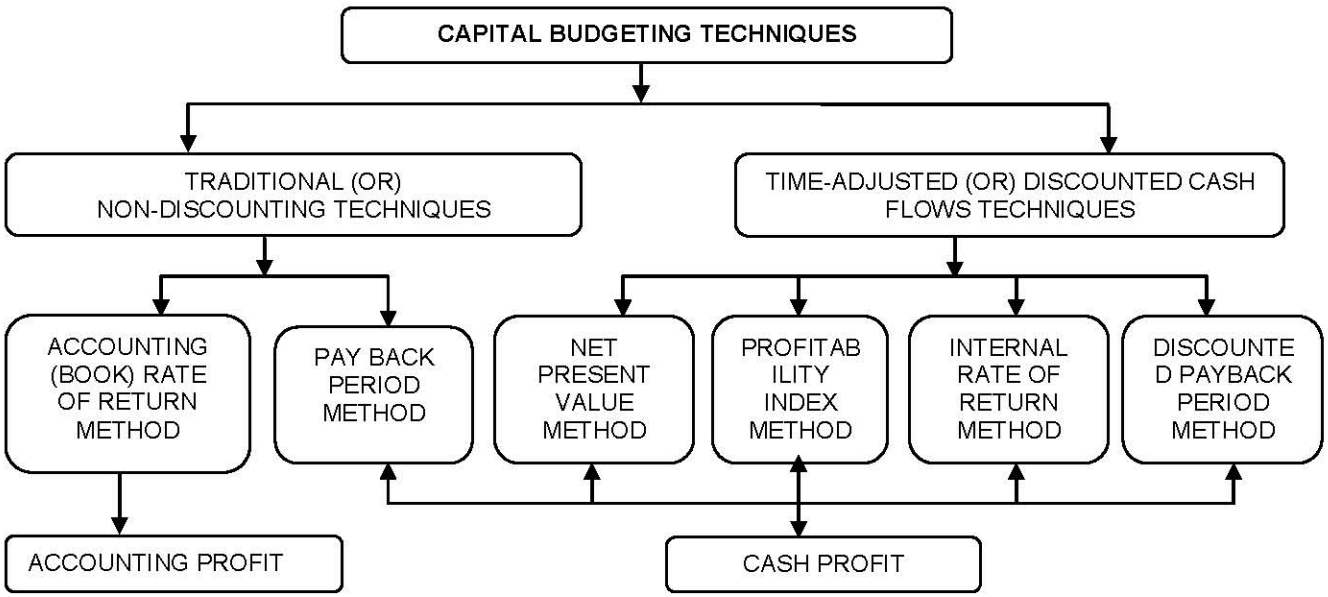
PROBLEM 3: Following is the income statement of a project on the basis of which calculates the annual cash inflows.

Particulars	Rs.	Rs.
Net Sales revenue		4,75,000
- Cost of goods sold	2,00,000	
- General Expenses	1,00,000	
- Depreciation	50,000	3,50,000
Profit before interest and taxes (PBIT)		1,25,000
- Interest		25,000
Profit before tax		1,00,000
-Tax @ 40%		40,000
Profit after tax		60,000

(M03) (A) (ANS.: ANNUAL CASH INFLOW RS.1,25,000)
(SOLVE PROBLEM NO.3 OF ASSIGNMENT PROBLEMS AS REWORK)



MODEL 2: ACCOUNTING (BOOK) RATE OF RETURN / AVERAGE RATE OF RETURN METHOD (ARR)

ACCOUNTING (BOOK) RATE OF RETURN:

a) The Accounting Rate of Return of an investment measures the average annual net income of the project (incremental income) as a percentage of the investment.

$$\text{Accounting rate of return} = \frac{\text{Average annual net income}}{\text{Investment}} \times 100$$

b) The numerator is the average annual net income generated by the project over its useful life.

c) The denominator can be either the initial investment (including installation cost) or the average investment over the useful life of the project.

d) Average investment means the average amount of fund remained blocked during the lifetime of the project under consideration.

e) Further ARR can be calculated in number of ways as shown in below

VERSION 1: ANNUAL BASIS

$$ARR = \frac{\text{Profit after Depreciation}}{\text{Investment in the begining of the year}} \times 100$$

VERSION 2: TOTAL INVESTMENT BASIS

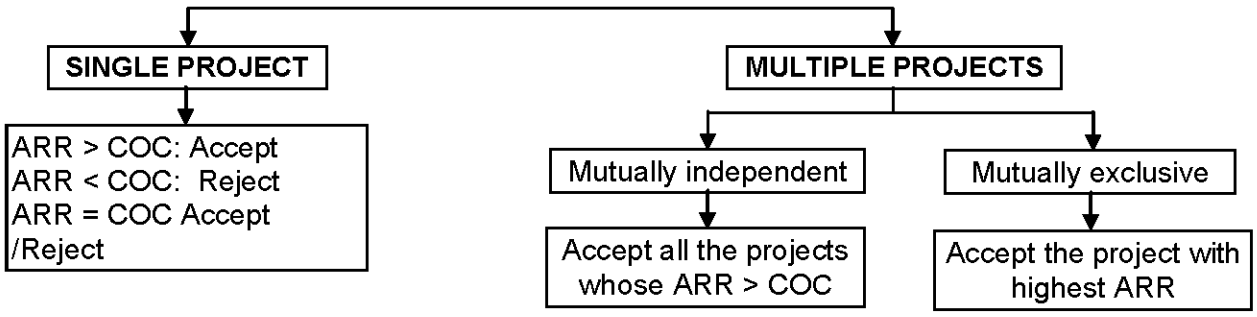
$$ARR = \frac{\text{Average Annual Profit}}{\text{Investment in the begining}} \times 100$$

VERSION 3: AVERAGE INVESTMENT BASIS

$$ARR = \frac{\text{Average Annual Profit (after tax)}}{\text{Average investment in the project}} \times 100$$

Where, Average investment = ½ (Initial Cost + Installation Expenses - Salvage value) + Salvage value + Additional Working Capital.

DECISION RULE:



COC = Cost of Capital

PROBLEM 4: A project requires an investment of Rs.10,00,000 yields Profit after Tax and Depreciation as follows:

Year	1	2	3	4	5
Profit After Tax & Depreciation (Rs.)	50,000	75,000	1,25,000	1,30,000	80,000

Suppose further that at the end of 5 years, the plant and machinery of the project can be sold for Rs. 80,000. Determine Average Rate of Return.

(B) (NEW SM, OLD SM) (ANS.: AVERAGE RATE OF RETURN = 9.2% OF INITIAL INVESTMENT, 17% OF AVERAGE INVESTMENT)
(SOLVE PROBLEM NO.4 OF ASSIGNMENT PROBLEMS AS REWORK)

PROBLEM 5: (PRINTED SOLUTION AVAILABLE) Times Ltd. is going to invest in a project a sum of Rs.3,00,000 having a life span of 3 years. Salvage value of machine is Rs. 90,000. The Profit Before Depreciation for each year is Rs.1,50,000.

Requirement:

1. ARR on the basis of
   a) Annual investment
   b) Total investment
   c) Average investment
2. Compute ARR if, additional working capital of Rs. 45,000 is required.

(A) (NEW SM, OLD SM) (ANS.: 1(A) ARR ON THE BASIS OF ANNUAL INVESTMENT = 37.15%, TOTAL INVESTMENT 1(B) = 26.67%, AVERAGE INVESTMENT 1(C) = 41.03%, 2) ARR= 33.33%)
(SOLVE PROBLEM NO.6 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 3: PAYBACK PERIOD METHOD

PAYBACK PERIOD METHOD:

The payback period of an investment is the length of time required for the cumulative total net cash flows from the investment to equal the total initial cash outlays. At that point in time, the investor has recovered the money invested in the project.

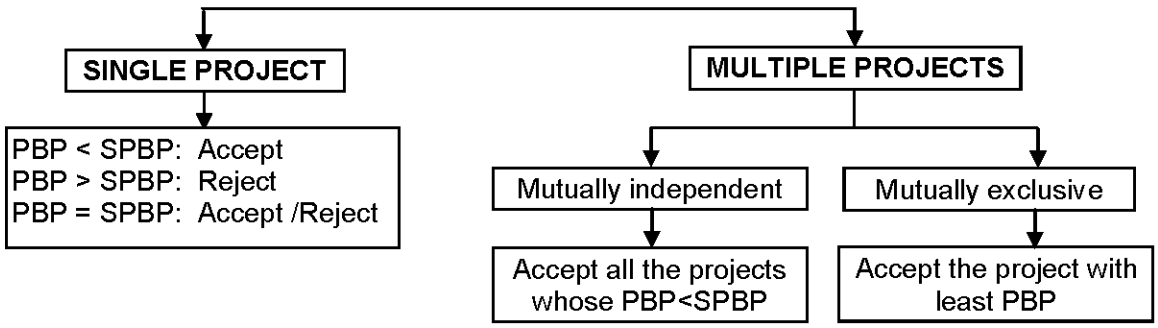
CALCULATION OF PAYBACK PERIOD:

1. When the net cash flows are uniform over the useful life of the project:

$$PBP = \frac{\text{Initial Investment}}{\text{Annual cashinflow}}$$

2. When the annual cash flows are not uniform, the cumulative cash flows from operations must be calculated for each year. The PBP shall be corresponding period when total of cumulative cash inflows is equal to the initial capital investment. However, if exact sum does not match then the period in which it lays should be identified. After that we need to compute the fraction of the year that is needed to complete the total payback.

DECISION RULE:



Where PBP = Payback Period, SPBP= Standard Payback Period

PROBLEM 6: From the following situations calculate the payback period.

SITUATION 1: An Investment requires a cash outflow of Rs.1,00,000 and is expected to generate cash inflow of Rs. 20,000 p.a for 6 years.

SITUATION 2: Cash inflows from an investment proposal are Rs. 8,000, Rs.6,000, Rs.4,000, Rs. 2,000 and Rs. 2,000 over next 5 years and the cost of proposal is Rs. 18,500.

(B) (ANS.: 1) PAYBACK PERIOD 5YRS, 2) 3.25 YRS OR 3 YRS & 3 MONTS)

(SOLVE PROBLEM NO.7 OF ASSIGNMENT PROBLEMS AS REWORK)

PROBLEM 7: MM Limited is considering three projects A, B and C. The cash flows associated with the projects are given below:

Cash flows associated with the Three Projects (Rs.)					
Project	**C_0**	**C_1**	**C_2**	**C_3**	**C_4**
A	(5,000)	1,000	1,000	3,000	0
B	(1,000)	0	1,000	2,000	3,000
C	(5,000)	1,000	1,000	3,000	5,000

You are required to:

a) Calculate the Payback period of each of the three projects.

b) If the cut-off period is two years, then which projects should be accepted? Will your answer be different if the standard payback period is 3 years?

c) "Payback gives too much weight to cash flows that occur after the cut-off date". Is it true or false?

"If a firm used a single cut-off period for all projects, it is likely to accept too many short-lived projects." Is it true or false? *(A)*

(RTP, M15) (ANS.: A)PROJECT A=3YRS,PROJECT =2YRS,PROJECT =3YRS B)PROJECT B, IF STANDARD PBP IS 3 YRS, THEN WE CAN ACCEPT ALL PROJECTS C)FALSE D)TRUE) (SOLVE PROBLEM NO 5 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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PROBLEM 8: (PRINTED SOLUTION AVAILABLE) M/s Quality Products are going for a purchase of new machine to increase their installed capacity to meet the growing demand. There are three machines under the consideration of management. The relevant details including estimated yearly expenditure and sales are given below. All sales are on cash basis with corporate tax rate of 40%. Interest on capital may be assumed at 10%. Tell about the most profitable investment on the principle of "pay back method".

Machines	**1**	**2**	**3**
Initial investment (cash outflow)	3,00,000	3,00,000	3,00,000
Expected annual sales	5,00,000	4,00,000	4,50,000
Cost of production:			
Direct material	40,000	50,000	48,000
Direct Labour	50,000	30,000	36,000
Factory overheads	60,000	50,000	58,000
Administrative costs	20,000	10,000	15,000
Selling and distribution costs	10,000	10,000	10,000

The economic life of machine No.1 is 2 years, while it is 3 years for the other two. The scrap values are Rs.40,000, Rs.25,000 and Rs.30,000 respectively.

(A) (Ans.: Machine 1 is preferable, Pay back periods: 1.32Yrs, 1.77Yrs & 1.59 Yrs. Respectively)
(SOLVE PROBLEM NO 8 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 4: CALCULATION OF NPV UNDER DIFFEREMNT CONDITIONS

NET PRESENT VALUE:

a) The Net present value technique is a discounted cash flow method that considers the time value of money in evaluating capital investments.

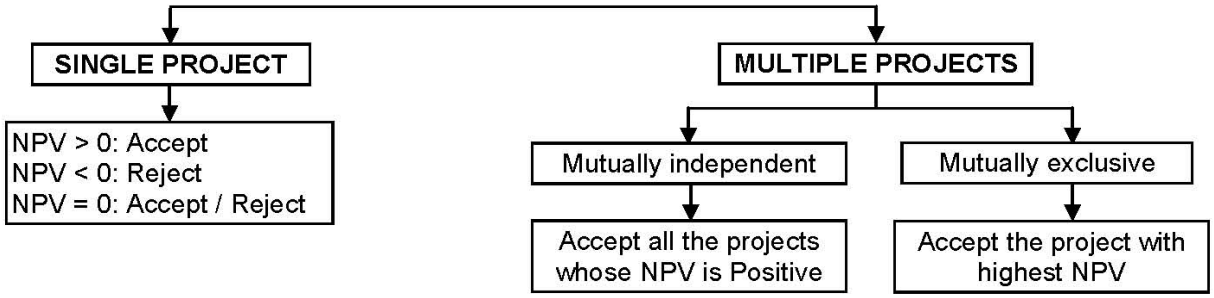
b) The Net present value of a project is the amount, in current value of rupees, the investment earns after paying cost of capital in each period.

c) CALCULATION OF NPV:

NPV = Present value of cash inflows - Present value of cash outflows.
= PV of Operating Cash Inflows + PV of Terminal Cash Inflows - PV of cash outflows.

$$NPV = \left(\frac{C_1}{(1+k)} + \frac{C_2}{(1+k)} + \frac{C_3}{(1+k)^3} + ... + \frac{C_n}{(1+k)^n} \right) - I$$

DECISION RULE:



MODEL 4.1: NPV - BASIC MODEL

PROBLEM 9: (PRINTED SOLUTION AVAILABLE) A company wants to invest in a machinery that would cost Rs.50,000 at the beginning of year 1. It is estimated that the net cash inflows from operations will be Rs.18,000 per annum for 3 years, if the company opts to service a part of the machine at the end of year 1 at Rs.10,000. In such a case, the scrap value at the end of year 3 will be Rs.12,500. However, if the company decides not to service the part, then it will have to be replaced at the end of year 2 at Rs.15,400. But in this case, the machine will work for the 4th year also and get operational cash inflow of Rs.18,000 for the 4th year. It will have to be scrapped at the end of year 4 at Rs.9,000. Assuming cost of capital at 10% and ignoring taxes, will you recommend the purchase of this machine based on the Net Present Value of its cash flows?

If the supplier gives a discount of Rs.5,000 for purchase, what would be your decision? (The present value factors at the end of years 0, 1, 2, 3, 4, 5 and 6 are respectively 1, 0.9091, 0.8264, 0.7513, 0.6830, 0.6209 and 0.5644).

(B) (OLD PM) (ANS.: I. SINCE NPV IS POSITIVE IN CASE OF OPTION 2, IT IS BENEFICIAL FOR THE COMPANY TO PURCHASE THE MACHINERY AND REPLACE THE PART AT THE END OF YEAR 2. II. SINCE SUPPLIER IS PROVIDING DISCOUNT FOR BOTH (SOLVE PROBLEM NO.9 OF ASSIGNMENT PROBLEMS AS REWORK)THE OPTIONS DECISION MAKING WILL REMAIN SAME)

NOTE: _____

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PROBLEM 10: A machine costing Rs.110 lacs has a life of 10 years, at the end of which its scrap value is likely to be Rs.10 lacs. The machine is expected to yield an annual profit after tax of Rs.12 lacs, depreciation being reckoned on straight line basis. Ascertain the net present value of the project in the following situations:

(i) If the cutoff rate is taken as 12%

(ii) If the cutoff rate is taken as 15%

(ANS.: (i) 17,52,000 & (ii) Rs. 2,88,800)

(SOLVE PROBLEM NO 10 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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PROBLEM 11: A Ltd. is considering the question of taking up a new project which requires an investment of Rs.200 lakhs on machinery and other assets. The project is expected to yield the following gross profits (before depreciation and tax) over the next five years:

Year1	1	2	3	4	5
G.P. (Lakhs)	80	80	90	90	75

The cost of raising the additional capital is 12% and the assets have to be depreciated at 20% on 'written down value' basis. The scrap value at the end of the five-year period may be taken as zero. Income tax applicable to the company is 50%. Calculate the Net Present Value of the project and advise the management whether the project has to be implemented.

(A) (ANS.: NPV = RS 18.94 LAKHS. ADVISABLE TO ACCEPT THE PROJECT)

(SOLVE PROBLEM NO 13 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 4.2: NPV - INVESTMENT IN TWO PERIODS

PROBLEM 12: Cello Limited is considering buying a new machine which would have a useful economic life of five years, at a cost of Rs.1,25,000 and a scrap value of Rs.30,000, with 80 percent of the cost being payable at the start of the project and 20 percent at the end of the first year. The machine would produce 50,000 units per annum of a new project with an estimated selling price of Rs.3 per unit. Direct costs would be Rs.1.75 per unit and annual fixed costs, including depreciation calculated on a straight-line basis, would be Rs.40,000 per annum.

In the first year and the second year, special sales promotion expenditure, not included in the above costs, would be incurred, amounting to Rs.10,000 and Rs.15,000 respectively.

Evaluate the project using the NPV method of investment appraisal, assuming the company's cost of capital to be 10 percent. *(A) (NEW SM, OLD SM, RTP, MTP M15) (ANS.: NPV= RS. 31,712)*

(SOLVE PROBLEM NO.12 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 4.3: NPV - INCREMENTAL APROACH

PROBLEM 13: The United Petroleum Ltd (UPL) has a retail outlet of petrol, diesel and petroleum products. Presently, it has two pumps exclusively for petrol, one for non-lead petrol and one for diesel. Free air filling is carried out for vehicles buying fuel from the outlet. The pumps have a useful life of 10 years with no salvage value as the underground tank will be completely corroded and unfit for reuse.

The UPL sells petrol and diesel @ Rs.23 and Rs.10 per liter respectively. The existing annual sale is petrol, 5 lakh litres, and diesel, 2 lakh litres. Its earnings are 4 per cent as commission on sales.

Due to a manifold increase in traffic, the existing pumps are not able to meet the demand during peak hours. The UPL is contemplating installation of additional pumps for diesel and petrol at a cost of Rs.10,00,000 together with additional working capital of Rs.5,00,000. The additional sales of petrol and diesel are expected to be 2 lakh litres and 1 lakh litres per annum respectively. As a result of the installation of the new pump, the operating cost would increase by Rs.24,000 annually by way of salary of the pump operator. Other yearly associated additional costs are estimated to be: insurance @ 1 per cent of the cost of the pump, maintenance cost, Rs.12,000 and power costs, Rs.13,000.

United Petroleum Ltd pays 35 per cent on tax on its income. Depreciation will be on straight line basis and the same is allowed for tax purposes.

The management of UPL seeks your advice on the financial viability of the expansion proposal. Prepare a report for its consideration, assuming 12 per cent required rate of return. *(ANS.: 5,35,287.5)*

(SOLVE PROBLEM NO.16 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 4.4: NPV - EXPANSION AND DIVERSIFICATION OF PROJECT

PROBLEM 14: Elite Cooker Company is evaluating three investment situations: (1) Produce a new line of aluminum skillets, (2) Expand its existing cooker line to include several new sizes, and (3) develop a new, higher-quality line of cookers. If only the project in question is undertaken, the expected present values and the amounts of investment required are:

Project	Investment required (Rs.)	Present value of Future Cash-Flows (Rs.)
1	2,00,000	2,90,000
2	1,15,000	1,85,000
3	2,70,000	4,00,000

If projects 1 and 2 are jointly undertaken, there will be no economies; the investments required and present values will simply be the sum of the parts. With projects 1 and 3, economies are possible in investment because one of the machines acquired can be used in both the production processes. The total investment required for projects 1 and 3 combined is Rs.4,40,000. If projects 2 and 3 are undertaken, there are economies to be achieved in marketing and producing the products but not in investment. The expected present value of future cash flows for projects 2 and 3 is Rs.6,20,000. If all the three projects are undertaken simultaneously, the economies noted will still hold. However, a Rs.1,25,000 extension on the plant will be necessary, as space is not available for all the three projects. Which project or projects should be chosen?

(A)(NEW SM, OLD SM) (ANS.: SINCE COMBINATION 5 HAS HIGHEST NPV IT HAS TO BE SELECTED I.E. ACCEPT THE PROJECTS 1&3.) (SOLVE PROBLEM NO 17 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 4.5: NPV - ADDITONAL INVESTMENT, WORKING CAPITAL, SUBSIDY, TAX & TAX SHIELD, CARRY FORWARD OF LOSS, PV RATIO, VC RATIO

PROBLEM 15: (PRINTED SOLUTION AVAILABLE) XYZ Ltd. is planning to introduce a new product with a project life of 8 years. The project is to be set up in Special Economic Zone (SEZ), qualifies for one time (at its starting) tax free subsidy from the State Government of Rs.25,00,000 on capital investment. Initial equipment cost will be Rs.1.75 crores. Additional equipment costing Rs.12,50,000 will be purchased at the end of the third year from the cash inflow of this year. At the end of 8 years, the original equipment will have no resale value, but additional equipment can be sold for Rs.1,25,000. A working capital of Rs.20,00,000 will be needed and it will be released at the end of eighth year. The project will be financed with sufficient amount of equity capital.

The sales volumes over eight years have been estimated as follows:

Year	1	2	3	4 - 5	6 - 8
Units	72,000	1,08,000	2,60,000	2,70,000	1,80,000

A sales price of Rs.120 per unit is expected and variable expenses will amount to 60% of sales revenue. Fixed cash operating costs will amount Rs.18,00,000 per year. The loss of any year will be set off from the profits of subsequent two years. The company is subject to 30 percent tax rate and considers 12 percent to be an appropriate after tax cost of capital for this project. The company follows straight line method of depreciation.

Required: Calculate the Net Present Value of the project and advise the management to take appropriate decision.

The PV factors at 12% are

Year	1	2	3	4	5	6	7	8
PVF	0.893	0.797	0.712	0.636	0.567	0.507	0.452	0.404

(A) (ANS.: NPV = RS.1,05,56,539) (SOLVE PROBLEM NO. 15 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 4.6: NPV - PROJECT BEP

PROBLEM 16: X Co Ltd is evaluating the following investment:

Initial investment		End of life recovery	
Fixed assets	Rs. 60,000	Fixed Assets	Rs. 10,000
Working capital	Rs. 20,000	Working capital	Rs. 20,000
Project life	5 years		

Annual operations		Additional information	
Unit sales	2,000	Income tax rate	40%
Unit selling price	Rs. 30	Time Value of Money	14%
Unit Variable costs	Rs. 10	Use Straight Line Dep.	
Annual cash fixed costs	Rs. 10,000		

Compute (a) the project's net present value and suggest whether the project can be accepted. (b) The minimum yearly sales required providing a 14% return on initial investment.

(A) (ANS.: A.11096, B. 1731 AND C. 6,923)
(SOLVE PROBLEM NO.13 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 4.7: NPV - INVESTMENT ON MULTIPLE FIXED ASSETS, OPERATIONS BEGING IN THE MIDDLE OF THE LIFE OF THE ASSET

PROBLEM 17: (PRINTED SOLUTION AVAILABLE) Santosh & Co. is considering setting up a new unit. The following data has been compiled by the company for the purpose of determining the acceptability of the proposal for setting up the new unit.

A. Land:

a) To be paid at the time of purchase (t=0) Rs.2 lakhs

b) 1st, 2nd & 3rd installments at the end of next 3 following years.1 lakh each installment

B. Factory buildings (Total Rs. 20 lakhs)

a) Initial payment on signing of contract Rs.2 lakhs

b) At the end of year 2 Rs.10 lakhs

c) Balance at the end of year 3 Rs.8 lakhs

C. Plant, Machinery & Equipment:

To be paid at the beginning of - Year 4 Rs.15 lakhs

- Year 5 Rs.5 lakhs

D. Extra margin for working capital (at the end of year 5) - Rs.1 Lakh.

E. Operations will begin in the 6th year and will continue for 10 years upto year 15. Assume revenue and costs t the end of each year.

F. Buildings, Plant, Machinery and equipment will be depreciated on straight line method over the 10 years starting form year 6, as under:

a) Buildings @ 5%

b) Plant, machinery and equipment @ 10%

G. Buildings are expected to be sold for Rs.6 lakhs and land for Rs.8 lakhs at the end.

H. Plant, Machinery & Equipment will have a salvage value of Rs.2 lakhs.

I. Cost of Capital is 12%

J. Other operating data:

a) Annual Sales - Rs.30 lakhs

b) Variable costs of operation - Rs.12 lakhs.

c) Fixed costs (excluding depreciation) - Rs.8 lakhs; and Tax rate - 50%.

Advise whether the company should accept the project or reject it on the basis of NPV of the project.

(A) (ANS.: NPV=RS. 10.6365 LAKHS) (SOLVE PROBLEM NO 14 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 5: PROFITABILITY INDEX METHOD / DESIRABILITY FACTOR

PROFITABILITY INDEX:

a) PI is the benefit (in present value terms) per rupee invested in the proposal.

b) This technique which is a variant of NPV technique is also known as 'Desirability factor' or "Benefit-cost ratio" or "Present Value Index".

c) The PI is also based upon the basic concept of discounting the future cash flows and is ascertained by comparing the present value of future cash inflows with the present value of future cash outflows.

d) PI is calculated by dividing the former by the latter.

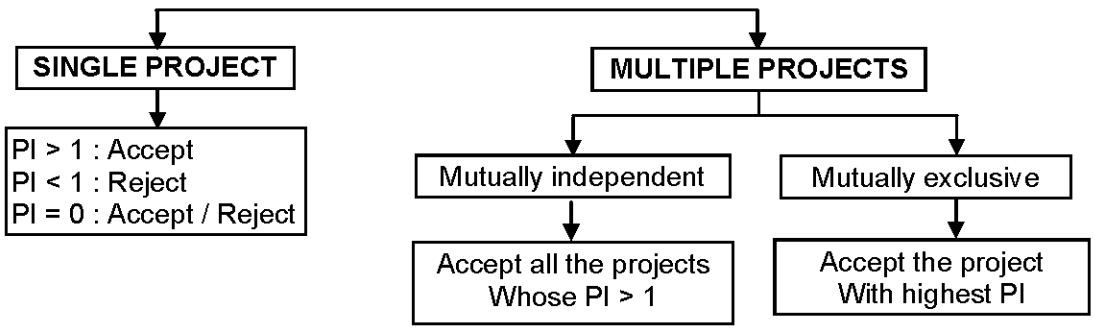
Mathematically:

$$PI = \frac{\text{Sum of discounted cash in flows}}{\text{Initial cash outlay Or Total discounted cash outflow (as the case may)}}$$

(or)

$$PI = \frac{\text{Total Present Value of cash inflows}}{\text{Total Present Value of cash outflows}} = \sum_{i=1}^{n} \frac{CF_1}{(1+K)^i} \div C_o$$

DECISION RULE:



PROBLEM 18: Suppose we have three projects involving discounted cash outflow of Rs. 5,50,000, Rs. 75,000 and Rs. 1,00,20,000 respectively. Suppose further that the sum of discounted cash inflows for these projects are Rs. 6,50,000, Rs. 95,000 and Rs. 1,00,30,000 respectively. Calculate the desirability factors for the three projects. *(A) (NEW SM, OLD SM) (ANS.: I) 1.18, II) 1.27 III) 1.001)*

(SOLVE PROBLEM NO. 19 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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PROBLEM 19: FH hospital is considering purchasing a CT-Scan machine. Presently the hospital is outsourcing the CT-Scan machine and is earning commission of Rs.15,000 per month (net of tax). The following details are given regarding the machine:

	Rs.
Cost of CT-Scan machine	15,00,000
Operating Cost per annum (excluding depreciation)	2,25,000
Expected revenue per annum	7,90,000
Salvage value of the machine (after 5 years)	3,00,000
Expected life of the machine	5 years

Assuming tax rate @ 30%, whether it would be Profitable for the hospital to purchase the machine?

Give your recommendation under:

i) Net Present Value Method, and

ii) Profitability Index Method

Year	1	2	3	4	5
PV factor	0.893	0.797	0.712	0.636	0.567

(A) (M14 - 8M, SIMILAR:M18(0)-8M) (ANS.: (I) NPV = RS. (2,93,462.50), (II) PI = 0.804)

(SOLVE PROBLEM NO. 18 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 6: CALCULATION OF IRR

INTERNAL RATE OF RETURN:

a) **Internal rate of return** for an investment proposal is the discount rate that equates the present value of the expected net cash flows with the initial cash outflow.

b) The IRR of a proposal is defined as the discount rate which produces a zero NPV i.e. the IRR is the discount rate which will equate the present value of cash inflows with the present value of cash outflows

c) This IRR is then compared to a criterion rate of return that can be the organization's desired rate of return for evaluating capital investments.

OTHER NAMES:

a) Yield on investment,

b) Marginal efficiency of capital,

c) Rate of return over cost,

d) Time adjusted rate of internal return,

e) Productivity of capital,

f) Marginal rate of return.

CALCULATION OF IRR: The procedure for computing Internal Rate of Return may vary with the pattern of net cash flows over the useful life of an investment.

1. **SCENARIO I: FOR AN INVESTMENT WITH SINGLE CASH FLOW**

   Step 1: Future Value = PV X FVF (FVF = FV/PV)

   Step 2: Trace the rate of interest corresponding to x number of years

2. **SCENARIO II: FOR AN INVESTMENT WITH UNIFORM CASH FLOWS OVER ITS LIFE**

Step 1: Here we got multiple inflows.

We know that, at IRR, NPV is zero.

Present value of inflows = PV of outflows.

Periodic cash flow X PVAF = PV of outflows.

PVAF = PV of out flows / Periodic cash flow.

Step 2: Trace the interest rate using PVAF table.

3. **SCENARIO III: FOR AN INVESTMENT WITH NOT UNIFORM CASH FLOWS OVER ITS LIFE.**

There are 2 methods for calculation of IRR:

a) **Trail & Error method:**

- Assume one guess rate and calculate NPV at that first guess rate.
- Assume another guess rate. Calculate NPV at the 2nd guess rate. (If NPV becomes Zero in step a itself, no need to come to step b)
- Continue till you get NPV = 0.
- The only problem with this method is that it is based on trail and error approach.

b) **Interpolation:**

Let LR = Lower rate,

HR = Higher rate.

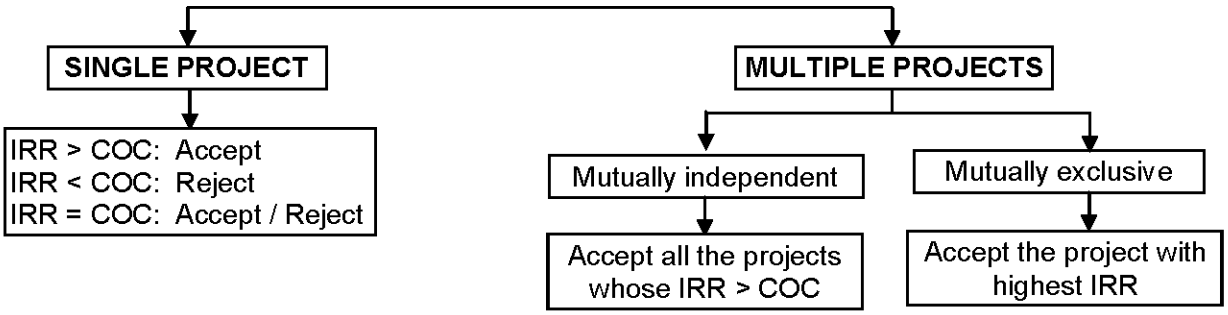
It is preferable to take HR in such a way that NPV is negative. Using interpolation,

$$IRR = LR + \frac{\text{NPV at LR}}{\text{NPV at LR} - \text{NPV at HR}} X (HR - LR)$$

4. **SCENARIO IV: FOR AN INVESTMENT WITH INFINITE UNIFORM CASH FLOWS OVER ITS LIFE (PERPETUITY)**

IRR = Perpetuity / Initial outlay X 100.

DECISION RULE:



Where, COC = Cost of capital

PROBLEM 20: Computation of IRR in four situations.

1. Find the IRR of a project with a cash outflow of Rs.20,000 in year 0 and a cash inflow two years later of Rs. 25,992.
2. A Ltd. is evaluating a project involving an outlay of Rs. 10,00,000 resulting in an annual cash inflow of Rs. 2,50,000 for 6 years. Assuming salvage value of the project is zero determining the IRR of the project.
3. Find the IRR of a project with a cash outflow in year 0 of Rs.50,000 and which produces cash inflows in perpetuity of Rs.8,750

4. Find the IRR of the project whose cash flow is given below:

Year	0	1	2	3	4	5
Cash flows	(1,36,000)	30,000	40,000	60,000	30,000	20,000

(A) (NEW SM, OLD SM) (ANS.: IRR IN SITUATION 1. 14%, 2. 12.98%, 3. 15.289 %, 4. 10.70%)

(SOLVE PROBLEM NO.21 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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PROBLEM 21: A company proposes to install machine involving a capital cost of Rs.3,60,000. The life of the machine is 5 years and its salvage value at the end of the life is nil. The machine will produce the net operating income after depreciation of Rs.68,000 per annum. The company's tax rate is 45%.

The Net Present Value factors for 5 years are as under:

Discounting rate:	14	15	16	17	18
Cumulative factor:	3.43	3.35	3.27	3.20	3.13

You are required to calculate the Internal Rate of Return of the proposal

(B) (NEW SM, OLD SM) (ANS.: IRR = 15.74%)

(SOLVE PROBLEM NO.22 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 7: PAYBACK PERIOD RECIPROCAL

PAYBACK PERIOD RECIPROCAL:

a) As the name indicates it is the **reciprocal of payback period**.

b) It is, however, argued that the reciprocal of the payback would be a **close approximation of the Internal Rate of Return** (later discussed in detail) if the life of the project is at least twice the payback period and the project generates equal amount of annual cash inflows.

c) In practice, the payback reciprocal is a **helpful tool for quickly estimating the rate of return** of a project provided its life is at least twice the payback period.

$$\text{Payback reciprocal} = \frac{\text{Average Annual Cash Inflow}}{\text{Initial investment}}$$

d) If a proposal has a **payback period of 4 years** then its payback period **reciprocal is 25%.** Higher the payback period reciprocal (and hence lower the payback period), more worth while the proposal is.

e) There is no positive relevance of the **payback period reciprocal** except that it is in **percentage form.**

$$\text{Payback period reciprocal} = (1/\text{Payback period}) \times 100$$

PROBLEM 22: A project requires an initial investment of Rs.20,000 and it would give annual cash inflow of Rs.4,000. The useful life of the project is estimated to be 5 years. Compute Payback Reciprocal.

(B) (NEW SM, OLD SM) (ANS.: PAYBACK RECIPROCAL = 20%)

(SOLVE PROBLEM NO. 20 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 8: DISCOUNTED PAYBACK PERIOD (DPBP)

DISCOUNTED PAY BACK PERIOD:

a) Discounted payback period is the payback period which is calculated from **discounted the cash flows by a predetermined rate.**

b) This method is a combination of **original payback** method and the **discounted cash flow technique.**

c) DPBP is **superior** because in addition to the recovery of original investment, **the time value of money** is also considered. In the discounted payback method, a project is **acceptable if its discounted payback is less than target payback period.**

PROBLEM 23: ABC manufacturing company uses discounted payback period to evaluate Investment in capital asset. The company expects annual cash inflows of 6000 from an Investment of 30,000 for the life of ten years. The companies cost of capital is 15%. *(B) (NEW SM, OLD SM) (ANS.: RS. 30,114)*

(SOLVE PROBLEM NO. 23 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 9: CAPITAL RATIONING

1. **Resource Constraint:** There may be situations where a Firm has a number of projects that yield a positive NPV. However, the most important resource in investment decisions, i.e. funds, are not fully available to undertake all the projects. Such a situation is considered as a Resource Constraint situation.

2. **Capital Rationing:** In case of restricted availability of funds, the objective of the Firm is to maximize the wealth of Shareholders with the available funds. Such investment planning is called Capital Rationing. There are two possible situations of Capital Rationing

   a) Generally, Firms fix up maximum amount that can be invested in capital projects, during a given period of time, say a year. This budget ceiling imposed internally is called as **Soft Capital Rationing.**

   b) There may be a market constraint on the amount of funds available for investment during a period. This inability to obtain funds from the market, due to external factors is called **Hard Capital Rationing.**

3. **NPV Maximisation:** In a Capital Rationing situation, the Firm should allocate the limited funds available to maximize its NPV. The following principles may be applied in selecting the appropriate investment proposals / combinations —

Nature of Project	Indivisible	Divisible
Meaning	Investment should be made in full. Partial or Proportionate investment is not possible.	Partial Investment is also possible, and proportionate NPV can be obtained.
Steps involved in Decision—making	• Determine the combination of projects to utilize amount available. • Compute NPV of each combination. • Select combination with maximum NPV.	• Compute PI of various Projects and rank them based on PI. • Projects are selected based on maximum Profitability Index.

PROBLEM 24: Master Minds has a capital budget of Rs.20,00,000 for the year 1999. It has before it the following 6 proposals for which the necessary information is provided here under.

Proposal	Outlay (Rs.)	NPV (Rs)	IRR
A	7,00,000	3,00,000	20.0%
B	2,50,000	1,60,000	17.0%
C	5,00,000	2,00,000	19.0%
D	2,00,000	1,00,000	17.5%
E	5,50,000	4,50,000	18.0%
F	7,50,000	-2,50,000	12.0%

Find out the ranking of the proposals given that:

a) The projects are indivisible, and

b) The projects are divisible

Also evaluate the ranking and make a final selection.

(A) (ANS.: A. A-IV, B-II, C-V, D-III, E-I, B. INVESTMENT PACKAGE WITH E, B, D, A HAS MORE NPV)

(SOLVE PROBLEM NO. 25 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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PROBLEM 25: (PRINTED SOLUTION AVAILABLE) Shiva Limited is planning its capital investment program for next year. It has five projects all of which give a positive NPV at the company cut-off rate of 15 percent, the investment outflows and present values being as follows:

Project	Investment	NPV @ 15%
	Rs.'000	Rs.'000
A	(50)	15.4
B	(40)	18.7
C	(25)	10.1
D	(30)	11.2
E	(35)	19.3

The company is limited to a capital spending of Rs.1,20,000.

You are required to optimize the returns from a package of projects within the capital spending limit. The projects are independent of each other and are divisible (i.e. part-project is also possible).

(B) (NEW SM, OLD SM) (ANS.: THE HIGHEST POSSIBLE AMOUNT OF NPV IS RS 55,567/- WITH THE AVAILABLE FUNDS OF RS.1,20,000)

(SOLVE PROBLEM NO. 24 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 10: FINDING OUT MISSING VALUES

PROBLEM 26: A proposal to invest in project, which has a useful life of 5 years and no salvage value at the end of useful life, is under consideration of a firm. It is anticipated that the project will generate a steady cash inflow of Rs.70,000 per annum. After analyzing other facts of the project, following information was revealed:

Internal rate of return 13%

Desirability factor 1.07762

You are required to find out:

i) Cost of project

ii) Cost of capital

iii) Payback period

iv) Net present value

Present value factors at different rates are given as under:

Year	10%	11%	12%	13%
1	0.909	0.901	0.893	0.885
2	0.826	0.812	0.797	0.783
3	0.751	0.731	0.712	0.693
4	0.683	0.659	0.636	0.613
5	0.621	0.593	0.567	0.543
Total	3.790	3.696	3.605	3.517

Note: Use only above present values to solve this question. *(M 18 (OLD)-8M)*

(SOLVE PROBLEM NO. 26 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 11: COMPREHENSIVE PROBLEMS

MODEL 11.1: ESTIMATION OF PBP, NPV, IRR OF THE PROJECT

PROBLEM 27: (PRINTED SOLUTION AVAILABLE) Hind lever Company is considering a new product line to supplement its range line. It is anticipated that the new product line will involve cash investments of Rs.7,00,000 at time 0 and Rs.10,00,000 in year 1. After-Tax cash inflows of Rs.2,50,000 are expected in year 2, Rs.3,00,000 in year 3, Rs.3,50,000 in year 4 and Rs.4,00,000 each year thereafter through year 10. Although the product line might be viable after year 10, the company prefers to be conservative and end all calculations at that time.

a) If the required rate of return is 15 percent, what is the Net Present Value of the project? Is it acceptable?

b) What would be the case if the required rate of return were 10 percent?

c) What is its internal rate of return?

d) What is the project's payback period?

(A) (NEW SM, OLD SM) [ANS.: A) NPV: RS -1,18,200, SINCE NPV IS NEGATIVE IT IS NOT ADVISABLE TO ACCEPT THE PROPOSAL B) NPV: RS 2,51,450 C)IRR: 13.40% D)PBP: 6Y]

(SOLVE PROBLEM NO. 27 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 11.2: ESTIMATION OF NPV, IRR, PI & DPBP EACH OF THE MACHINES

PROBLEM 28: (PRINTED SOLUTION AVAILABLE) X Ltd. is considering selecting a machine out of two mutually exclusive machines. The company's cost of capital is 15 per cent and corporate tax rate is 30 per cent. Other information relating to both machines are as follows:

	Machine - I	Machine - II
Cost of Machine	Rs. 30,00,000	Rs. 40,00,000
Expected Life	10 years	10 years
Annual Income (Before Tax and Depreciation)	Rs. 12,50,000	Rs.17,50,000

Depreciation is to be charged on straight line basis:

You are required to calculate:

i) Discounted Pay Back Period

ii) Net Present Value

iii) Profitability Index

The present value factors of Re.1 @ 15% are as follows:

Year	1	2	3	4	5
PV factor @ 15%	0.870	0.756	0.658	0.572	0.497

(A) (OLD PM, M13, MTP MAR17-8M, MTP MAR18 (OLD)-8M)

(ANS.: I) 4.5087 YEARS OR 4 YEARS 6.10 MONTHS, 4.2374 YEARS OR 4 YEARS 2.85 MONTHS, II) RS. 2,35,645, RS. 5,09,785, III) 1.08, 1.03) (SOLVE PROBLEM NO. 28 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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ASSIGNMENT PROBLEMS

MODEL 1: CALCULATION OF CTAT

PROBLEM 1: X Ltd. is manufacturing electronic motors fitted in the desert coolers. Its annual turnover is Rs.30 crore and cash expenses to generate this sale are Rs.25 crore. Tax rate is 30%.

Requirement: Find the cash flows if,

i) There is no depreciation

ii) Depreciation amounted to Rs.1.5 crores per annum. *(B) [ANS.: I) RS.3.50 CRORES, II) RS. 3.95 CRORES]*

PROBLEM 2 : A firm buys an asset costing Rs.5,00,000 and expects operating profits (before depreciation @ 25% WDV and Tax @ 40%) of Rs.2,00,000 p.a. for the next four years after which the asset would be disposed off for Rs.1,50,000. Find out the cash flows for different years.

iii) *(B) (ANS.: CASH FLOWS YEAR 1= RS. 1,65,000; YEAR 2 = RS. 1,57,500; YEAR 3 = RS. 1,48,125; YEAR 4 = RS. 1,41,094; TERMINAL CASH FLOWS= RS. 1,53,281)*

PROBLEM 3: Following is the income statement of a project on the basis of which calculates the annual cash inflows.

Particulars	Rs.	Rs.
Net Sales revenue		10,00,000
- Cost of goods sold	4,00,000	
- General Expenses	2,00,000	
- Depreciation	1,00,000	7,00,000
Profit before interest and taxes (PBIT)		3,00,000
- Interest		1,00,000
Profit before tax		2,00,000
-Tax @ 40%		80,000
Profit after tax		1,20,000

iv) *(M03) (A) (ANS.: ANNUAL CASH INFLOW RS. 2,80,000)*

MODEL 2: ACCOUNTING (BOOK) RATE OF RETURN / AVERAGE RATE OF RETURN METHOD (ARR)

PROBLEM 4 : From the following information determine the ARR of the two machines:3

	Machine A	Machine B
Original cost	50,000	50,000
Additional investment in net working capital	4,000	14,000
Estimated life in years	5 years	5 years

Estimated salvage value	2,000	2,000
Average income tax rate	40%	40%
Annual estimated income after depreciation and tax:		
1st year	5,000	25,000
2nd year	10,000	20,000
3rd year	15,000	15,000
4th year	20,000	10,000
5th year	25,000	5,000
Total	75,000	75,000

Depreciation has been charged on straight-line basis.

(B) (ANS.: ARR OF MACHINE A: 50%, MACHINE B: 37.5%)

PROBLEM 5: Siddhi Ltd. is going to invest in a project a sum of Rs.10,00,000 having a life span of 3 years. Salvage value of machine is Rs.4, 00,000. The Profit before Depreciation for each year is Rs.4,00,000.

Requirement:

1. ARR on the basis of
   a) Annual investment
   b) Total investment
   c) Average investment
2. Compute ARR if, additional working capital of Rs.2,00,000 is required. *(A)*

(ANS.: 1(A) ARR ON THE BASIS OF ANNUAL INVESTMENT = 26.11%, TOTAL INVESTMENT 1(B) = 20%, AVERAGE INVESTMENT 1(C) = 28.57%, 2) ARR= 22.22%)

MODEL 3: PAYBACK PERIOD METHOD

PROBLEM 6: Consider the following projects:

Cash flows (Rs.'000)					
Project	**C_0**	**C_1**	**C_2**	**C_3**	**C_4**
A	-1,000	+600	+200	+200	+1,000
B	-1,000	+200	+200	+600	+1,000
C	-300	+100	+100	+100	+600
D	-300	0	0	+300	+600

a) Calculate the payback period for each project.

b) If the standard payback period is 2 year which project will you select? Will your answer be different if the standard payback is 3 years? *(A)*

[ANS.: A) PBP FOR A= 3YRS, B= 3YRS, C = 3YRS AND D = 3YRS RESPECTIVELY, B) IF IT IS 2 YRS THEN IT IS ADVISABLE TO REJECT ALL THE PROJECTS. IF IT IS 3YRS THEN THE PROJECTS CAN EITHER BE ACCEPTED OR REJECTED]

PROBLEM 7: From the following situations calculate the payback period.

SITUATION 1: An Investment requires a cash outflow of Rs.6,00,000 and is expected to generate cash inflow of Rs. 1,50,000 p.a for 8 years.

SITUATION 2: Cash inflows from an investment proposal are Rs. 10,000, Rs.12,000, Rs.15,000, Rs. 5,000 and Rs. 5,000 over next 5 years and the cost of proposal is Rs. 37,000.

(B) (ANS.: 1) PAYBACK PERIOD 4 YRS, 2) 3 YRS)

PROBLEM 8: M/s Hawkins are going for a purchase of new machine to increase their installed capacity to meet the growing demand. There are 3 machines under the consideration of management. The relevant details including estimated yearly expenditure and sales are given below.

All sales are on cash basis with corporate tax rate of 20%. Interest on capital may be assumed at 12%. Tell about the most profitable investment on the principle of "pay back method".

Machines	1	2	3
Initial investment (cash outflow)	5,00,000	5,00,000	5,00,000
Expected annual sales	10,00,000	7,50,000	12,50,000
Cost of Production:			
Direct material	1,00,000	75,000	1,25,000
Direct Labour	1,25,000	1,00,000	1,50,000
Factory overheads	1,50,000	1,25,000	1,75,000
Administrative costs	40,000	30,000	50,000
Selling and distribution costs	20,000	10,000	30,000

The economic life of Machine No.1 is 4 years, while it is 5 years for the other two. The scrap values are Rs. 75,000; Rs. 45,000 and Rs. 50,000 respectively.

(A) (ANS.: MACHINE 1 IS PREFERABLE, PAY BACK PERIODS: 1.176 YRS, 1.68 YRS & 1.597 YRS. RESPECTIVELY)

MODEL 4: CALCULATION OF NPV UNDER DIFFERENT CONDITIONS

4.1: NPV - BASIC MODEL

PROBLEM 9: A company wants to invest in a machinery that would cost Rs. 2,00,000 at the beginning of year 1. It is estimated that the net cash inflows from operations will be Rs. 80,000 per annum for 3 years, If the company opts to service a part of the machine at the end of year 1 at Rs.50,000. In such a case, the scrap value at the end of year 3 will be Rs. 60,000 .However, if the company decides not to service the part, then it will have to be replaced at the end of year 2 at Rs.70,000. But in this case, the machine will work for the 4^{th} year also and get operational cash inflow of Rs. 80,000 for the 4^{th} year. It will have to be scrapped at the end of year 4 at Rs.30,000. Assuming cost of capital at 12% and ignoring taxes, will you recommend the purchase of this machine based on the Net Present Value of its cash flows?

If the supplier gives a discount of Rs.20,000 for purchase, what would be your decision? (The present value factors at the end of years 0, 1, 2, 3, 4, 5 and 6 are respectively 1, 0.893, 0.797, 0.712, 0.636, 0.567 and 0.507 @ 12%).

(B) (ANS.: I. SINCE NPV IS POSITIVE IN CASE OF OPTION 2, IT IS BENEFICIAL FOR THE COMPANY TO PURCHASE THE MACHINERY AND REPLACE THE PART AT THE END OF YEAR 2. II. SINCE SUPPLIER IS PROVIDING DISCOUNT FOR BOTH THE OPTIONS DECISION MAKING WILL REMAIN SAME)

4.2: NPV - SHIFTING OF STORES DEPARTMENT NOW OR AFTER 1 YEAR

PROBLEM 10: ABC Ltd. is considering shifting its stores departments from the present location to another. This shifting will require some investment in alterations and new racks. The finance manager is of the view that the shifting can either be taken now or can even be postponed for a year.

Further, it is assessed that the shifting benefits will no doubt accrue forever but benefits accruing during next 2 years only are relevant for the decision. Evaluate the proposal to shift the stores department now or after a year in view of the following information regarding cash flows.

	Year 0	Year 1	Year 2	Year 3
Shifting	- 250	160	170	-
Shifting after a year	-	-350	200	250
PVF(15%,n)	1.000	.870	.756	.658

(A) (ANS.: OPTION I: NPV 17.72, OPTION II: NPV (11.2))

4.3: NPV - EXPANSION OF PROJECT

PROBLEM 11: A company is considering the proposal of taking up a new project which requires an investment of Rs.400 lakhs on machinery and other assets. The project is expected to yield the following earnings (before depreciation and taxes) over the next five years:

Year	Earnings (Rs. in lakhs)
1	160
2	160
3	180
4	180
5	150

The cost of raising the additional capital is 12% and assets have to be depreciated at 20% on 'Written down Value' basis. The scrap value at the end of the five years' period may be taken as zero. Income-tax applicable to the company is 50%.

You are required to calculate the net present value of the project and advise the management to take appropriate decision. Also calculate the Internal Rate of Return of the Project.

Note: Present values of Rs.1 at different rates of interest are as follows:

Year	10%	12%	14%	16%
1	0.91	0.89	0.88	0.86
2	0.83	0.80	0.77	0.74
3	0.75	0.71	0.67	0.64
4	0.68	0.64	0.59	0.55
5	0.62	0.57	0.52	0.48

(B) (PM) (ANS.: NPV AT 12% = RS 38.62 LAKHS, SO IT IS ADVISE TO IMPLEMENT PROJECT, IRR = 15.61%)

NPV- INVESTMENT IN TWO PERIODS

PROBLEM 12: Montex Limited is considering buying a new machine which would have a useful economic life of five years, at a cost of Rs.4,50,000 and a scrap value of Rs. 75,000 , with 70 percent of the cost being payable at the start of the project and 30 percent at the end of the first year. The machine would produce 60,000 units per annum of a new project with an estimated selling price of Rs. 10 per unit. Direct costs would be Rs.4 per unit and annual fixed costs, including depreciation calculated on a straight-line basis, would be Rs.1,00,000 per annum.

In the first year and the second year, special sales promotion expenditure, not included in the above costs, would be incurred, amounting to Rs.60,000 and Rs.75,000 respectively.
Evaluate the project using the NPV method of investment appraisal, assuming the company's cost of capital to be15 percent.

NPV - PROJECT BEP

PROBLEM 13: A Company is considering whether is should spend Rs.4 lacs on a project to manufacture and sell a new product. The unit variable cost of the product is Rs.6. It is expected that the new product can be sold at Rs.10 per unit. The annual fixed costs (only cash) will be Rs.20,000. The project will have a life of six years with a scrap value of Rs.20,000. The cost of capital of the company is 15%. The only uncertain factor is the volume of sales. To start with the company expects to sell at least 40,000 units during the first year. You are required to find out:

a) Net present Value of the project based on the sales expected during the first year and on the assumption that it will continue at the same level during the remaining years.

b) The minimum volume of sales required to justify the project.

(ANS.: a) NPV RS. 1,38,400, SINCE NPV IS POSITIVE IT IS ADVISABLE TO ACCEPT, b) 30,856 UNITS PA)

NPV - INVESTMENT ON MULTIPLE FIXED ASSETS, OPERATIONS BEING IN THE MIDDLE OF THE LIFE OF THE ASSET

PROBLEM 14: A company is engaged in evaluating an investment project which requires an initial cash outlay of Rs.2,50,000 on equipment. The project's economic life is 10 years and its salvage value is Rs.30,000. It would require current assets of Rs.50,000. An additional investment of Rs. 60,000 would also be necessary at the end of five years to restore the efficiency of the equipment. This would be written off completely over the last five years. The project is expected to yield annual

profit (before tax) of Rs.1,00,000. The company follows the sum of the year's digit method of depreciation. Income-tax rate is assumed to be 40%. Should the project be accepted if the minimum required rate of return is 20%. *(ANS: NPV RS. (6,662), SINCE NPV IS NEGATIVE IT IS NOT ADVISABLE TO ACCEPT)"*

NPV - ADDITIONAL INVESTMENT, WORKING CAPITAL,SUBSIDY, ADDITIONAL INVESTMENT, WORKING CAPITAL, VC RATIO, PV RATIO

PROBLEM 15: Sager industries are planning to introduce a new product with a project life of 8 years. The project, to be set up in a backward region, qualifies for a one-time (as its starting) tax-free subsidy from the government of Rs.20 lakhs. Initial equipment cost will be Rs.140 lakhs and additional equipment costing Rs.10 lakhs will be needed at the beginning of the third year. At the end of 8 years the original equipment will have no resale value, but the supplementary equipment can be sold for Rs.1 lakh. A working capital of Rs.15 lakhs will be needed. The sales volumes over the eight-year period have been forecasted as follows:

Year	Units	Lakhs
1	80,000	30
2	1,20,000	15
3-5	3,00,000	10
6-8	2,00,000	4

A sale price of Rs.100 per unit is expected and variable expenses will amount to 40% of sales revenue. Fixed cash operating costs will amount to Rs.16 lakhs per year. In addition, an extensive advertising campaign will be implemented, requiring annual outlays as above. The company is subject to 50% tax rate and considers 12% to be an appropriate after-tax cost of capital for this project. The company follows the straight-line method of depreciation. Should the project be accepted? Assume that the company has enough income from its existing products

MODEL 4.3: NPV - INCREMENTAL APROACH

PROBLEM 16: The PVR has a retail outlet of petrol, diesel and petroleum products. Presently, it has two pumps exclusively for petrol, one for non-lead petrol and one for diesel. Free air filling is carried out for vehicles buying fuel from the outlet. The pumps have a useful life of 10 years with no salvage value as the underground tank will be completely corroded and unfit for reuse.

The UPL sells petrol and diesel @ Rs.80 and Rs.60 per liter respectively. The existing annual sale is petrol, 10 lakh litres, and diesel, 5 lakh litres. Its earnings are 6 per cent as commission on sales.

Due to a manifold increase in traffic, the existing pumps are not able to meet the demand during peak hours. The PVR is contemplating installation of additional pumps for diesel and petrol at a cost of Rs.80,00,000 together with additional working capital of Rs.20,00,000. The additional sales of petrol and diesel are expected to be 6 lakh litres and 3.5 lakh litres per annum respectively. As a result of the installation of the new pump, the operating cost would increase by Rs.1,50,000 annually by way of salary of the pump operator. Other yearly associated additional costs are estimated to be: insurance @ 3 per cent of the cost of the pump, maintenance cost, Rs.1,00,000 and power costs, Rs.1,75,000.

PVR pays 40 per cent on tax on its income. Depreciation will be on straight line basis and the same is allowed for tax purposes.

The management of PVR seeks your advice on the financial viability of the expansion proposal. Prepare a report for its consideration, assuming 15 per cent required rate of return.

(ANS.: 25.646 LAKHS)

NPV- EXPANSION AND DIVERSIFICATION OF PROJECT

PROBLEM 17: Divine Cooker Company is evaluating three investment situations: (1) Produce a new line of aluminum skillets, (2) Expand its existing cooker line to include several new sizes, and (3) develop a new, higher-quality line of cookers. If only the project in question is undertaken, the expected present values and the amounts of investment required are:

Project	Investment required (Rs.)	Present value of Future Cash-Flows (Rs.)
1	4,00,000	5,80,000
2	2,30,000	3,70,000
3	5,40,000	8,00,000

If projects 1 and 2 are jointly undertaken, there will be no economies; the investments required and present values will simply be the sum of the parts. With projects 1 and 3, economies are possible in investment because one of the machines acquired can be used in both the production processes. The total investment required for projects 1 and 3 combined is Rs.9,00,000. If projects 2 and 3 are undertaken, there are economies to be achieved in marketing and producing the products but not in investment. The expected present value of future cash flows for projects 2 and 3 is Rs.12,70,000. If all the three projects are undertaken simultaneously, the economies noted will still hold. However, a Rs.2,50,000 extension on the plant will be necessary, as space is not available for all the three projects. Which project or projects should be chosen? *(A)*

(ANS.: SINCE COMBINATION 2 & 3 HAS HIGHEST NPV IT HAS TO BE SELECTED I.E. ACCEPT THE PROJECTS 2 & 3: NPV: RS. 5,00,000)

MODEL 5: PROFITABILITY INDEX METHOD / DESIRABILITY FACTOR

PROBLEM 18: A hospital is considering to purchase a diagnostic machine costing Rs.80,000. The projected life of the machine is 8 years and has an expected salvage value of Rs.6,000 at the end of 8 years. The annual operating cost of the machine is Rs.7,500. It is expected to generate revenues of Rs.40,000 per year for eight years. Presently, the hospital is outsourcing the diagnostic work and is earning commission income of Rs.12,000 per annum (net of taxes).

Required: Whether it would be profitable for the hospital to purchase the machine? Give your recommendation under:

(i) Net Present Value method **(ii)** Profitability Index method.

PV factors at 10% are given below:

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467

(A) (OLD PM) [ANS.: (I) NPV IS NEGATIVE RS. (5,055.64), (II) PI IS 0.937, IT IS ADVISABLE TO THE HOSPITAL NOT TO PURCHASE THE DIAGNOSTIC MACHINE]

PROBLEM 19: Suppose we have three projects involving discounted cash outflow of Rs. 7,50,000, Rs. 3,50,000 and Rs. 5,50,000 respectively. Suppose further that the sum of discounted cash inflows for these projects are Rs. 8,55,000, Rs. 4,25,000 and Rs. 725,000 respectively. Calculate the desirability factors for the three projects. *(A) (NEW SM, OLD SM) (ANS.: I) 1.14 II) 1.21 III) 1.32)*

MODEL 6: PAYBACK PERIOD RECIPROCAL

PROBLEM 20: A project requires an initial investment of Rs1,00,000 and it would give annual cash inflow of Rs.25,000. The useful life of the project is estimated to be 6 years. Compute Payback Reciprocal. *(B) (NEW SM, OLD SM) (ANS.: PAYBACK RECIPROCAL = 25%)*

MODEL 7: CALCULATION OF IRR

PROBLEM 21: Compute IRR in the following situations

A) A project costs Rs. 36,000 and is expected to generate cash inflows of Rs.11,200 annually for 5 years. Calculate the IRR of the project. *(C) (ANS.: IRR= 17%)*

B) The following are two mutually exclusive projects?

	Cash Flows (Rs.)				
Project	C_0	C_1	C_2	C_3	C_4
I	-25,000	+30,000			
II	-25,000	0	0	0	43,750

Assume a 10% opportunity cost of capital. Compute the IRR for each project.

(C) (ANS.: IRR OF PROJECT I = 20% AND PROJECT II = 15%)

C) A company has to select one of the following two projects:

		Project A	Project B
Cost		Rs.11,000	Rs.10,000
Cash Inflows:	Year 1	6,000	1,000
	2	2,000	1,000
	3	1,000	2,000
	4	5,000	10,000

Using the Internal Rate of Return Method suggest which project is preferable.

(B) (ANS.: IRR PROJECT A = 11.264 % AND PROJECT B = 10.22%)

PROBLEM 22: X Company is evaluating the rate of return on two of its Assets, I and II. The Asset I was purchased a year ago for Rs. 4,00,000 and since then it has generated cash inflows of Rs.16,000. Presently, it can be sold for a price of Rs. 4,30,000. Asset II was purchased a few years ago and its market price in the beginning and at the end of the year was Rs. 2,40,000 and Rs.2,36,000 respectively. The Asset II has generated cash inflows of Rs. 34,000. Find out the rate of return on these Assets. *(C) (ANS.: IRR OF ASSET I = 11.5%, ASSET II= 12.5%)*

MODEL 8: DISCOUNTED PAYBACK PERIOD (DPBP)

PROBLEM 23: Consider the following mutually exclusive projects:

	Cash flows in Rs.				
Projects	C_0	C_1	C_2	C_3	C_4
A	-10,000	6,000	2,000	2,000	12,000
B	-10,000	2,500	2,500	5,000	7,500
C	-3,500	1,500	2,500	500	5,000
D	-3,000	0	0	3,000	6,000

Required:

If the cost of capital is 10%, compute the discounted payback period for each project. Which projects will you recommend, if standard discounted payback period is (i) 2 years, (ii) 3 years?

(B) (OLD PM) (ANS.: A= 3Y AND 2 M, B= 3Y AND 4.6 M, C= 2Y AND 2.25 M, D=3Y AND 2.18M, (i) NO PROJECTS IS ACCEPTABLE, (ii) PROJECT C IS ACCEPTABLE]

MODEL 9: CAPITAL RATIONING

PROBLEM 24: S Ltd. has Rs.10,00,000 allocated for capital budgeting purposes. The following proposals and associated profitability indexes have been determined.

Project	Amount in (Rs.)	Profitability index
1	3,00,000	1.22
2	1,50,000	0.95
3	3,50,000	1.20
4	4,50,000	1.18
5	2,00,000	1.20
6	4,00,000	1.05

Which of the above investments should be undertaken? Assume that projects are indivisible and there is no alternative use of the money allocated for capital budgeting. *(A) (ANS.: PROJECTS 3, 4 AND 5)*

PROBLEM 25: A company is considering three methods of attracting customers to expand its business:

a) Advertisement campaign.

b) Display of neon signs.

c) Direct delivery service.

The initial outlays for each alternative are: A-Rs.1,00,000, B-Rs.1,50,000, C-Rs.1,50,000. If A is carried out, but not B, it has an NPV of Rs.1,25,000. If B is done, but not A, has an NPV of Rs.45,000. However, if both are done, their NPV's are Rs.2,00,000. The NPV of the delivery system,

C, is Rs.90,000. Its NPV is not dependent on whether A or B is adopted, and the NPV of A or B does not depend on whether C is adopted. Which of the investments should be made by the company?

a) If the firm has no budget constraint,

b) If the budgeted amount is only Rs.2,50,000.

(A) [ANS.: (A) SINCE ALL THE PROJECTS HAVE POSITIVE NPV IT IS BETTER TO SELECT ALL PROJECTS I.E A, B, C (B) SELECT PROJECTS A&C)

MODEL 10: FINDING OUT MISSING VALUES

PROBLEM 26: ANP Ltd. is providing the following information:

Annual cost of saving	Rs.96,000
Useful life	5 years
Salvage value	zero
Internal rate of return	15%
Profitability index	1.05

Table of discount factor:

Discount factor	Years					
	1	2	3	4	5	Total
15%	0.870	0.756	0.658	0.572	0.497	3.353
14%	0.877	0.769	0.675	0.592	0.519	3.432
13%	0.886	0.783	0.693	0.614	0.544	3.52

You are required to find out:

i) Cost of the project

ii) Payback period

iii) Net present value of cash inflow

iv) Cost of capital

(A) (PM, MTP N15, M12 8M) (ANS.: I) COST OF PROJECT = RS. 3,21,888, II) PBP= 3.353 Y, III) NPV= RS 16,094.40, IV) COST OF CAPITAL =13%)

MODEL 11: COMPREHENSIVE PROBLEMS

MODEL 11.1: ESTIMATION OF PBP, NPV FOR EACH OF THE MACHINES

PROBLEM 27: PR Engineering Ltd. is considering the purchase of a new machine which will carry out some operations which are at present performed by manual labour. The following information related to the two alternative models - 'MX' and 'MY' are available:

	Machine 'MX'	Machine 'MY'
Cost of Machine	Rs.8,00,000	Rs.10,20,000
Expected Life	6 years	6 years
Scrap Value	Rs.20,000	Rs.30,000

Estimated net income before depreciation and tax:

Year	Rs.	Rs.
1	2,50,000	2,70,000
2	2,30,000	3,60,000
3	1,80,000	3,80,000
4	2,00,000	2,80,000
5	1,80,000	2,60,000
6	1,60,000	1,85,000

Corporate tax rate for this company is 30 percent and company's required rate of return on investment proposals is 10%. Depreciation will be charged on straight line basis.

You are required to:

a) Calculate the pay-back period of each proposal.

b) Calculate the Net Present Value of each proposal, if the P.V.factors at 10% are - 0.909, 0.826, 0.751, 0.683, 0.621 and 0.564.

c) Which proposal would you recommend and why?

(B) (OLD PM) (ANS.: A) PBP OF MX-4.25Y, PBP OF MY -3.67Y, B)NPV OF MX- RS.4,807, NPV OF MY-RS.1,12,092, C) RANKING BASED ON PBP MACHINE MX & MY- II, I RESPECTIVELY, RANKING BASED ON NPV MACHINE MX & MY- II,I RESPECTIVELY)

MODEL 11.2: ESTIMATION OF DPBP, NPV, IRR FOR EACH OF THE MACHINES

PROBLEM 28: The management of P Limited is considering selecting a machine out of two mutually exclusive machines. The company's cost of capital is 12 percent and corporate tax rate for the company is 30 percent. Details of the machines are as follows:

	Machine - 1	Machine - 2
Cost of machine	Rs.10,00,000	Rs.15,00,000
Expected life	5Yrs	6Yrs
Annual income before tax and depreciation	Rs.3,45,000	Rs.4,55,000

Depreciation is to be charged on straight line basis.

You are required to:

i) Calculate the discounted pay-back period, net present value and internal rate of return for each machine.

ii) Advise the management of P Limited as to which machine they should take up.

The present value factors of Rs. 1 are as follows:

Year	1	2	3	4	5	6
At 12%	0.893	0.797	0.712	0.636	0.567	0.507
At 13%	0.885	0.783	0.693	0.613	0.543	0.480
At 14%	0.877	0.769	0.675	0.592	0.519	0.456
At 15%	0.870	0.756	0.658	0.572	0.497	0.432
At 16%	0.862	0.743	0.641	0.552	0.476	0.410

(A) (OLD PM, M13) (ANS.: (I) DPBP FOR MACHINE-1= 4.49 Y, MACHINE-2 = 5.41Y, NPV FOR MACHINE-1= RS 86,909, MACHINE-2=RS 1,18,074, IRR FOR MACHINE-1= 15.46%, MACHINE-2= 14.74%, (II) SINCE IRR IS MORE & DPBP IS LOW IN CASE OF MACHINE-1 THEREFORE IT IS BETTER TO CHOOSE MACHINE-1)

PRINTED SOLUTIONS TO SOME SELECTIVE PROBLEMS

PROBLEM NUMBERS TO WHICH SOLUTIONS ARE PROVIDED: 5, 8, 10, 15, 17, 25, 27, 28

PROBLEM NO 5:

The Profit after Tax and value of Investment in the Beginning and at the End of the each year shall be as follows

Year	PBT (Rs.)	Depreciation (Rs.)	Profit after Dep (Rs.)	Value of Investment in(Rs.)	
				Beginning	End
1	1,50,000	70,000	80,000	3,00,000	2,30,000
2	1,50,000	70,000	80,000	2,30,000	1,60,000
3	1,50,000	70,000	80,000	1,60,000	90,000

The ARR can be computed by following methods as follows:

a) Version 1: Annual Basis

$$ARR = \frac{\text{profit after Depreciation}}{\text{Investment in the begning of the year}}$$

Year	
1	$=\frac{80,000}{3,00,000} x100 = 26.67\%$
2	$=\frac{80,000}{2,30,000} x100 = 34.78\%$
3	$=\frac{80,000}{1,60,000} x100 = 50\%$

$$\text{Average ARR} = \frac{26.67\% + 34.78\% + 50\%}{3} = 37.15\%$$

b) Version 2: Total Investment Basis

$$ARR = \frac{\text{Average annual profit}}{\text{Investment in the begning}} x100$$

$$= \frac{(80,000 + 80,000 + 80,000)/3}{3,00,000} x100 = 26.67\%$$

c) Version 3: Average Investment Basis

$$ARR = \frac{\text{Average annual profit}}{\text{Average Investment}} x100$$

Average Investment = (Rs.3,00,000 + Rs. 90,000)/2 = Rs.1,95,000

Or ½ (Initial Investment - Salvage Value) + Salvage Value

= ½ (Rs.3,00,000 - Rs. 90,000) + Rs. 90,000 =Rs.1,95,000

$$= \frac{80,000}{1,95,000} x100 = 41.03\%$$

Further, it is important to note that project may also require additional working capital during its life in addition to initial working capital. In such situation formula for the calculation of average investment shall be modified as follows:

½(Initial Investment - Salvage Value) + Salvage Value+ Additional Working Capital

Continuing above example suppose a sum of Rs. 45,000 is required as additional working capital during the project life then average investment shall be:

= ½ (Rs.3,00,000 - Rs. 90,000) + Rs. 90,000 + Rs. 45,000 = Rs.2,40,000 and

$$ARR = \frac{80,000}{2,40,000} x100 = 33.33\%$$

PROBLEM NO.8

CALCULATION OF PAY BACK PERIOD OF EACH PROJECT

Particulars	M - I	M - 2	M - 3
Step - 1: Calculation of Dep. P.a. $\left(\frac{\text{Cost} - \text{Scrap Value}}{\text{Life}}\right)$	1,30,000 $\left(\frac{3,00,000 - 40,000}{2}\right)$	91,667 $\left(\frac{3,00,000 - 25,000}{2}\right)$	90,000 $\left(\frac{3,00,000 - 30,000}{2}\right)$

Step-2: Calculation of CFAT p.a.			
Sales	5,00,000	4,00,000	4,50,000
Less:			
Direct Materials	40,000	50,000	48,000
Direct Labour	50,000	30,000	36,000
Factory Overheads	60,000	50,000	58,000
Administrative Overheads	20,000	10,000	15,000
Selling and Distributive Overheads	10,000	10,000	10,000
Interest on Capital (3,00,000 x 10%)	30,000	30,000	30,000
PBDT	2,90,000	2,20,000	2,53,000
Less:			
Depreciation (Step - 1)	1,30,000	91,667	90,000
PBT	1,60,000	1,28,333	1,63,000
Less: Tax @ 40%	64,000	51,333	65,200
PAT	96,000	77,000	97,800
Add: Depreciation	1,30,000	91,667	90,000
CFAT	2,26,000	1,68,667	1,87,800
Step -3: Calculation of Pay back period $\left(\frac{\text{Initial Investment}}{\text{CFAT p.a.}}\right)$	1.327yrs $\left(\frac{3,00,000}{2,26,000}\right)$	1.778 yrs $\left(\frac{3,00,000}{1,68,667}\right)$	1.597 yrs $\left(\frac{3,00,000}{1,87,800}\right)$

Assumption: It is assumed that cash inflows accrue evenly throughout the year.

Decision Making:

- If the given 3 machines are assumed to be mutually exclusive then accept the machine with least payback period i.e. Machine 1.
- If the given 3 machines are assumed to be mutually independent then purchase all the machines whose payback period is less than the standard payback period, subject to availability of funds.

PROBLEM NO 10:

Option I: Purchase Machinery and Service Part at the end of Year 1.

Net Present value of cash flow @ 10% per annum discount rate.

$$NPV = -50,000 + \frac{18,000}{1.1} + \frac{18,000}{(1.1)^2} + \frac{18,000}{(1.1)^3} - \frac{10,000}{(1.1)} + \frac{12,500}{(1.1)^3}$$

= - 50,000 + 18,000 (0.9091 + 0.8264 + 0.7513) - (10,000 × 0.9091) + (12,500 × 0.7513)

= - 50,000 + (18,000 × 2.4868) - 9,091 + 9,391

= - 50,000 + 44,762 - 9,091 + 9,391

NPV = - Rs.4,938

Since, Net Present Value is negative; therefore, this option is not to be considered.

If the Supplier gives a discount of Rs 5,000 then,

NPV = +5,000 - 4,938 = Rs + 62

In this case, Net Present Value is positive but very small; therefore, this option may not be advisable.

Option II: Purchase Machinery and Replace Part at the end of Year 2.

$$NPV = -50,000 + \frac{18,000}{1.1} + \frac{18,000}{(1.1)^2} + \frac{18,000}{(1.1)^3} - \frac{15,400}{(1.1)^2} + \frac{27,000}{(1.1)^4}$$

= -50,000+ 18,000 (0.9091 + 0.8264 + 0.7513) - (15,400 × 0.8264) + (27,000 × 0.6830)

= -50,000 + 18,000 (2.4868) - (15,400 × 0.8264) + (27,000 × 0.6830)

= -50,000 + 44,762 - (15,400 × 0.8264) + (27,000 × 0.6830)

= -50,000 + 44,762 - 12,727+ 18,441

= -62,727+ 63,203 = Rs +476

Net Present Value is positive, but very low as compared to the investment.

If the Supplier gives a discount of Rs 5,000, then

NPV = 5,000 + 476 = Rs 5,476

Decision: Option II is worth investing as the net present value is positive and higher as compared to Option I.

PROBLEM NO 15

(Rs.'000)

Year	Sales	VC	FC	Dep.	Profit	Tax	PAT	Dep.	Cash inflow
1	86.40	51.84	18	21.875	(5.315)	-	-	21.875	16.56
2	129.60	77.76	18	21.875	11.965	1.995*	9.97	21.875	31.845
3	312.00	187.20	18	21.875	84.925	25.4775	59.4475	21.875	81.3225
4-5	324.00	194.40	18	24.125	87.475	26.2425	61.2325	24.125	85.3575
6-8	216.00	129.60	18	24.125	44.275	13.2825	30.9925	24.125	55.1175

* (30% of 11.965 - 30% of 5.315) = 3.5895 - 1.5945 = 1.995)

	Rs.
Cost of New Equipment	1,75,00,000
Less: Subsidy	25,00,000
Add: Working Capital	20,00,000
Outflow	1,70,00,000

Calculation of NPV

Year	Cash inflows	PV factor	NPV
	Rs.		Rs.
1	16,56,000	.893	14,78,808
2	31,84,500	.797	25,38,047
3	81,32,250 - 12,50,000 = 68,82,250	.712	49,00,162
4	85,35,750	.636	54,28,737
5	85,35,750	.567	48,39,770
6	55,11,750	.507	27,94,457
7	55,11,750	.452	24,91,311
8	55,11,750 + 20,00,000 + 1,25,000 = 76,36,750	.404	30,85,247
	Net Present Value		**2,75,56,539**

NPV	2,75,56,539
Less: Out flow	1,70,00,000
Saving	**1,05,56,539**

PROBLEM NO 17:

Step I: Estimation of cash outflow

Year	Land	Factory & Building	Plant, Machinery & Equipment		W.C	Total	PVF
0	2	2			4	1	4
1	1				1	0.893	0.893

2	1	10			11	0.797	8,767
3	1	8	15		24	0.712	17,088
4			5		5	0.636	3.18
5				1	1	0.567	0.567
6					-	0.507	-
Total	5	20	20	1	46		34.495

WN 1:

Estimation of depreciation

Factory & Building = 20L x 5% = 1L

Plant, Machinery & Equipment = 20L x 10% = 2L

= 3L

Step II: Estimation of PV of OPCI

Particulars	Amount
Sales	30L
(-) Variable costs	12L
Contribution	18L
(-) Fixed cost	8L
PBDT	10L
(-) Depreciation	3L
PBT	7L
Tax @ 50%	3.5L
PAT	35L
Depreciation	3L
CFAT	6.5
PVF (12%, 15yrs - 5 yrs)	3206
PV of OPCI	20.839

Step III: Estimated of PV of TMCI

Particulars	Amount
Gross sale proceed (6 + 8 + 2)	16
WDV (10 + 5 + 0)	15
Capital gain	1L
Tax@50%	0.5
Net sale proceed	15.5
Recovery of working capital	1
TMCI	16.5
PVF @ (12% 15y)	0.183
	3.0195

NPV = PV of OPCI + PV of TMCI = PV of CO

= 20.839 + 3.0195 - 14.495 = - 10.6365

Since NPV is negative. It is not advisable to accept the project

PROBLEM NO 25

Step 1: Calculation of Net Present Values per Rs.1 of Investment and Ranking of the projects

Project	Investment Rs.000	NPV @ 15% Rs.000	NPV per Rs.1 Invested	Rank
A	(50)	15.4	0.31	5
B	(40)	18.7	0.47	2
C	(25)	10.1	0.40	3
D	(30)	11.2	0.37	4
E	(35)	19.3	0.55	1

Step 2: Building up of Programme of Projects based on their Rankings.

Project	Investment Rs.000	NPV@ 15% Rs.000
E	(35)	19.3
B	(40)	18.7
C	(25)	10.1
D	(20)	7.5
	120	55.6

Thus Project A should be rejected and only two-third of Project D shall be undertaken.

If the projects are not divisible then other combinations can be examined as:

Project	Investment Rs.000	NPV @ 15% Rs.000
E +B + C	100	48.1
E + B + D	105	49.2

In this case E + B + D would be preferable as it provides a higher NPV despite D ranking lower than C.

Assumptions:

1. It is the assumed that there is scarcity of funds in current year only. In other words, there is no scarcity of funds in subsequent years.
2. The given projects are mutually independent.
3. A Project can be accepted only once.
4. A project can either be accepted now or rejected. In other words, there is no question of postponement.
5. Perfect linear relationship is assumed to exist between cash inflows and cash outflows.

PROBLEM NO 27:

a) **Calculation of Net Present Value at 15%:**

Year	Cash flows	PVF@15%	Present Value
0	(7,00,000)	1.000	(7,00,000)
1	(10,00,000)	0.870	(8,70,000)
2	2,50,000	0.756	1,89,000
3	3,00,000	0.658	1,97,400
4	3,50,000	0.572	2,00,200
5 - 10	4,00,000	2.163 (5.019-2.856)	8,55,200
		Net Present Value	(1,18,200)

As the Net Present Value is negative the project is unacceptable.

b) **Calculation of Net Present Value at 10%:**

Year	Cash flows	PVF@10%	Present Value
0	(7,00,000)	1	(7,00,000)
1	(10,00,000)	0.909	(9,09,000)
2	2,50,000	0.826	2,06,500
3	3,00,000	0.751	2,25,300
4	3,50,000	0.683	2,39,050
5 - 10	4,00,000	2.974	11,89,600
		Net Present Value	**2,51,450**

Since Net Present Value = Rs.2,51,450 i.e. positive, hence the project would be acceptable.

(Or)

Note: Alternatively, NPV at 10% as well as 15% can be calculated using the same table, the students are advised to present in this manner based on the availability of time and marks allotted to the problem.

Calculation of Net Present Value at 10% and 15%

Year	Cash flows	NPV@10%		NPV@15%	
		PVF@10%	PV	PVF@15%	PV
0	(7,00,000)	1	(7,00,000)	1.000	(7,00,000)
1	(10,00,000)	0.909	(9,09,000)	0.870	(8,70,000)
2	2,50,000	0.826	2,06,500	0.756	1,89,000
3	3,00,000	0.751	2,25,300	0.658	1,97,400
4	3,50,000	0.683	2,39,050	0.572	2,00,200
5 - 10	4,00,000	2.974	11,89,600	2.163 (5.019-2.856)	8,55,200
		Net Present Value	**2,51,450**		**(1,18,200)**

Assumptions:

- Cash flows are assumed to accrue at the end of each year.
- Interim cash inflows at the end of each year are assumed to be reinvested at the rate of cost of capital.
- Cash flows given in the problem are assumed to be certain.

c) **Calculation of Internal Rate of Return**

Using Interpolation

$$IRR = LR + \frac{NPV\ @\ LR}{NPV\ @LR - NPV\ @HR} \times (HR - LR)$$

$$IRR = 10\% + \frac{2,51,450}{2,51,450 - (1,18,200)} X1 = 10\% + 3.4012 = 13.40\%$$

Note: Using Interpolation we can get more accurate answer if the two given guess rates are taken in such a way that the difference between the two guess rates is as short as possible. We deviated this rule as the same is being followed by ICAI.

d) **Calculation of Payback Period**

Payback Period = 6 Yrs

Rs.7,00,000 - Rs.10,00,000 + Rs.2,50,000 + Rs.3,00,000 + Rs.3,50,000 + Rs.4,00,000 + Rs.4,00,000 = 0.

Assumption: It is assumed that cash inflows accrue evenly throughout the year.

PROBLEM NO 28:

Working Notes:

$$\text{Depreciation on Machine - I} = \frac{30,00,000}{10} = Rs.3,00,000$$

$$\text{Depreciation on Machine - II} = \frac{40,00,000}{10} = Rs.4,00,000$$

Particulars	Machine-I (Rs.)	Machine-II (Rs.)
Annual Income (before Tax and Depreciation)	12,50,000	17,50,000
Less: Depreciation	3,00,000	4,00,000
Annual Income (before Tax)	9,50,000	13,50,000
Less: Tax @ 30%	2,85,000	4,05,000

Annual Income (after Tax)	6,65,000	9,45,000
Add: Depreciation	3,00,000	4,00,000
Annual Cash Inflows	9,65,000	13,45,000

Year	Machine - I				Machine - II		
	PV of Re 1 @ 15%	Cash flow	PV	Cumulative PV	Cash flow	PV	Cumulative PV
1	0.870	9,65,000	8,39,550	8,39,550	13,45,000	11,70,150	11,70,150
2	0.756	9,65,000	7,29,540	15,69,090	13,45,000	10,16,820	21,86,970
3	0.658	9,65,000	6,34,970	22,04,060	13,45,000	8,85,010	30,71,980
4	0.572	9,65,000	5,51,980	27,56,040	13,45,000	7,69,340	38,41,320
5	0.497	9,65,000	4,79,605	32,35,645	13,45,000	6,68,465	45,09,785

i) Discounted Payback Period

Machine - I

$$\text{Discounted Payback Period} = 4 + \frac{(30,00,0,00 - 27,56,040)}{4,79,605}$$

$$= 4 + \frac{2,43,960}{4,79,605} = 4 + 0.5087 = 4.5087 \text{ years or } 4 \text{ years } 6.10 \text{ months}$$

Machine - II

$$\text{Discounted Payback Period} = 4 + \frac{(40,00,000 - 38,41,320)}{6,68,465}$$

$$= 4 + \frac{1,58,680}{6,68,465} = 4 + 0.2374 = 4.2374 \text{ years or } 4 \text{ years } 2.85 \text{ months}$$

ii) Net Present Value (NPV)

Machine - I

NPV = 32,35,645 - 30,00,000 = Rs. 2,35,645

Machine - II

NPV = 45,09,785 - 40,00,000 = Rs. 5,09,785

iii) Profitability Index

Machine - I

$$\text{Profitability Index} = \frac{32,35,645}{30,00,000} = 1.08$$

Machine - II

$$\text{Profitability Index} = \frac{45,09,785}{40,00,000} = 1.13$$

Conclusion:

Method	Machine - I	Machine - II	Machine - III
Discounted Payback Period	4.51 Years	4.24 years	II
Net Present Value	Rs.2,35,645	Rs.5,09,785	II
Profitability Index	1.08	1.13	II

THE END