PRE RESULTS CRASH MATERIAL / CA INTER / GR. 2 / BOOK 12 / F.M – PART 1 / 42.5(2nd Version)

CHAPTERS INCLUDED – INVESTMENT DECISIONS, ADVANCED CONCEPTS IN INVESTMENT DECISIONS (APPLICABLE TO MAY 2020 ATTEMPT OF CA INTER. SYNCHRONISED WITH JULY 2019 EDITION OF ICAI SM. ISSUED ON 28/11/19)

2. INVESTMENT DECISIONS

NO. OF PROBLEMS IN 41.5E OF CA INTER: CLASSROOM – 28, ASSIGNMENT - 30

NO. OF PROBLEMS IN 42E OF CA INTER: CLASSROOM – 28, ASSIGNMENT – 31

NO. OF PROBLEMS IN 42.5E (2nd Version) OF CA INTER: CLASSROOM – 17, ASSIGNMENT - 17

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)	N19-(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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
10.	FINDING OUT MISSING VALUES	8	8	-	-	8	-	-	-	-	-	8	-	8	-	-	-	8	-	-	-	
11.	COMPREHENSIVE PROBLEMS	8	8	-	-	-	10	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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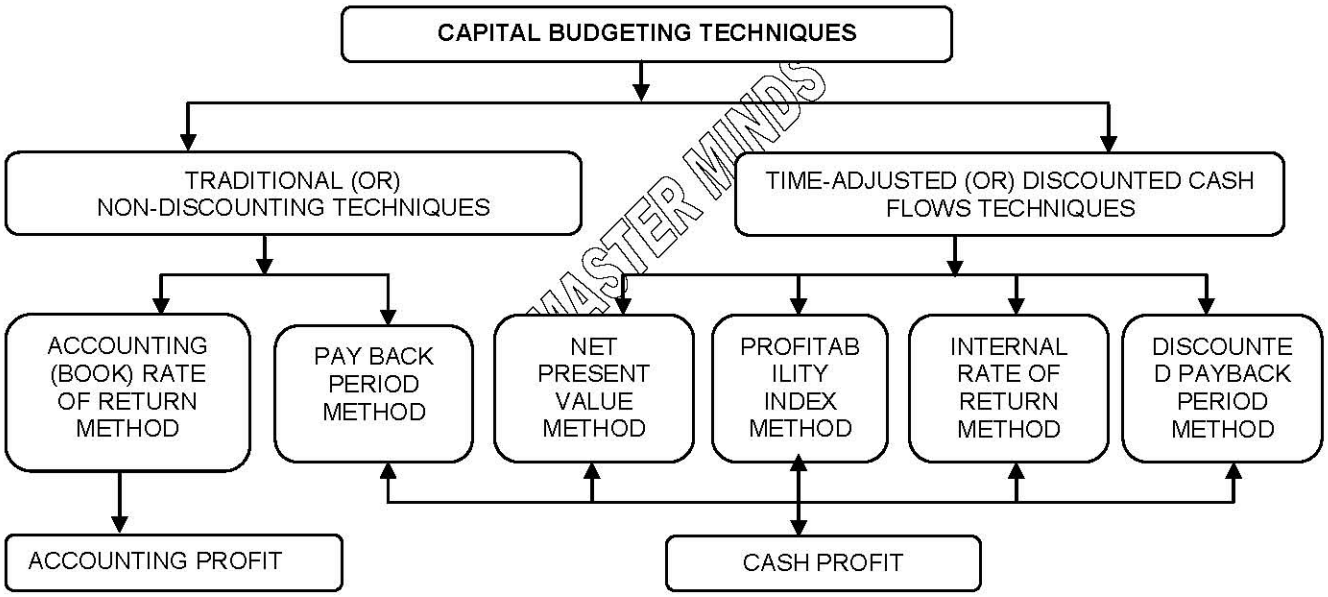


MODEL 2: ACCOUNTING (BOOK) RATE OF RETURN / AVERAGE RATE OF RETURN METHOD (ARR)

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

$$ARR = \frac{\text{Profit after Depreciation}}{\text{Investment in the begining of the year}} x100$$

VERSION 2: TOTAL INVESTMENT BASIS

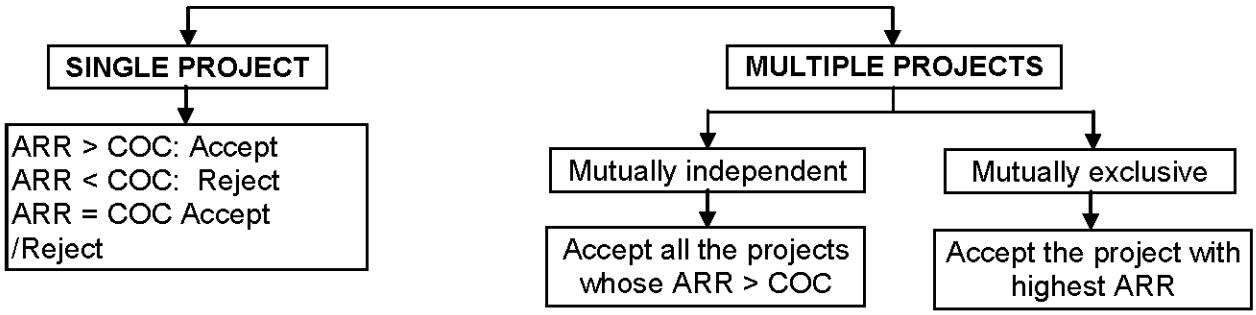
$$ARR = \frac{\text{Average Annual Profit}}{\text{Investment in the begining}} \times 100$$

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 3: (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.3 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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.

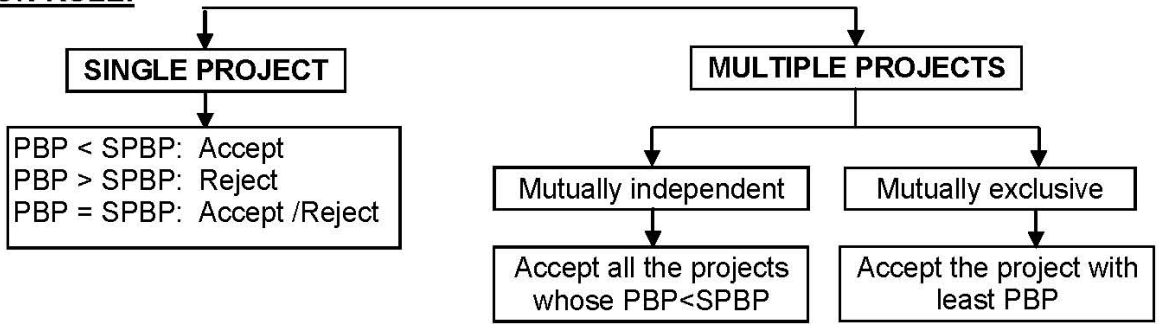
CALCULATION OF PAYBACK PERIOD:

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 4: 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 4 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.

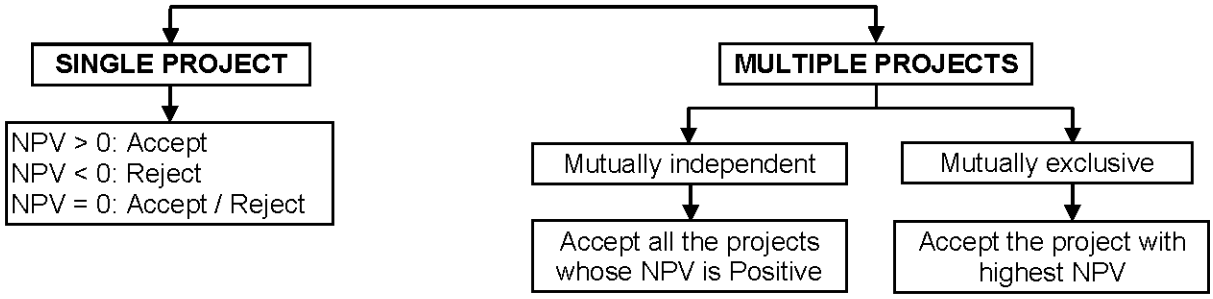
c) **CALCULATION OF NPV:**

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 5: (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.5 OF ASSIGNMENT PROBLEMS AS REWORK)THE OPTIONS DECISION MAKING WILL REMAIN SAME)

NOTE: _____

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PROBLEM 6: 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 6 of assignment problems as rework)

NOTE: _____

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MODEL 4.2: NPV – INVESTMENT IN TWO PERIODS

PROBLEM 7: 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. *(similar to nov 19 RTP(n)) (A) (NEW SM, OLD SM, RTP, MTP M15) (ANS.: NPV= RS. 31,712)*

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

NOTE: _____

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MODEL 4.4: NPV – EXPANSION AND DIVERSIFICATION OF PROJECT

PROBLEM 8: 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 8OF 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 9: (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. 9 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 4.6: NPV – PROJECT BEP

PROBLEM 10: 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.10 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.

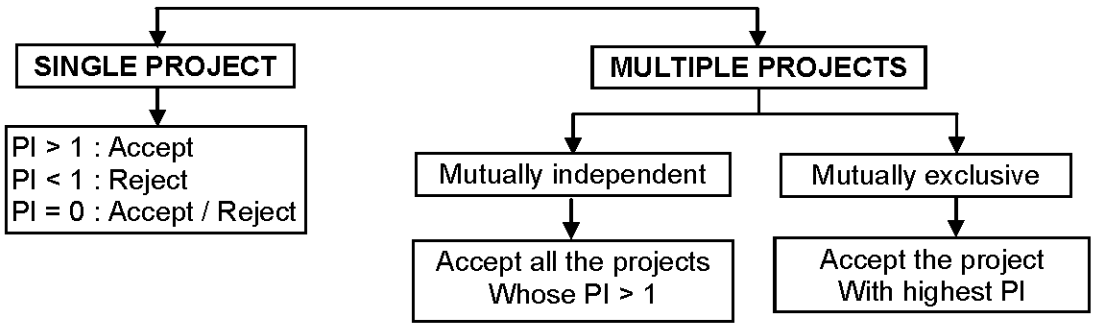
Mathematically:

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

(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 11: 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. 11 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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PROBLEM 12: 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)(SIMILAR:M18(0)-8M) (ANS.: (I) NPV = RS. (2,93,462.50), (II) PI = 0.804)
(SOLVE PROBLEM NO. 12 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 6: CALICULATION 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. **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.

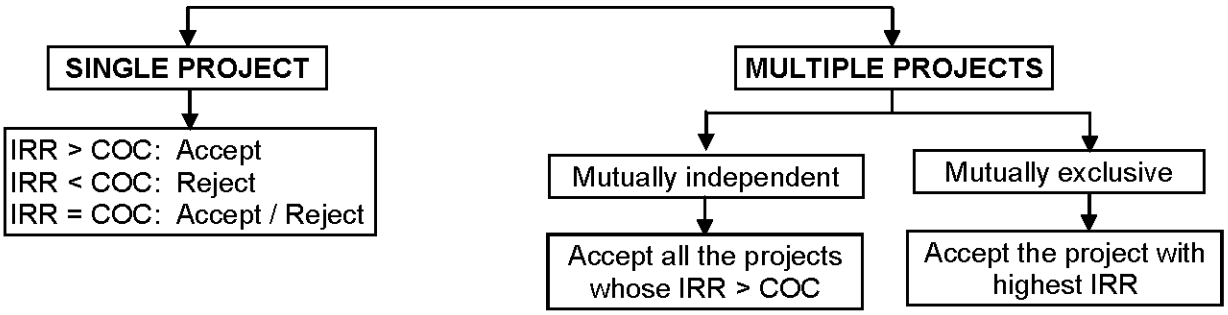
   b) **Interpolation:**

   Let LR = Lower rate,
   HR = Higher rate.

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

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

DECISION RULE:



Where, COC = Cost of capital

PROBLEM 13: 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.13 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 7: FINDING OUT MISSING VALUES

PROBLEM 14: 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

v)

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. 14 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 8: COMPREHENSIVE PROBLEMS

PROBLEM 15: (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]

(Similar to MTP NOV 19(o)),(MPT NOV 19(n)),(SOLVE PROBLEM NO. 15 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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PROBLEM 16: (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

Note: Restrict your calculation up to 5 years

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. 16 OF ASSIGNMENT PROBLEMS AS REWORK)

NOTE: _____

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MODEL 9: CAPITAL RATIONING

PROBLEM 17: A company has 1,00,000 available for investment and has identified the following four Investments in which to invest.

Project	Investment	NPV
C	40,000	20,000
D	1,00,000	35,000
E	50,000	24,000
F	60,000	18,000

You are required to optimize the returns from a package of projects within the capital spending limit if

(i) The projects are independent of each other and are divisible.

(ii) The projects are not divisible *(N 19 (NEW)) (SOLVE PROBLEM NO. 17 OF ASSIGNMENT PROBLEMS AS REWORK)*

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)*

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

PROBLEM 3: 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:

3. ARR on the basis of
   a) Annual investment b) Total investment c) Average investment
4. 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 4: 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]

MODEL 4: CALCULATION OF NPV UNDER DIFFERENT CONDITIONS

NPV – BASIC MODEL

PROBLEM 5: 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 4th year also and get operational cash inflow of Rs. 80,000 for the 4th 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)

PROBLEM 6: 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

(C) (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 7: 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. **(ans: NPV=6,19,180)**

NPV- EXPANSION AND DIVERSIFICATION OF PROJECT

PROBLEM 8: 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)

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

PROBLEM 9: 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 ***(Ans:NPV=1,42,25,900)***

NPV - PROJECT BEP

PROBLEM 10: 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)

PROBLEM 11: 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)*

NOTE: _____

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MODEL 5: PROFITABILITY INDEX METHOD / DESIRABILITY FACTOR

PROBLEM 12: 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]

MODEL 6: CALICULATION OF IRR

PROBLEM 13: 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%)

MODEL 10: FINDING OUT MISSING VALUES

PROBLEM 14: 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

ESTIMATION OF PBP, NPV FOR EACH OF THE MACHINES

PROBLEM 15: 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)

ESTIMATION OF NPV, IRR OF THE PROJECT

ESTIMATION OF DPBP, NPV, IRR FOR EACH OF THE MACHINES

PROBLEM 16: 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)

MODEL 12: CAPITAL RATIONING

PROBLEM 17: Prem Ltd has a maximum of Rs.8,00,000 available to invest in new projects. Three possibilities have emerged and the business finance manager has calculated Net present Value (NPVs) for each of the projects as follows:

Investment	Initial cash outlay (Rs.)	NPV (Rs.)
Alfa (α)	5,40,000	1,00,000
Beta (β)	6,00,000	1,50,000
Gama (Y)	2,60,000	58,000

Determine which investment/combination of investments should the company invest in, if we assume that the projects can be divided?

(MTP _May 19(S2) (NEW)) (Ans: Rs.6,00,000 into β and 2,00,000 into Y, total NPV:1,94,615)

PRINTED SOLUTIONS TO SOME SELECTIVE PROBLEMS

PROBLEM NUMBERS TO WHICH SOLUTIONS ARE PROVIDED :3,5,9,15,16

PROBLEM NO 3

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 5:

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 9

(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 *Less:* Subsidy *Add:* Working Capital	1,75,00,000 25,00,000 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**

1. A project can either be accepted now or rejected. In other words, there is no question of postponement.
2. Perfect linear relationship is assumed to exist between cash inflows and cash outflows.

PROBLEM NO 15:

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 16:

Working Notes:

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

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

	Machine – I				Machine - II		
Year	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

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

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

Machine – II

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

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

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

Machine – II

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