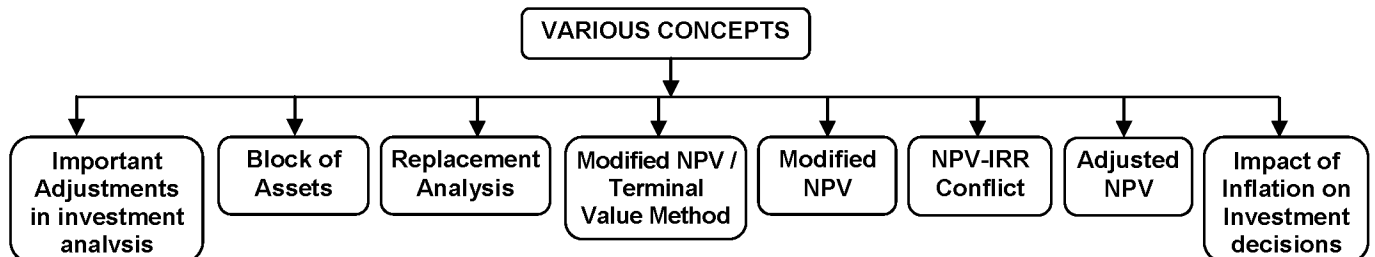# 6. ADVANCED CONCEPTS IN INVESTMENT DECISIONS

NO. OF PROBLEMS IN 40E OF CA INTER: CLASSROOM - 19, ASSIGNMENT - 17

NO. OF PROBLEMS IN 41E OF CA INTER: CLASSROOM - 17, ASSIGNMENT - 15

SIGNIFICANCE OF EACH PROBLEM COVERED IN THIS CHAPTER

Problem No. in this Material	Problem No. in NEW SM	Problem No. in OLD SM	Problem No. in OLD PM	RTP	MTP	Previous Exams	Remarks
CR 1	-	-	-	-	-	-	
CR 2	-	-	-	-	-	-	
CR 3	-	-	-	-	-	-	RST
CR 4	-	-	-	-	-	-	RST
CR 5	-	-	-	-	-	-	
CR 6	-	-	15	N18 (N&O), M16	-	-	
CR 7	-	-	-	-	-	-	
CR 8	ILL-9	ILL-9	-	-	-	-	
CR 9	-	-	-	M14	-	-	
CR 10	-	-	-	-	-	-	
CR 11	-	-	-	-	-	N13 - 8M	
CR 12	-	-	-	N15	-	-	
CR 13	-	-	17	-	-	-	
CR 14	-	-	-		-	-	PTB
CR 15	-	-	-		-	M18 (N)-8M	
CR 16	-	-	-	-	-	-	PTB
CR 17	-	-	-	-	-	M18 (N)-10M	
ASG 1	-	-	-	-	-	-	
ASG 2	-	-	-	-	-	-	
ASG 3	EX (7.11)	EX (6.9)		-	-	-	
ASG 4	-	-		-	-	-	
ASG 5	-	-	-	-	-	-	TULSIAN
ASG 6	-	-	-	-	-	-	
ASG 7	-	-	-	-	-	-	
ASG 8	ILL-10	ILL-10	-	-	-	-	
ASG 9	-	-	-	-	-	-	
ASG 10	-	-	8	-	-	-	
ASG 11	-	-	-	-	-	-	
ASG 12	-	-	-	-	-	-	RK
ASG 13	-	-	-	-	-	-	PTB
ASG 14	-	-	-	-	-	-	PDK
ASG 15	-	-	-	-	-	-	PTB

VARIOUS CONCEPTS

- Important Adjustments in investment analysis
- Block of Assets
- Replacement Analysis
- Modified NPV / Terminal Value Method
- Modified NPV
- NPV-IRR Conflict
- Adjusted NPV
- Impact of Inflation on Investment decisions

MODEL 1 - IMPORTANT ADJUSTMENTS IN INVESTMENT ANALYSIS

NPV - OPPURTUNITY COST, COMMON COST, SUNK COST

PROBLEM 1: (PRINTED SOLUTION AVAILABLE) Swastik Ltd. has two divisions, which are periodically assisted by visiting teams of consultants. The management is worried about the steady increase of expenses in this regard over the years. An analysis of last year's expenses reveals the following:

Consultants Remuneration	2,50,000
Travel and conveyance	1,50,000
Accommodation exp.	6,00,000
Boarding Charges	2,00,000
Special Allowances	50,000

The management estimates accommodation expenses to increase by Rs.2,00,000/- annually. As part of cost reduction drive, Swastik Ltd. is proposing to construct a consultancy center to take care of the accommodation requirements of the consultants. This center will additionally save the company Rs.50,000/- in boarding charges and Rs.2,00,000/- in the cost of Executive Training Programs hitherto conducted outside the company's premises, every year.

The detail's regarding the construction and maintenance of the new center is:

a) Land at a cost of Rs.8,00,000/- already owned by the company, will be used.

b) Construction cost Rs.15,00,000/- including special furnishings.

c) Cost of annual maintenance: Rs.1,50,000 /-

d) Construction cost will be written off over 5 years, being the useful life.

Assume that the write-off of construction cost as aforesaid will be accepted for tax purposes. Is the proposal feasible? Cost of capital - 10%, Tax rate - 50%.   *(ANS.: NPV = RS.14,60,100)*

(SOLVE PROBLEM NO. 1 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

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NPV - OPPURTUNITY COST (LOSS & BENEFIT) COMMON COST, CAPITAL GAINS

PROBLEM 2: A chemical company is presently paying an outside firm Rs.1 per gallon to dispose of the waste material resulting from its manufacturing operations. At normal operating capacity, the waste is about 50,000 gallons per year. After spending Rs.60,000 on research, the company discovered that the waste could be sold for Rs.10 per gallon if it was processed further. Additional processing would, however, require an investment of Rs.6,00,000 in new equipment, which would have an estimated life of 10 years with no salvage value. Depreciation would be calculated by straight line method. Except of the costs incurred in advertising Rs.20,000 per year; no change in the present selling and administrative expenses is expected, if the new product is sold, The details of additional processing costs are as follows:

a) Variable   : Rs.5 per gallon of waste put into process.

b) Fixed (excluding depreciation)   : Rs.30,000 per year.

In costing the new product, general administrative overheads will be allocated at the rate of Rs.2 per gallon. There will be no losses in processing, and it is assumed that the total waste processed in a given year will be sold in that very year. Estimates indicate that 40,000 gallons of the product could be sold each year. The management when confronted with the choice of disposing off the waste or processing it further and selling it, seeks your advice. Which alternative would you recommend? Assume that the firm's cost of capital is 15% and it pays on an average 35% tax on its income.

(A) (ANS.: NPV: RS.1,25,246) (SOLVE PROBLEM NO. 2 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

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MODEL 2 - BLOCK OF ASSETS AND DEPRECIATION

a) Since depreciation is a tax allowable expenditure, tax shield/ benefit from depreciation is considered while calculating cash flows from the project.

b) Taxable income is calculated as per the provisions of Income Tax or similar Act of a country. The treatment of deprecation is based on the concept of "Block of Assets", which means a group of assets falling within particular class of assets.

c) This class of assets can be building, machinery, furniture etc.in respect of which depreciation is charged at same rate. The treatment of tax depends on the fact whether block of asset consist of one asset or several assets.

PROBLEM 3: A Construction Company is interested in the computerization of its office work. For this purpose, two models have been shortlisted, for which the relevant information is as follows:

Particulars	Model I	Model II
Cost	Rs. 1,50,000	Rs. 2,50,000
Salvage Value	Nil	Nil
Working Capital Required	Rs. 50,000	Rs. 70,000
Savings in Expenses	Rs. 1,00,000 p.a.	Rs. 1,50,000 p.a.
Life	5 years	5 years
Depreciation	25% W.D.V	25% W.D.V

Find out which model is better, given that:

i) Tax rate is 35%.

ii) Required rate of return is 13%.

iii) There is no other asset in the same block of assets.

(B) (CA FINAL RST) (ANS.: AS BOTH THE PROPOSALS HAVE POSITIVE NPV, BOTH ARE ACCEPTABLE. HOWEVER, MODEL II SHOULD BE PREFERRED BECAUSE IT HAS HIGHER NPV)

Note:_____

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PROBLEM 4: ABC Industries Ltd. Is expanding its operations and is in the midst of replacing one of its plant (Original cost Rs. 10,00,000, Life 10 years, Dep. @ 25% WDV) which has a remaining life of 6 years. This machine has a salvage value of Rs. 2,00,000 at present.

The new machine being considered for replacement is costing Rs. 15,00,000 (salvage value 10% at the end of 6 years). The important data regarding new machine are as follows:

Incremental Revenue   Rs. 5,00,000

Fixed Cost (Excluding Depreciation)   Unchanged

Variable Cost   30%

Depreciation rate   25% WDV

Evaluate the replacement decision, given that:

i) The required rate of return 10%.

ii) Rate of tax 30%.

iii) There are several assets in the same block of assets.   *(A) (CA FINAL RST)*

(ANS.: AS THE NPV OF THE REPLACEMENT PROPOSAL IS POSITIVE, THE PROPOSAL MAY BE IMPLEMENTED)

(SOLVE PROBLEM NO. 3 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

MODEL 3 - REPLACEMENT DECISIONS

REPLACEMENT DECISIONS:

a) In some of the capital budgeting decisions, an existing asset is to be replaced by a new one due to expiry of economic life of the asset is known as Replacement Decision.

b) The purpose of replacement decision is to <u>improve operating efficiency</u> and <u>to reduce cost.</u>

PROBLEM 5: (PRINTED SOLUTION AVAILABLE) An existing company has a machine which has been in operation for 2 years; its remaining estimated useful life is 10 years, with no salvage value at the end. Its current market value is Rs.1,00,000. The management is considering a proposal to purchase an improved model of a similar machine, which gives increased output. The relevant particulars are as follows:

Particulars	Existing machine	New machine
Purchase price	Rs. 2,40,000	Rs. 4,00,000
Estimated life	12 years	10 years
Salvage value	Nil	Nil
Annual operating hours	2,000	2,000
Selling price per unit	Rs.10	Rs. 10
Output per hour	15 units	30 units
Material cost per unit	Rs. 2	Rs. 2
Labour cost per hour	20	40
Consumable stores per year	2,000	5,000
Repairs and maintenance per year	9,000	6,000
Working capital	25,000	40,000

The company follows straight-line method of depreciation and is subject to 50% tax. Should the existing machine be replaced? Assume that the company's required rate of return is 15%.

(A) (ANS.: INCREMENTAL NPV = RS. 2,90,795; SINCE INCREMENTAL NPV IS POSITIVE, IT IS ADVISABLE TO ACCEPT AND REPLACE THE EXISTING MACHINE) (SOLVE PROBLEM NO. 4 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

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PROBLEM 6: (PRINTED SOLUTION AVAILABLE) MNP Limited is thinking of replacing its existing machine by a new machine which would cost Rs.60 lakhs. The company's current production is 80,000 units, and is expected to increase to 1,00,000 units, if the new machine is bought. The selling price of the product would remain unchanged at Rs.200 per unit. The following is the cost of producing one unit of product using both the existing and new machine:

Particulars	Existing Machine (80,000 units)	New Machine (1,00,000 units)	Unit Cost Difference
Materials	75.00	63.75	-11.25
Wages and Salaries	51.25	37.50	-13.75
Supervision	20.00	25.00	5.00
Repairs and Maintenance	11.25	7.50	-3.75
Power and Fuel	15.50	14.25	-1.25
Depreciation	0.25	5.00	4.75
Allocated Corporate Overheads	10.00	12.50	2.50
Total	**183.25**	**165.50**	**-17.75**

The existing machine has an accounting book value of Rs.1,00,000, and it has been fully depreciated for tax purpose. It is estimated that machine will be useful for 5 years. The supplier of the new machine has offered to accept the old machine for Rs.2,50,000. However, the market price of old machine today is Rs.1,50,000 and it is expected to be Rs.35,000 after 5 years. The new machine has a life of 5 years and a salvage value of Rs.2,50,000 at the end of its economic life. Assume corporate Income tax rate at 40%, and depreciation is charged on straight line basis for Income-tax purposes. Further assume that book profit is treated as ordinary income for tax purpose. The opportunity cost of capital of the Company is 15%.

Required:

a) Estimate net present value of the replacement decision.

b) Estimate the internal rate of return of the replacement decision.

c) Should Company go ahead with the replacement decision? Suggest.

Year (t)	1	2	3	4	5
PVIF0.15,t	0.8696	0.7561	0.6575	0.5718	0.4972
PVIF0.20,t	0.8333	0.6944	0.5787	0.4823	0.4019
PVIF0.25,t	0.80	0.64	0.512	0.4096	0.3277
PVIF0.30,t	0.7692	0.5917	0.4552	0.3501	0.2693
PVIF0.35,t	0.7407	0.5487	0.4064	0.3011	0.2230

(A) (OLD PM, RTP M16, RTP N18 (N&O)) (ANS.: I) NPV= RS.1913.32/-, II) IRR= 28.23%, III) THE COMPANY SHOULD GO AHEAD WITH REPLACING THE PROJECT SINCE IT IS POSITIVE NPV)

(SOLVE PROBLEM NO. 5 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

MODEL 4 - MODIFIED NPV / TERMINAL VALUE METHOD

a) The other variant of NPV technique is TVM. In this case, a new dimension is added to the NPV technique. In NPV technique, future cash flows are discounted to make them comparable.

b) In the TV technique, the future cash flows are first compounded at the expected rate of interest for the period from their occurrence till the end of the economic life of the project.

c) The compounded values are then discounted at an appropriate discount rate to find out the present value. This present value is compared with the initial outflow to decide about the suitability of the proposal.

ASSUMPTION: The TV technique is based on the assumption that all future cash inflows are reinvested elsewhere at the then prevailing rate of interest until the end of the economic life of the project.

PROBLEM 7:

Cost of machine	Rs. 10,000
Estimate life of machine	3 years
Cash inflows	Rs. 6,000 every year for 3 years
Cost of capital "r"	15%

Expected interest rates, at which cash inflows shall be re-invested:

Year ending	1	2	3
Percentage	12%	10%	9%

State whether the project should be accepted under terminal value method.

(B) (ANS.: MODIFIED NPV RS. 3,242) (SOLVE PROBLEM NO. 6 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

MODEL 5 - MODIFIED IRR

a) There are several limitations attached with the concept of conventional IRR. The MIRR addresses some of these deficiencies, e.g. it eliminates multiple IRR rates, it addresses the reinvestment rate issue and produces results which are consistent with the NPV method.

b) Under this method, all cash flows, apart from the initial investment, are brought to the terminal value using an appropriate discount rate (usually the cost of capital). This results in a single stream of cash inflow in the terminal year.

c) The MIRR is obtained by assuming a single outflow in the year ZERO and the terminal cash inflow as mentioned above. The discount rate which equates the present value of the terminal cash inflows to the year ZERO cash outflow is called MIRR.

PROBLEM 8: (PRINTED SOLUTION AVAILABLE) An investment of Rs.1,36,000 yields the following cash inflows (Profits Before Depreciation but After Tax). Determine Modified Internal Rate of Return (MIRR) considering 8% cost of capital.

| Year	1	2	3	4	5
Rs.	30,000	40,000	60,000	30,000	20,000

(B) (NEW SM, OLD SM) (ANS.: MODIFIED IRR = 9% (APPROX.))

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

Note:_____

MODEL 6 - NPV & IRR CONFLICT

➢ There is no ranking conflict between NPV&IRR in case of mutually independent projects.

➢ The ranking conflict between NPV & IRR in case of mutually exclusive projects is arises in the following situations.
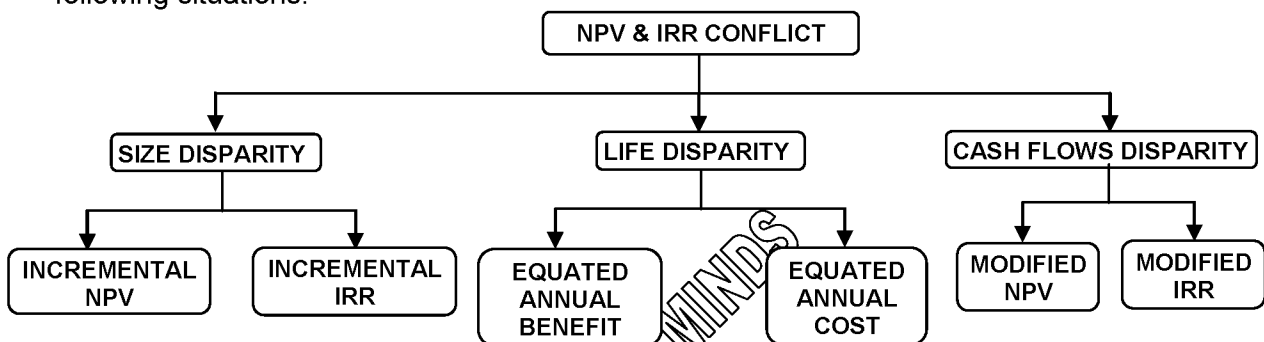
MODEL 6.1 - SCALE OR SIZE DISPARITY

PROBLEM 9: Gamma Limited is considering building an assembly plant and the company has two options, out of which it wishes to choose the best plant. The projected output is 10,000 units per month. The following data is available:

Particulars	Amount (Rs.)	
	Plant A	Plant B
Initial Cost	60,00,000	44,00,000
Direct Labour Cost p.a. (1st Shift)	30,00,000	15,00,000
(Second Shift)	-	19,00,000
Overhead (per year)	5,00,000	4,20,000

Both the plants have an expected life of 10 years after which there will be no salvage value. The cost of capital is 10 percent. The present value of an ordinary annuity of Re. 1 for 10 years @ 10 percent is 6.1446. Ignore effect of taxation.

You are required to determine:

a) What would be the desirable choice?

b) What other important elements are to be considered before the final decision is taken?

(B) (RTP M14) (ANS.: PRESENT VALUE OF NET SAVING FOR PLANT A RS 19,66,272, ADDITIONAL OUTLAY FOR USING PLANT A 16,00,000, NET SAVING FOR THE COMPANY IN CHOOSING PLANT A = RS. 19,66,272 -RS. 16,00,000 = RS. 3,66,272. HENCE, PLANT A SHOULD BE IMPLEMENTED) (SOLVE PROBLEM NO. 8 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

MODEL 6.2 - LIFE DISPARITY OR PROPOSALS WITH UNEQUAL LIVES

PROBLEM 10: R Ltd. is considering modernizing its production facilities and it has two proposals under consideration. Which project should be accepted basing on annualized NPV at given discounting rate of 12%.

Particulars	Project A	Project B
NPV	6.497	5.156
Life	6 Years	3 Years

(B) (ANS.: PROJECT A: 1.580, PROJECT B: 2.146, PROJECT B IS ACCEPTED)

(SOLVE PROBLEM NO. 9 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

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PROBLEM 11: The following data related to two machines, which machine should be bought?

Particulars	Project A	Project B
PV of cash outflow	11,23,310	10,34,000
Life	3 Years	2 Years

Year	t_1	t_2	t_3
$PVIF_{0.10.t}$	0.9091	0.8264	0.7513
$PVIFA_{0.10.2}$ =1.7355			
$PVIFA_{0.10.3}$ =2.4868			

(A) (N13 - 8M) (ANS.: EQUIVALENT PRESENT VALUE OF NET CASH OUTFLOW OF MACHINE A: RS. 4,51,673; MACHINE B: RS.5,95,622, SINCE EQUIVALENT PRESENT VALUE OF NET CASH OUTFLOW IS LESS, IT IS BENEFICIAL TO PURCHASE MACHINE A) (SOLVE PROBLEM NO. 10 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

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PROBLEM 12: (PRINTED SOLUTION AVAILABLE) BT Pathology Lab Ltd. is using a X-ray machines which reached at the end of their useful lives. Following new X-ray machines of two different brands with same features are available for the purchase.

Brand	Cost of Machine	Life of Machine	Maintenance Cost			Rate of Depreciation
			Year 1-5	Year 6-10	Year 11-15	
XYZ	Rs.6,00,000	15 years	Rs.20,000	Rs.28,000	Rs.39,000	4%
ABC	Rs.4,50,000	10 years	Rs.31,000	Rs.53,000	--	6%

Residual Value of both of above machines shall be dropped by 1/3 of Purchase Price in the first year and thereafter shall be depreciated at the rate mentioned above.

Alternatively, the machine of Brand ABC can also be taken on rent to be returned back to the owner after use on the following terms and conditions:

• Annual Rent shall be paid in the beginning of each year and for first year it shall be Rs. 1,02,000.

• Annual Rent for the subsequent 4 years shall be Rs.1,02,500.

• Annual Rent for the final 5 years shall be Rs.1,09,950.

• The Rent Agreement can be terminated by BT Labs by making a payment of Rs.1,00,000 as penalty. This penalty would be reduced by Rs.10,000 each year of the period of rental agreement.

You are required to:

a) Advise which brand of X-ray machine should be acquired assuming that the use of machine shall be continued for a period of 20 years.

b) Which of the option is most economical if machine is likely to be used for a period of 5 years?

The cost of capital of BT Labs is 12%.

(B) (RTP N15) (ANS.: A) MACHINE XYZ SHOULD BE PURCHASED B) MACHINE ABC SHOULD BE TAKEN ON RENT)

(SOLVE PROBLEM NO. 11 OF ASSIGNMENT PROBLEMS AS REWORK)

MODEL 6.3 - CASH FLOW DISPARITY OR TIME DISPARITY

PROBLEM 13: (PRINTED SOLUTION AVAILABLE) A firm can make investment in either of the following two projects. The firm anticipates its cost of capital to be 10% and the net (after tax) cash flows of the projects for five years are as follows:

	Figures in (Rs. Rs.000)					
Year	0	1	2	3	4	5
Project-A	(500)	85	200	240	220	70
Project-B	(500)	480	100	70	30	20

The discount factors are as under:

Year	0	1	2	3	4	5
PVF (10%)	1	0.91	0.83	0.75	0.68	0.62
PVF (20%)	1	0.83	0.69	0.58	0.48	0.41

Required:

a) Calculate the NPV and IRR of each project.

b) State with reasons which project you would recommend.

c) Explain the inconsistency in ranking of two projects.   *(A) (OLD PM)*

(ANS.: A) NPV FOR PROJECT A IS RS.116.35 & PROJECT B IS RS.105.1, IRR FOR PROJECT A IS 18.66%, & PROJECT B IS 24.10%,
B) AS PER OBJECTIVE OF F.M, IT IS BENEFICIAL TO SELECT THE PROJECT BEING PREFERRED BY NPV. I.E., PROJECT A)

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

Note:_____

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MODEL 7 - ADJUSTED NPV

ADJUSTED NPV:

i) In capital budgeting, by discounting the after tax cash flows at the WACC we intuitively assumed that every rupee of capital expenditure was funded both by debt and by equity in the company's debt equity ratio.

ii) But at times the investment decision is inexorably tied to a financing decision. For example a project may be eligible for concessional finance because it is being set up in a backward area or because the government is keen that funds should flow to this area.

iii) Adjusted NPV (ANPV) is the project's NPV after considering the effect of financing. Two adjustments are relevant here:

    a) Issue costs

    b) Tax shield on interest on debt.

Method of computing ANPV:

The following should be the step-by-step procedure.

Step 1: Compute base case NPV. This is NPV of the project computed on the assumption that it is fully financed by equity. This would mean that you would discount the cash flows at cost of equity. This is called base case NPV.

Step 2: Compute the issue costs. The firm has to incur costs to raise the money. This is already in today's value and represents an outflow.

Step 3: Compute the tax saved on interest payable. The interest paid is tax deductible. We must hence compute the tax saved on interest paid.

Step 4: Compute present value of the tax shield. The "tax saving" takes place at different points in time. They must therefore be brought down to today's value. This is achieved by discounting the tax

saving **at the pre tax cost of debt.** The logic for pretax cost of debt lies in the assumption that the cash flow arising out of thx saving is as risky as the cash flow from debt.

Step 5: Compute ANPV. ANPV = Base case NPV - Issue costs + PV of interest tax Shield.

PROBLEM 14: A project requires an investment of Rs. 50 lakhs. The annual CFAT is Rs 10 lakhs for the 10 years. The opportunity cost of capital is 12% and is the rate of return expected by shareholders. Issue costs are 5% of net proceeds of the issue. The project enables the firm to borrow Rs 20 lakhs of debt finance. The cost of debt is 6% and is payable in 10 equal annual installments of principal. Tax rate is 50%. Compute base case NPV. Compute adjusted NPV. Is the project viable?

(B) (CA FINAL PTB) (ANS.: BASE CASE NPV 650, ADJUSTED NPV 663.96 THE PROJECT HAS A POSITIVE ADJUSTED NPV AND SHOULD BE ACCEPTED) (SOLVE PROBLEM NO. 13 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

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PROBLEM 15: (PRINTED SOLUTION AVAILABLE) XYZ Ltd. is presently all equity financed. The directors of the company have been evaluating investment in a project which will require Rs.270 lakhs capital expenditure on new machinery. They expect the capital investment to provide annual cash flows of Rs.42 lakhs indefinitely which is net of all tax adjustments. The discount rate which it applies to such investment decisions is 14% net.

The directors of the company believe that the current capital structure fails to take advantage of tax benefits of debt, and propose to finance the new project with undated perpetual debt secured on the company's assets. The company intends to issue sufficient debt to cover the cost of capital expenditure and the after tax cost of issue.

The current annual gross rate of interest required by the market on corporate undated debt of similar risk is 10%. The after tax costs of issue are expected to be Rs. 10 lakhs. Company's tax rate is 30%.

You are required to calculate:

i)   The adjusted present value of the investment,

ii) The adjusted discount rate and

iii) Explain the circumstances under which this adjusted discount rate may be used to evaluate future investments.   *(B) (M18 (N) - 8M) (ANS: i) RS. 104 LAKHS, ii) 8.8%)*
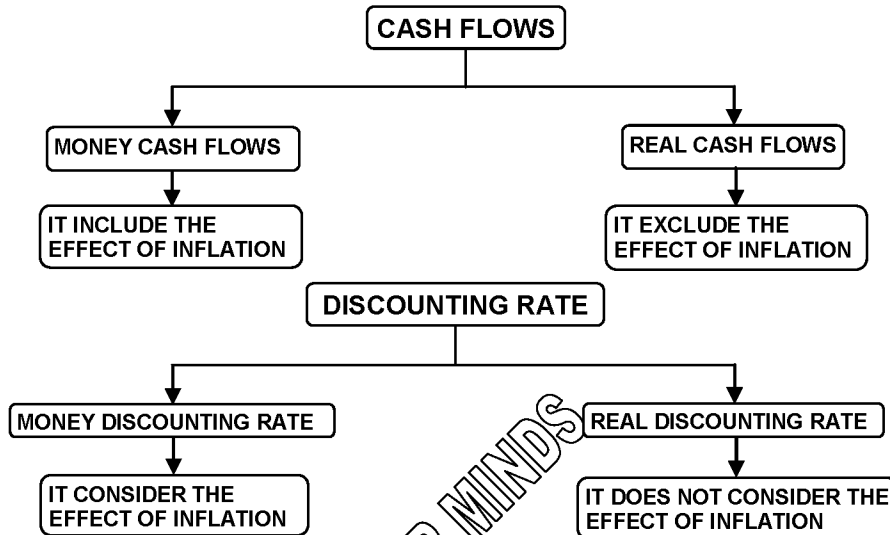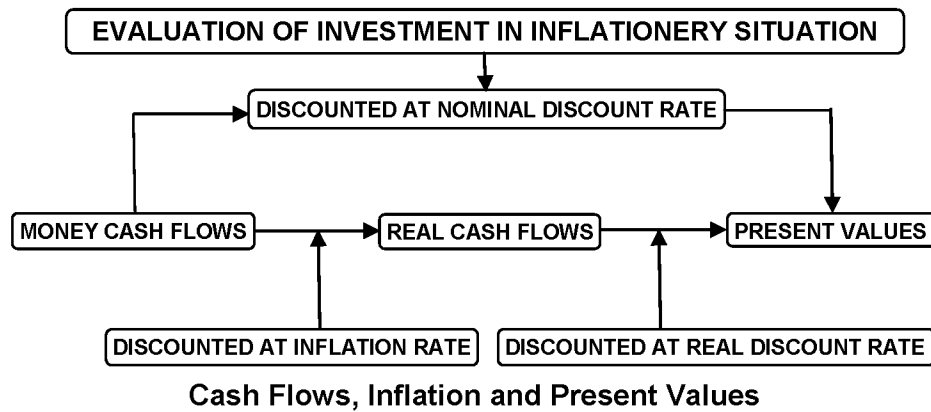
(SOLVE PROBLEM NO. 14 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

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MODEL 8 - IMPACT OF INFLATION ON INVESTMENT DECISIONS:

IMPACT OF INFLATION:

➢ The capital budgeting decision process discussed so far has not considered the effect of inflation which can definitely distort the entire evaluation procedure.

➢ Prices rise gradually of all goods and services, of raw materials, of labour etc. The effect of inflation, which is usually defined as increase in prices, is that the purchasing power of money or the value of money goes down.

➢ A finance manager, who is dealing with the cash flows in monetary terms, might be losing in terms of decrease in purchasing power of money.

➢ He should therefore, be careful in evaluating the effect of inflation on capital budgeting decisions process.

➢ The inflation not only affects the cash flows of a project but also affects the discount rate / cut off rate because there is an irresistible relationship between the inflation, interest rates and the discount rate.

EVALUATION OF INVESTMENT IN INFLATIONERY SITUATION

DISCOUNTED AT NOMINAL DISCOUNT RATE

MONEY CASH FLOWS → REAL CASH FLOWS → PRESENT VALUES

DISCOUNTED AT INFLATION RATE   DISCOUNTED AT REAL DISCOUNT RATE

Cash Flows, Inflation and Present Values

CASH FLOWS

MONEY CASH FLOWS — IT INCLUDE THE EFFECT OF INFLATION

REAL CASH FLOWS — IT EXCLUDE THE EFFECT OF INFLATION

DISCOUNTING RATE

MONEY DISCOUNTING RATE — IT CONSIDER THE EFFECT OF INFLATION

REAL DISCOUNTING RATE — IT DOES NOT CONSIDER THE EFFECT OF INFLATION

$$(1 + MDR) = (1 + RDR)(1 + IFR)$$

$$MDR = [(1 + RDR)(1 + IFR)] - 1$$

$$RDR = \left(\frac{1 + MDR}{1 + IFR}\right) - 1$$

$$IFR = \left(\frac{1 + MDR}{1 + RDR}\right) - 1$$

MDR = Money Discount Rate

RDR = Real Discount Rate

IFR = Inflation Rate

PROBLEM 16: **(PRINTED SOLUTION AVAILABLE)** A new project with a life of 4 years involves expenditure on plant of Rs 20,000, which has an expected scrap value of Rs 2,000/-. Annual cash outflows will be Rs 9,000 in the first year and will be constant over the 4 years in real terms. The cash inflows including the effect of inflation are estimated at Rs 14,000 in Year 1, Rs 21,000 in years 2 and 3 each and Rs 17,000 in year 4. The appropriate market discount rate is 18% and all cash flows are affected by constant inflation of 6% per annum. Find NPV using (a) Money terms (b) Real terms.

(B) (CA FINAL: PTB) (ANS.: A) RS. 3,367; B) RS. 3,375) (SOLVE PROBLEM NO. 15 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

_____

PROBLEM 17: **(PRINTED SOLUTION AVAILABLE)** A company is evaluating a project that requires initial investment of Rs.60 lakhs in fixed assets and Rs. 12 lakhs towards additional working capital.

The project is expected to increase annual real cash inflow before taxes by Rs.24,00,000 during its life. The fixed assets would have zero residual value at the end of life of 5 years. The company

follows straight line method of depreciation which is expected for tax purposes also. Inflation is expected to be 6% per year. For evaluating similar projects, the company uses discounting rate of 12% in real terms. Company's tax rate is 30%.

Advise whether the company should accept the project, by calculating NPV in real terms.

PVIF (12%, 5 Yrs)		PVIF (6%, 5 Yrs.)	
Year 1	0.893	Year 1	0.943
Year 2	0.797	Year 2	0.890
Year 3	0.712	Year 3	0.840
Year 4	0.636	Year 4	0.792
Year 5	0.567	Year 5	0.747

(B) (M18 (N) - 10M) (ANS.: ADVICE: COMPANY SHOULD ACCEPT THE PROJECT AS THE NPV IS POSITIVE)

Note:_____

_____

ASSIGNMENT PROBLEMS

MODEL 1 - IMPORTANT ADJUSTMENTS IN INVESTMENT ANALYSIS

NPV - OPPURTUNITY COST, COMMON COST, SUNK COST

PROBLEM 1: Maharshi Ltd. has two divisions, which are periodically assisted by visiting teams of consultants. The management is worried about the steady increase of expenses in this regard over the years. An analysis of last year's expenses reveals the following:

Consultants Remuneration	6,00,000
Travel and conveyance	1,00,000
Accommodation exp.	8,00,000
Boarding Charges	1,00,000
Special Allowances	75,000

The management estimates accommodation expenses to increase by Rs.1,00,000/- annually. As part of cost reduction drive, Maharshi Ltd. is proposing to construct a consultancy center to take care of the accommodation requirements of the consultants. This center will additionally save the company Rs.1,00,000/- in the cost of Executive Training Programs hitherto conducted outside the company's premises every year.

The detail's regarding the construction and maintenance of the new center is:

a) Land at a cost of Rs.10,00,000/- already owned by the company, will be used.

b) Construction cost Rs.20,00,000/- including special furnishings.

c) Cost of annual maintenance: Rs.2,50,000/-

d) Construction cost will be written off over 5 years, being the useful life.

Assume that the write-off of construction cost as aforesaid will be accepted for tax purposes. Is the proposal feasible? Cost of capital - 12%, Tax rate - 50%.   *(B) (ANS.: NPV = RS.5,72,975)*

NPV - OPPURTUNITY COST (LOSS & BENEFIT), COMMON COST, CAPITAL GAINS

PROBLEM 2: A chemical company is presently paying an outside firm Rs.3 per gallon to dispose of the waste material resulting from its manufacturing operations. At normal operating capacity, the waste is about 40,000 gallons per year. After spending Rs.1,00,000 on research, the company discovered that the waste could be sold for Rs.20 per gallon if it was processed further. Additional processing would, however, require an investment of Rs.10,00,000 in new equipment, which would have an estimated life of 10 years with no salvage value. Depreciation would be calculated by straight line method. Except of the costs incurred in advertising Rs.50,000 per year; no change in the present selling and administrative expenses is expected, if the new product is sold, The details of additional processing costs are as follows:

a) Variable   : Rs.10 per gallon of waste put into process.

b) Fixed (excluding depreciation)   : Rs.50,000 per year.

In costing the new product, general administrative overheads will be allocated at the rate of Rs.4 per gallon. There will be no losses in processing, and it is assumed that the total waste processed in a given year will be sold in that very year. Estimates indicate that 40,000 gallons of the product could be sold each year. The management when confronted with the choice of disposing off the waste or processing it further and selling it, seeks your advice. Which alternative would you recommend? Assume that the firm's cost of capital is 10% and it pays on an average 40% tax on its income.

(A) (ANS.: NPV: RS.1,06,972)

MODEL 2 - BLOCK OF ASSETS AND DEPRECIATION

PROBLEM 3: A Ltd. acquired new machinery for Rs.1,00,000 depreciable at 20% as per Written Down Value (WDV) method. The machine has an expected life of 5 years with salvage value of Rs. 10,000. Estimate the treatment of Depreciation/ Short Term Capital Loss in the 5th year in two cases i.e. (Tax rate @ 30%)

Case I: There is no other asset in the Block.

Case II: More than one asset exists in the Block.

(A) (NEW SM, OLD SM) (ANS.: CASE 1: RS. 9,288; CASE 2: RS. 2,712)

MODEL 3 - REPLACEMENT DECISIONS

PROBLEM 4: WX Ltd. has a machine which has been in operation for 3 years. Its remaining estimated useful life is 8 years with no salvage value at the end. Its current market value is Rs. 2,00,000. The company is considering a proposal to purchase a new model of machine to replace the existing machine. The relevant information's are as follows:

	Existing Machine	New Machine
Purchase Price	Rs. 3,30,000	Rs. 10,00,000
Estimated life	11 years	8 years
Salvage value	Nil	Rs. 40,000
Annual output	30,000 units	75,000 units
Selling price per unit	Rs. 15	Rs. 15
Annual operating hours	3,000	3,000
Material cost per unit	Rs. 4	Rs. 4
Labour cost per hour	Rs. 40	Rs. 70
Indirect cash cost per annum	Rs. 50,000	Rs. 65,000

The company follows straight line method of depreciation. The corporate tax rate is 30 percent and WX Ltd. does not make any investment, if it yields less than 12 percent. Present value of annuity of Rs.1 at 12% rate of discount for 8 years is 4.968. Present value of Rs.1 at 12% rate of discount, received at the end of 8th year is 0.404. Ignore capital gain tax.

Advise WX Ltd. whether the existing machine should be replaced or not.

(A) (OLD PM) (ANS.: HENCE, EXISTING MACHINE SHOULD BE REPLACED BECAUSE NPV IS POSITIVE I.E. RS. 7,06,560)

PROBLEM 5: MP Ltd manufactures a special chemical. It is thinking of replacing its existing machine by a new one, which would costs Rs. 25 lakh

The company current production is 40,000 units and is expending to increase to 50,000 units if the new machine is bought. The selling price of the product would remain unchanged at Rs. 160 per unit. The following is the cost of producing on unit of product using both the existing and new machine ;

Particulars	Existing Machine	New machine
Variable Cost	138.4	118.4
Fixed overheads	8.2	12.4
(Depreciation & Allocated corporate over heads		

The existing machine has an accounting book value of Rs. 40,000 and it is fully depreciation for tax purpose. It has a remaining economic life of 5 years.

The supplier of the new machine has offered to accept the old machine in exchange for Rs. 1,00,000. However the market price of the existing machine today is Rs. 60,000 and Rs. 15,000 after years. New Machine has a life of 5 years and a salvage value of Rs. 1,00,000 at the end of its economic life.

Assume that tax rate is 30% and cost of capital is 20%.

Required: Advise the company whether to replace the existing machine or not on the basis of Net Present Value.

Note: The present value of Annuity for 5 years @ 20% is 2.991 and the present value for 5th year is 0.402.   *(TN) (ANS.: INCREMENTAL NPV: RS. 5,82,622; NEW MACHINE SHOULD PURCHASED)*

MODEL 4 - MODIFIED NPV / TERMINAL VALUE METHOD

PROBLEM 6: Consider the cash flows of two projects, X and Y:

Year	Project X (Rs.)	Project Y (Rs.)
0	(3,00,000)	(3,00,000)
1	40,000	80,000
2	50,000	70,000
3	60,000	60,000
4	70,000	60,000
5	80,000	50,000
6	90,000	40,000
7	1,00,000	30,000

The cost of capital is 13%. Calculate modified NPV for projects X and Y, assuming re-investment rate of 15%.   *(B) (ANS.: MODIFIED NPV OF PROJECT X AND Y IS RS. 3,339.5, RS. 17,753 RESPECTIVELY)*

MODEL 5 - MODIFIED IRR

PROBLEM 7: Estimate Modified IRR from the given information.

Initial investment = Rs.1,00,000

Year	1	2	3	4
CFAT	50,000	40,000	30,000	10,000

Assume Reinvestment rate @ 4%.   *(B) (ANS.: MIRR: 9%)*

MODEL 6.1 - SCALE OR SIZE DISPARITY

PROBLEM 8: Suppose Project A and Project B are under consideration. The cash flows associated with these projects are as follows:

Year	Project A (Rs)	Project B (Rs)
0	(1,00,000)	(3,00,000)
1	50,000	1,40,000
2	60,000	1,90,000
3	40,000	1,00,000

Assuming Cost of Capital equal to 10% which project should be accepted as per NPV Method and IRR Method. Is there is any ranking conflict between NPV&IRR? Resolve the same.

(B) (NEW SM, OLD SM) (ANS.: NPV OF A: RS. 25,050, B: RS. 59,300, IRR OF A: 24.26%, B: 21.48%)

MODEL 6.2 - LIFE DISPARITY OR PROPOSALS WITH UNEQUAL LIVES

PROBLEM 9: National Electronics Ltd., an electronic goods manufacturing company, is producing a large range of electrical goods. It has under consideration two projects "X" and "Y" each costing Rs.120 lacks. The projects are mutually exclusive and the company is considering the question of selecting one of the two. Cash flows have been worked out for both the projects and the details are given below: "X" has a life of 8 years and "Y" has a life of 6 years. Both will have zero salvage value at the end of their operational lives. The company is already making profits and its tax rate is 50%. The cost of capital of the company is 15%.

At the end of the year	Net cash inflow		P.V. of rupee at 15%
	Project X	Project Y	
1	25	40	0.870
2	35	60	0.756
3	45	80	0.658
4	65	50	0.572
5	65	30	0.497
6	55	20	0.432
7	35	--	0.376
8	15	--	0.327

The company follows straight line method of depreciating assets. Advise the company regarding the selection of the project using the concept of Annualized NPV. *(B)*

(ANS.: NPV OF PROJECT X =15.4 LAKHS, Y = 17.16 LAKHS SINCE ANNUALIZED NPV MORE, IT IS BENEFICIAL TO SELECT PROJECT Y)

PROBLEM 10: Company UVW has to make a choice between two identical machines, in terms of Capacity, 'A' and 'B'. They have been designed differently, but do exactly the same job.

Machine 'A' costs Rs.7,50,000 and will last for three years. It costs Rs.2,00,000 per year to run. Machine 'B' is an economy model costing only Rs.5,00,000, but will last for only two years. It costs Rs.3,00,000 per year to run.

The cash flows of Machine 'A' and 'B' are real cash flows. The costs are forecasted in rupees of constant purchasing power. Ignore taxes. The opportunity cost of capital is 9%.

Required: Which machine the company UVW should buy? *(A) (OLD PM)*

(ANS.: SINCE EQUIVALENT PRESENT VALUE OF NET CASH OUTFLOWS IS LESS IT IS BENEFICIAL TO PURCHASE MACHINE A)

PROBLEM 11: Z Ltd. is using a Scan machines which reached at the end of their useful lives. Following new X-ray machines of two different brands with same features are available for the purchase.

Brand	Cost of Machine	Life of Machine	Maintenance Cost			Rate of Depreciation
			Year 1-5	Year 6-10	Year 11-15	
MNO	10,00,000	15 years	25,000	28,000	32,000	5%
PQR	7,50,000	10 years	40,000	60,000	-	6%

Residual Value for MNO brand shall be dropped by 25% of Purchase Price in the first year, Residual Value for PQR brand shall be dropped by 1/3 of Purchase Price in the first year and thereafter shall be depreciated at the rate mentioned above.

Alternatively, the machine of Brand PQR can also be taken on rent to be returned back to the owner after use on the following terms and conditions:

- Annual Rent shall be paid in the beginning of each year and for first year it shall be Rs. 1,20,000.

- Annual Rent for the subsequent 4 years shall be Rs.1,25,000.

- Annual Rent for the final 5 years shall be Rs.1,50,000.

- The Rent Agreement can be terminated by Z Ltd. by making a payment of Rs. 2,50,000 as penalty. This penalty would be reduced by Rs. 25,000 each year of the period of rental agreement.

You are required to:

a) Advise which brand of Scan machine should be acquired assuming that the use of machine shall be continued for a period of 20 years.

b) Which of the option is most economical if machine is likely to be used for a period of 5 years?

   The cost of capital of Z Ltd. is 12%.

(B) (ANS.: A) MACHINE MNO SHOULD BE PURCHASED B) MACHINE PQR SHOULD BE TAKEN ON RENT]

PROBLEM 12: The cash flows of projects C and D are reproduced below:

Project	Cash Flow				NPV at 10%	IRR
	C_0	C_1	C_2	C_3		
C	-10,000	+2,000	+ 4,000	+12,000	+4,139	26.5%
D	-10,000	+10,000	+ 3,000	+3,000	+3,823	37.6%

i)   Why there is a conflict of ranking?

ii) Why should you recommend project C in spite of lower internal rate of return?

Time	1	2	3
PVIF 0.10,t	0.9090	0.8264	0.7513
PVIF 0.14,t	0.8772	0.7695	0.6750
PVIF 0.15,t	0.8696	0.7561	0.6575
PVIF 0.30,t	0.7692	0.5917	0.4552
PVIF 0.40,t	0.7143	0.5102	0.3644

(RK) (ANS.: I) SKEWNESS IN CASH FLOWS; PROJECT C NPV IS HIGHER THAN PROJECT D NPV AT LOWER DISCOUNT RATE; PROJECT C NPV WILL FALLS FASTER WHEN DISCOUNT RATE INCREASES DUE TO COMPOUNDING EFFECT; AT BEP DISCOUNT RATE, PROJECT D IS HAVING WITH HIGHER NPV AND IRR; II) PROJECT C SHOULD BE ACCEPTED WHEN OPPORTUNITY COST OF FUNDS IS 10%)

MODEL 7 - ADJUSTED NPV

PROBLEM 13: A project involves an initial capital expenditure of Rs. 10 lakhs. The annual CFAT is Rs. 2 lakhs for the next 10 years/ the opportunity cost of capital is 12% which reflects the project's business risk. Issue costs are 5% of the gross proceeds of the issue. The firm can borrow up to Rs. 5 lakhs. The cost of debt is 6% and is payable in 10 equal annual installments of principal. Tax rate @ 50%.

i)   Compute base case NPV and

ii) Compute adjusted NPV   *(A) (CA FINAL PTB) (ANS.: I) 1,30,000; II) 1,43,360)*

PROBLEM 14: Sanathana Ltd., evaluating a project costing Rs. 20 lakhs, The project generates savings of Rs. 2.95 lakhs per annum to perpetuity. The business risk of the project warrants a rate of return of 15%.

a)   Calculate Base case NPV of the project assuming on tax.

b)   Assuming Tax of 30% with 12% cost of Debt constituting 30% of the Project Cost, determine Adjusted Net Present Value.

c)   Find out minimum acceptable Base Case NPV, as well as Minimum IRR (or) Adjusted Discount Rate.

d)   Explain the circumstances under which this adjusted discount rate may be used to evaluate future investments.

(PDK) (ANS.: A) NPV (BASE CASE): (0.33) LAKHS; B) ADJUSTED NPV: 1.47 LAKHS; C) MINIMUM BASE CASE NPV: RS. 1.8 LAKHS, IRR: 13.65%)

MODEL 8 - IMPACT OF INFLATION ON INVESTMENT DECISIONS

PROBLEM 15: A firm has projected the following cash flows from a project under evaluation:

Year	Rs. lakhs
0	(70)
1	30
2	40
3	30

The above cash flows have been made at expected prices after recognizing inflation. The firm's cost of capital is 10%. The expected annual rate of inflation is 5%.

Show how the viability of the project is to be evaluated.

(A) (CA FINAL PTB, MAY 2005) (ANS.: SINCE THE NPV IS POSITIVE THE PROJECT SHOULD BE ACCEPTED)

PRINTED SOLUTIONS TO SOME SELECTIVE PROBLEMS

PROBLEM NUMBERS TO WHICH SOLUTIONS ARE PROVIDED: 1, 5, 6, 8, 12, 13, 15, 16, 17

PROBLEM NO.1

Note: Cost of land is irrelevant for decision making as it is a sunk cost.

Following expenses are also irrelevant for decision making as they are common costs.

a) Consultants remuneration

b) Travel and conveyance

c) Boarding charges to the extent of Rs.1,50,000

d) Special allowances

Calculation of Net Present Value using Incremental approach

Step - 1: Calculation of Present Value of Cash Outflows

Particulars	Amount
Cost of land	-
Construction Cost	15,00,000
Present Value of Cash Outflows	15,00,000

Step - 2: Calculation of Present Value of Operating Cash Inflows   **(in lakhs)**

Particulars	Y_1	Y_2	Y_3	Y_4	Y_5
Savings accommodation Expenses	8.0	10.0	12.0	14.0	16.0
Savings in Boarding Charges	0.5	0.5	0.5	0.5	0.5
Savings in ETP Cost	2.0	2.0	2.0	2.0	2.0
	10.5	12.5	14.5	16.5	18.5
Less: Incremental Expenses					
i) A.M.C	(1.5)	(1.5)	(1.5)	(1.5)	(1.5)
ii) Depreciation $\left(\dfrac{15L-0}{5}\right)$	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)
PBT	6.0	8.0	10.	12.0	14.0
PAT @ 50%	3.0	4.0	5.0	6.0	7.0
Add: Deprecation	3.0	3.0	3.0	3.0	3.0
CFAT	6.0	7.0	8.0	9.0	10.0
PVF @ 10%	0.909	0.826	0.751	0.683	0.621

Present value of Operating Cash inflows = Rs.29,60,100

Step - 3: Present value of Terminal Cash Inflows = 0

Step - 4: Calculation of Net Present Value

Net Present Value = Present Value of cash inflows - Present Value of cash outflows

= Present Value of operating Cash Inflows + Present Value of Terminal Cash Inflows - Present Value of Cash Outflows.

= 29,60,100 + 0 - 15,00,000

= Rs.14,60,100

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.

Conclusion: Since Net Present Value is positive it is beneficial for the company to construct own consultancy centre.

PROBLEM NO.5

Step: 1: NSP of existing machine as on today

	Particulars	Amount (Rs.)
a)	GSP	1,00,000
b)	WDV (2,40,000 - 40,000)	(2,00,000)
c)	Capital Loss	1,00,000
d)	Tax shield	(50,000)
	NSP	**1,50,000**

Step: 2: Estimation of PV of incremental cash outflow

	Particulars	Amount (Rs.)
a)	Cost of new machine	4,00,000
b)	NSP of existing machine	(1,50,000)
		2,50,000
c)	Incremental working capital	15,000
d)	PV of Incremental cash outflows	**2,65,000**

Step: 3: Computation of Depreciation p.a

$$
\begin{aligned}
\text{Depreciation p.a} &= \text{Cost - Scrap / Life} \\
\text{New Machine} &= 4,00,000 - 0 \ / \ 10 \\
&= 40,000 \\
\text{Existing Machine} &= 2,00,000 - 0 \ / \ 10 \\
&= 20,000 \\
\text{Incremental depreciation} &= 20,000 \ (40,000 - 20,000)
\end{aligned}
$$

Step 4: Computation of PV of Incremental Operating cash inflows

	Particulars	Existing Machine	New Machine
a)	Operating hours	2,000	2,000
b)	Output per hour	15	30
c)	Total output (a x b)	30,000	60,000
d)	Selling Price per unit	10	10
e)	Total Sales Revenue	3,00,000	6,00,000
f)	Material Cost	(60,000) (30,000 x 2)	(1,20,000) (60,000 x 2)
g)	Labour Cost	(40,000) (20,000 x 2)	(80,000) (40,000 x 2)
h)	Consumable Stores	(2,000)	(5,000)
i)	Repairs	(9,000)	(6,000)
j)	PBDT (e-f-g-h)	1,89,000	3,89,000

$$
\begin{aligned}
\text{Incremental PBDT} &= 2,00,000 \\
\textbf{Less: Incremental Depreciation} &= \underline{20,000} \\
\text{PBT} &= 1,80,000 \\
\text{Tax @ 50\%} &= (90,000) \\
\text{PAT} &= 90,000 \\
\text{CFAT} &= 1,10,000
\end{aligned}
$$

$$
\begin{aligned}
\text{PV of OPCI} &= 1,10,000 \ X \ \text{PVAF (15\%, 10Y)} \\
&= 1,10,000 \ X \ 5.09 = 5,52,090
\end{aligned}
$$

Step: 4: PV of TMCI   =   0

Step: 5: Estimation of PV of Incremental TMCI

Particulars		Amount
a) GSP / NSP of New Machine	=	0
b) GSP / NSP of Existing Machine	=	0
c) Recovery of Incremental working capital	=	15,000
TMCI		15,000
PV of TMCI	=	15,000 x PVF (15% X 10Y)
	=	15,000 x 0.247 = Rs. 3705

Step: 6: Computation of Incremental NPV

NPV   =   Incremental PV of OPCI + Incremental PV TMCI - Incremental PV Cash outflow

       =   5,52,090 + 3,705 - 2,65,000 = Rs.2,90,795.

Since, the incremental NPV is positive - it is advisable to replace the existing machine with new machine.

PROBLEM NO.6

i)   **Net Cash Outflow of New Machine:**

Particulars	Amount (Rs.000)
Purchase Price of New Machine	6,000
Less: Exchange value of Old Machine [2,50,000 - 0.40 (2,50,000 - 0)]	150
Net cash Out Flow	5,850

Market Value of Old Machine: The old machine could be sold for Rs.1,50,000 in the market. Since the exchange value is more than the market value, this option is not attractive. This opportunity will be lost whether the old machine is retained or replaced. Thus, on incremental basis, it has no impact.

Depreciation base: Old machine has been fully depreciated for tax purpose.

Thus the depreciation base of the new machine will be its original cost i.e. Rs.60,00,000.

Net Cash Flows: Unit cost includes depreciation and allocated overheads. Allocated overheads are allocations from corporate office therefore they are irrelevant. The depreciation tax shield may be computed separately. Excluding depreciation and allocated overheads, unit costs can be calculated. The company will obtain additional revenue from additional 20,000 units sold.

Thus, after-tax saving, excluding depreciation, tax shield, would be

= [1,00,000 (200 - 148) - 80,000(200 - 173)] x (1 - 0.40)

= [52,00,000 - 21,60,000] x 0.60 = Rs.18,24,000.

After adjusting depreciation tax shield and salvage value, net cash flows and net present value are estimated.

Calculation of Cash flows and Project Profitability

							Rs.('000)
Particulars		0	1	2	3	4	5
1.	Profit after tax savings	-	1824	1824	1824	1824	1824
2.	**Less:** Depreciation (6000 - 250) / 5 years	-	1150	1150	1150	1150	1150
3.	Tax shield on depreciation (Depreciation x Tax rate)	-	460	460	460	460	460
4.	Net cash flows from operations (1 + 3)	-	2284	2284	2284	2284	2284
5.	Initial cost	(5850)	-	-	-	-	-
6.	Net salvage value (250 - 35)	-	-	-	-	-	215
7.	Net Cash Flows	(5850)	2284	2284	2284	2284	2499
8.	PVF @ 15%	1.00	0.8696	0.7561	0.6575	0.5718	0.4972
9.	PV	(5850)	1986.166	1726.932	1501.73	1305.99	1242.50
10.	NPV	1913.32					

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.

Advise: The Company should go ahead with replacement project, since it is positive NPV decision.

ii)   **Calculation of Internal Rate of Return:**   Rs.('000)

Year	Net cash Flows	PVF at 20%	PV	PVF at 30%	PV
0	-5850	1	-5850.00	1	-5850.00
1	2284	0.8333	1903.26	0.7692	1756.85
2	2284	0.6944	1586.01	0.5917	1351.44
3	2284	0.5787	1321.75	0.455	1039.22
4	2284	0.4823	1101.57	0.3501	799.63
5	2499	0.4019	1004.35	0.2693	672.98
	NPV		**1066.94**		**-229.88**

Using Interpolation, IRR = $LR + \dfrac{NPV\ @LR}{NPV\ @LR - NPV\ @HR} \times HR - LR$

$$IRR = 0.20 + 0.1 \times \dfrac{1066.94}{1296.82} = 28.23\% \text{ (approx.)}$$

Advise: The Company should go ahead with replacement project. Since it is positive NPV decision.

PROBLEM NO.8

Year- 0, Cash flow- Rs.1,36,000

The MIRR is calculated on the basis of investing the inflows at the cost of capital. The table below shows the valued of the inflows if they are immediately reinvested at 8%.

Year	Cash flow	@ 8% reinvestment rate factor	Amount (Rs.)
1	30,000	1.3605*	40,815
2	40,000	1.2597	50,388
3	60,000	1.1664	69,984
4	30,000	1.0800	32,400
5	20,000	1.000	20,000
			2,13,587

* Investment of Rs. 1 at the end of the year 1 is reinvested for 4 years (at the end of 5 years) shall become 1 $(1.08)^4 = 1.3605$. Similarly, reinvestment rate factor for remaining years shall be calculated. Please note investment at the end of 5th year shall be reinvested for zero year hence reinvestment rate factor shall be 1.00.

The total cash outflow in year 0 (Rs. 1,36,000) is compared with the possible inflow at year 5 and the resulting figure of $\dfrac{1,36,000}{2,13,587} = 0.6367$ is the discount factor in year 5. By looking at the year 5 row in the present value tables, you will see that this gives a return of 9%. This means that the Rs.2,13,587 received in year 5 is equivalent to Rs.1,36,000 in year 0 if the discount rate is 9%. Alternatively, we can compute MIRR as follows:

Total return $= \dfrac{2,13,587}{1,36,000} = 1.5705$

$MIRR = \sqrt[5]{1.5705} - 1 = 9\%$

PROBLEM NO.12

Since the life span of each machine is different and time span exceeds the useful lives of each model, we shall use Equivalent Annual Cost method to decide which brand should be chosen.

a) **If machine is used for 20 years:**

   i) **Calculation of Present Value (PV) of cost if machine of Brand XYZ is purchased:**

Period	Cash flows (Rs.)	PVF @ 12%	Present Value
0	6,00,00	1.000	6,00,000
1-5	20,000	3.605	72,100
6-10	28,000	2.045	57,260
11-15	39,000	1.161	45,279
15	(64,000)	0.183	(11,712)
			7,62,927

PVAF for 1-15 years = 6.811

- Equivalent Annual Cost $= \dfrac{Present\ Value\ of\ cost}{Present\ Value\ of\ Annuity\ Factor(r,n)}$

- Equivalent Annual Cost $= \dfrac{Rs.7,62,927}{6.811} = Rs.1,12,014$

ii) Calculation of Present Value (PV) of cost if machine of Brand ABC is purchased:

Period	Cash Outflows (Rs.)	PVF @ 12%	Present Value
0	4,50,000	1.000	4,50,000
1-5	31,000	3.605	1,11,755
6-10	53,000	2.045	1,08,385
10	(57,000)	0.322	(18,354)
			6,51,786

PVAF for 1-10 years = 5.65

- Equivalent Annual Cost = $\dfrac{Rs.\ 6,51,786}{5.65}$ = Rs.1,15,360

iii) Calculation of Present Value (PV) of cost if machine of Brand ABC is taken on Rent:

Period	Cash Outflows (Rs.)	PVF @ 12%	Present Value
0	1,02,000	1.000	1,02,000
1-4	1,02,500	3.037	3,11,293
5-9	1,09,950	2.291	2,51,895
			6,65,188

PVAF for 1-10 years = 5.65

- Equivalent Annual Cost = $\dfrac{Rs.6,65,188}{5.65}$ = Rs.1,17,732

Decision: Since Equivalent Annual Cash Outflow is least in case of purchase of Machine of brand XYZ the same should be purchased.

b) If machine is used for 5 years:

W.N.1: Scrap Value of Machine of Brand XYZ

= Rs.6,00,000 - Rs.2,00,000 - Rs.6,00,000 x 0.04 x 4 = Rs.3,04,000

W.N.2: Scrap Value of Machine of Brand ABC

= Rs.4,50,000 - Rs.1,50,000 - Rs.4,50,000 x 0.06 x 4 = Rs.1,92,000

i) Calculation of Present Value (PV) of cost if machine of Brand XYZ is purchased:

Period	Cash Outflows (Rs.)	PVF @ 12%	Present Value
0	6,00,000	1.000	6,00,000
1-5	20,000	3.605	75,100
5	(3,04,000)	0.567	(1,72,368)
			4,99,732

ii) Calculation of Present Value (PV) of cost if machine of Brand ABC is purchased:

Period	Cash Outflows (Rs.)	PVF @ 12%	Present Value
0	4,50,000	1.000	4,50,000
1-5	31,000	3.605	1,11,755
5	(1,92,000)	0.567	(1,08,864)
			4,52,891

iii) Calculation of Present Value (PV) of cost if machine of Brand ABC is taken on Rent:

Period	Cash Outflows (Rs.)	PVF @ 12%	Present Value
0	1,02,000	1.000	1,02,000
1-4	1,02,500	3.037	3,11,293
5	50,000	0.567	28,350
			4,41,643

Decision: Since Cash Outflow is least in case of lease of Machine of brand ABC the same should be taken on rent.

PROBLEM NO.13

Calculation of NPV and IRR for each project:

Project A   **(Rs. In thousands)**

Year	Cash flows	PVF @ 10%	PV	PVF @ 20%	PV
0	(500)	1	(500)	1	(500)
1	85	0.91	77.35	0.83	70.55
2	200	0.83	166	0.69	138.00
3	240	0.75	180	0.58	139.20
4	220	0.68	149.6	0.48	105.60
5	70	0.62	43.4	0.41	28.70
		NPV	**116.35**		**(17.95)**

NPV of Project A at 10% (cost of capital) Rs.1,16,350.

IRR of Project A may be calculated by Interpolation method as under :

NPV at 20% is = (-) 17.98 (Rs.'000)

NPV at 10% is = + 116.35 (Rs.'000)

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

$$= 10 + \frac{116.35}{116.35 - (-17.95)} \times (20 - 10)\% = 18.66\% \text{ (approx.)}$$

Project B   **(Rs. In thousands)**

Year	Cash flows	PVF @ 10%	PV	PVF @ 20%	PV
0	(500)	1	(500)	1	(500)
1	480	0.91	436.8	0.83	398.40
2	100	0.83	83	0.69	69.00
3	70	0.75	52.5	0.58	40.60
4	30	0.68	20.4	0.48	14.40
5	20	0.62	12.4	0.41	8.20
		NPV	105.1	NPV	30.60

NPV of Project B at 10% (cost of capital) is Rs. 1,05,100.

IRR of Project B may be calculated by Interpolation method as under:

NPV at 10% is = + 105.10 (Rs.'000)

NPV at 20% is = + 30.60 (Rs.'000)

$$IRR = LR + \frac{NPV@LR}{NPV@LR - NPV@HR} \times HR - LR = 10 + \frac{105.10}{105.10 - (30.60)} \times (20 - 10)\% = 24.10\% \text{ (approx.)}$$

a) Ranking of the Projects will be as under:

Particulars	NPV	IRR
Project A	116.35 (I)	18.66% (II)
Project B	105.1 (II)	24.10% (I)

Decision: There is a conflict in ranking. IRR assumes that the project cash flows are reinvested at IRR whereas the cost of capital is 10%. The two projects are mutually exclusive. In the circumstances, the project which yields the larger NPV will earn larger cash flows. Hence the project with larger NPV should be chosen. Thus Project A qualifies for selection.

b) Inconsistency in ranking arises because if NPV criterion is used, Project A is preferable. If IRR criterion is used, Project B is preferable. The inconsistency is due to the difference in the pattern of cash flows.

Where an in consistency is experienced, the projects yielding larger NPV is preferred because of larger cash flows which it generates. IRR criterion is rejected because of the following reasons:

i) IRR assumes that all cash flows are re-invested at IRR.

ii) IRR is a percentage but the magnitude of cash flow is important.

iii) Multiple IRR may arise if the projects have non - conventional cash flows.

PROBLEM NO.15

i)   **Calculation of Adjusted Present Value of Investment (APV):**

Adjusted PV = Base Case PV + PV of financing decisions associated with the project

Base Case NPV for the project:

(-) Rs. 270 lakhs + (Rs. 42 lakhs / 0.14)	= (-) Rs. 270 lakhs + Rs. 300 lakhs = Rs. 30 lakhs
Issue costs	= Rs. 10 lakhs
Thus, the amount to be raised	= Rs. 270 lakhs + Rs. 10 lakhs = Rs. 280 lakhs
Annual tax relief on interest payment	= Rs. 280 X 0.1 X 0.3 = Rs. 8.4 lakhs in perpetuity
The value of tax relief in perpetuity	= Rs. 8.4 lakhs / 0.1 = Rs. 84 lakhs

Therefore, APV = Base case PV - Issue Costs + PV of Tax Relief on debt interest

= Rs. 30 lakhs - Rs. 10 lakhs + 84 lakhs = Rs. 104 lakhs

ii) **Calculation of Adjusted Discount Rate (ADR):**

Annual Income / Savings required to allow an NPV to zero

Let the annual income be x.

(-) Rs.280 lakhs + (Annual Income / 0.14)	= (-) Rs.104 lakhs
Annual Income / 0.14	= (-) Rs. 104 + Rs. 280 lakhs
Therefore, Annual income	= Rs. 176 X 0.14 = Rs. 24.64 lakhs
Adjusted discount rate	= (Rs. 24.64 lakhs / Rs.280 lakhs) X 100 = 8.8%

iii) **Useable circumstances:**

This ADR may be used to evaluate future investments only if the business risk of the new venture is identical to the one being evaluated here and the project is to be financed by the same method on the same terms. The effect on the company's cost of capital of introducing debt into the capital structure cannot be ignored.

PROBLEM NO.16

Money Terms calculations:

Step 1: Initial Cash Flows Rs.20,000

Cash flow in the base year is same both in money terms and in real terms because there can be no inflation in the base year with reference to base year.

Step 2: In-between Cash Flows

a) Cash inflows are already in money terms

b) Cash outflows:

- Year I Rs 9,000 is in money terms because it represents the actual physical currency paid.
- Since inflation is 6% the cash flow of Rs.9,000 will be compounded at 6% to arrive at money cash flow of subsequent years. It would hence be Rs 9,540 in year 2, Rs 10,112 in year 3 and Rs 10,719 in year 4.

Step 3: Terminal cash flow

The Rs 2,000 is in money terms since it represents the actual physical currency receipt.

Step 4: Computation of NPV (Rs.)

Year	Cash Inflow	Outflow	Net flow	DF @ 18%	Discounted cash flow
0	0	(20,000)	(20,000)	1.000	(20,000)
1	4,000	(9,000)	5,000	0.847	4,235
2	21,000	(9,540)	11,460	0.718	8,228
3	21,000	(10,112)	10,888	0.609	6,631
4	19,000	(10,719)	8,281	0.516	4,273
NPV					3,367

Note 1: Since all cash flows are expressed in money terms, the appropriate discount rate should be expressed in money terms namely 18%.

The NPV is Rs. 3,367.

Real Terms Calculations:

Step 1: Initial cash flow

This Rs.20,000 is both in Money and Real terms since there can be no inflation in the base year with reference to the base year.

Step 2: In-between Cash Flows

a) Cash inflows: These are in Money terms. They have to be converted to real terms by discounting at the inflation rate.

Year	Money Cash flows	DF @ 6%	Real cash flows
1	14,000	0.943	13,202
2	21,000	0.890	18,690
3	21,000	0.840	17,640
4	17,000	0.792	13,464

b) Cash out flows: The Year 1 figure was in money terms. In real terms it is Rs 8,487 if discounted at 1 year inflation rate. Since cash flows in real terms are said to be equal in the question, all years' outflows are also Rs 8,487 in real terms. (Rs.9,000 x 0.943).

Step 3: Terminal cash flows

The scrap value of Rs 2,000 in Year 4 is in money terms. We discount it at the inflation rate of 6% for 4 years and get 2,000 x 0.792 = Rs.1,584

Step 4: Computation of NPV

Year	Cash Inflows	Outflows	Net flows	DF @ 11.32%	DCF
0	-	(20,000)	(20,000)	1.00	(20,000)
1	13,202	(8,487)	4,715	0.898	4,234
2	18,690	(8,487)	10,203	0.807	8,234
3	17,640	(8,487)	9,153	0.725	6,636
4	15,048	(8,487)	6,561	0.651	4,272
			NPV		**3,375**

Note 1: Appropriate Discount Rate

$(1 + MDR) = (1 + RDR) \times (1 + IR)$

$(1 + 0.18) = (I + RDR) (1 + 0.06)$

RDR = 11.32%

Note 2: Since all cash flows are expressed in money terms, the appropriate discount rate should be expressed in money terms namely 18%.

The NPV is Rs. 3,375. The small difference in value is on account of rounding off.

PROBLEM NO.17

i) Equipment's initial cost = Rs. 60,00,000 + Rs. 12,00,000 = Rs. 72,00,000

ii) Annual straight line depreciation = Rs. 60,00,000/5 = Rs. 12,00,000.

iii) Net Annual cash flows can be calculated as follows:

= Before Tax CFs × (1 - Tc) + Tc × Depreciation (Tc = Corporate tax i.e. 30%)

= Rs. 24,00,000 × (1 - 0.3) + (0.3 x Rs. 12,00,000)

= Rs. 16,80,000 + Rs. 3,60,000 = Rs. 20,40,000

So, Total Present Value = PV of inflow + PV of working capital released

= (Rs. 20,40,000 × PVIF 12%, 5 years) + (Rs. 12,00,000 × 0.567)

= (Rs. 20,40,000 × 3.605) + Rs. 6,80,400

= Rs. 73,54,200 + Rs. 6,80,400 = Rs. 80,34,600

So NPV = PV of Inflows - Initial Cost

= Rs. 80,34,600 - Rs. 72,00,000 = Rs. 8,34,600

Advice: Company should accept the project as the NPV is Positive

THE END