7. ADVANCED CONCEPTS IN INVESTMENT DECISIONS

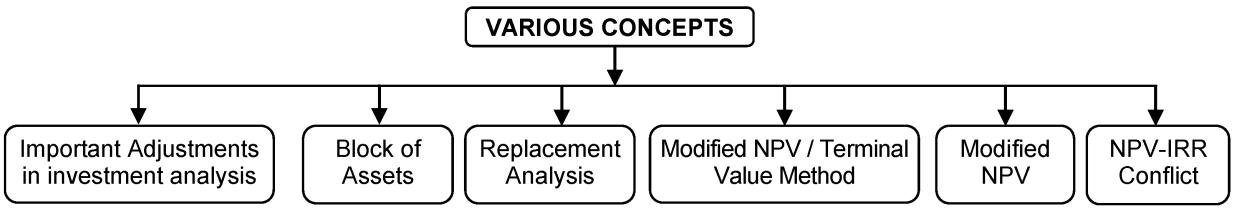
NO. OF PROBLEMS IN 41E OF CA INTER: CLASSROOM - 17, ASSIGNMENT - 15

NO. OF PROBLEMS IN 42E OF CA INTER: CLASSROOM - 11, ASSIGNMENT - 11

NO. OF PROBLEMS IN 43E OF CA INTER: CLASSROOM - 13, ASSIGNMENT - 12

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
CRD 1	-	-	-	-	-	-	
CRD 2	-	-	-	-	-	-	
CRD 3	-	-	-	-	-	-	
CRD 4	-	-	15	N18 (N&O), M16	-	-	
CRD 5	-	-	-	-	-	M19 - 8M	
CRD 6	-	-	-	M14	-	-	
CRD 7	-	-	-	-	-	-	
CRD 8	-	-	-	N19, N15			
CRD 9	-	-	17	-	-	-	
CRD 10	-	-	-	-	-	-	
CRD 11	ILL 10	ILL 10	-	-	-	-	
CRD 12	-	-	-	-	-	-	RST
CRD 13	-	-	-	-	-	-	RST
ASG 1	-	-	-	-	-	-	
ASG 2	-	-	-	-	-	-	
ASG 3	-	-	18	-	-	-	
ASG 4	-	-	-		-	-	TN
ASG 5	-	-	-		-	-	
ASG 6	ILL 5	ILL 5	-	-	-	-	
ASG 7	-	-	-		-	-	
ASG 8	-	-	-		-	-	
ASG 9	ILL 6	-	-	-	-	-	
ASG 10	-	-		-	-	-	
ASG 11	-	-		-	-	-	
ASG 12	ILL-9	ILL-9	-	-	-	-	
AQB 1	-	-	-				
AQB 2	-	-	-	-	-	N13 - 8M	
AQB 3	-	-	-	-	-	-	
AQB 4	-	-	19	-	-	-	
AQB 5	-	-	-	-	-	-	



MODEL 1 - IMPORTANT ADJUSTMENTS IN INVESTMENT ANALYSIS

- Capital Budgeting analysis considers only incremental cash flows from an investment likely to result due to acceptance of any project. Therefore, one of the most important tasks in capital budgeting is estimating future cash flows for a project.
- These cash flows are estimated on the basis of input provided by various departments.
- The project cash flow stream consists of cash outflows and cash inflows. The costs are denoted as cash outflows whereas the benefits are denoted as cash inflows.

Calculating Cash Flows: Before, we analyze how cash flow is computed in capital budgeting decision, following items need consideration:

a) **Depreciation:** As mentioned earlier depreciation is a **non-cash item** and itself does not affect the cash flow. However, we must consider tax shield or benefit from depreciation in our analysis. Since this benefit reduces cash outflow for taxes, it is considered as cash inflow.

b) **Opportunity Cost:** Opportunity cost is **foregoing of a benefit** due to choosing of an alternative investment option. This opportunity cost can occur both at the time of initial outlay and during the tenure of the project.

c) **Sunk Cost:** Sunk cost is an outlay of cash that has **already been incurred** and cannot be reversed in present. Therefore, these costs do not have any impact on decision making, hence should be excluded from capital budgeting analysis.

d) **Working Capital:** Every big project requires working capital because, for every business, investment in working capital is must. Therefore, while evaluating the projects **initial working capital requirement** should be treated as **cash outflow and at the end of the project** its release should be treated as **cash inflow**.

e) **Allocated Overheads:** Allocated overheads are charged on the basis of some rational basis such as machine hour, labour hour, direct material consumption etc. Since, expenditures already incurred are allocated to new proposal; they should not be considered as cash flows. However, it is expected that overhead cost shall increase due to acceptance of any proposal then incremental overhead cost shall be treated as cash outflow.

f) **Additional Capital Investment:** It is not necessary that capital investment shall be required in the beginning of the project. It can also be required during the continuance of the project. In such cases it shall be treated as cash outflows.

NPV - OPPURTUNITY COST, COMMON COST, SUNK COST

PROBLEM 1: 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%. ***(B) (ANS.: NPV = RS.14,60,100)***

Year (t)	1	2	3	4	5
PVIF0.10,t	0.909	0.826	0.751	0.683	0.621

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

***CONCEPT QUESTIONS:** How do you treat, if the land already owned by the company is -*

a) Rented for Rs.50,000 p.a.? *b) Used for business purpose?*

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)

Year (t)	1	2	3	4	5
PVIF0.15,t	0.870	0.756	0.656	0.572	0.497

CONCEPT QUESTIONS:

i) What would be the impact on decision if research cost increases / decreases by Rs.10,000?

ii) How do you treat, if additional administration cost of Rs.20,000 are to be incurred for producing the new product?

Note:

MODEL 2 - REPLACEMENT AND MODERNISATION DECISIONS

- The replacement and modernisation decisions aim at to improve operating efficiency and to reduce cost.
- Generally, all types of plant and machinery require replacement either because of the economic life of the plant or machinery is over or because it has become technologically outdated.
- The former decision is known as replacement decisions and latter is known as modernisation decisions. Both replacement and modernisation decisions are called cost reduction decisions.

If decision is related to replacement decision then initial cash outflow shall be calculated as follows:

Particulars	Amount (Rs.)	Amount (Rs.)
Cost of New Asset(s)		xxx
Add: Installation/Set-Up Costs	xxx	
Add/(Less): Increase (Decrease) in net working capital level	xxx	
Less: Net Proceeds from sale of old assets (If it is a replacement situation)	(xxx)	
Add/ Less: Tax expense (saving/ loss) due to sale of Old Asset	xxx	xxx
Initial Cash Outflow		**xxx**

Interim Cash Flows: After making the initial cash outflow that is necessary to begin implementing a project, the firm hopes to get benefit from the future cash inflows generated by the project. Interim cash flow in case of replacement decision shall be calculated as follows:

Particulars	Amount (Rs.)
Net increase (decrease) in Operating Revenue	xxx
Add/ (Less): Net decrease (increase) in operating expenses	xxx
Net change in income before taxes	xxx
Add/ (Less): Net decrease (increase) in taxes	xxx
Net change in income after taxes	xxx
Add/ (Less): Net decrease (increase) in depreciation charges	xxx
Incremental net cash flow for the period	xxx

Terminal-Year Incremental Net Cash Flow: We now pay attention to the Net Cash Flow in the terminal year of the project.

Particulars	Amount (Rs.)
Final salvage value (disposal costs) of asset	xxx
Add: Interim Cash Flow	xxx
Add/ (Less): Tax savings (tax expenses) due to sale or disposal of asset (Including Depreciation)	xxx
Add: Release of Net Working Capital	xxx
Terminal Year incremental net cash flow	**xxx**

PROBLEM 3: 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%.

PVAF (15%, 10yrs.) = 5.09; PVF (15%, 10 yr.) = 0.247.

(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. 3 OF ASSIGNMENT PROBLEMS AS REWORK)

CONCEPT QUESTIONS: What would be the impact on incremental investment, if-

i) Salvage value is given as Rs.3,00,000? ii) Working capital required for new machine is Rs.10,000 instead of Rs.40,000?

Note:_____

PROBLEM 4: (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. 4 OF ASSIGNMENT PROBLEMS AS REWORK)

CONCEPT QUESTIONS:

i) Will your decision change, if supplier accepts the old machine for Rs.2,50,000 & the MP of the new machine is Rs.3,00,000?

ii) What is the purpose of ignoring book value of Rs.1,00,000 related to old machine?

Note:

PROBLEM 5: (PRINTED SOLUTION AVAILABLE) Excel Manufacturing Co. is considering a proposal to replace one of its existing machines by the CNC machine. In this connection, the following information is available:

The existing machine was bought 3 years ago for Rs.15,40,000. It was depreciated on straight line basis and has a remaining useful life of 7 years. It's annual maintenance cost is expected to increase by Rs.40,000 from the sixth year of its installation. It's present realisable value is Rs.6,50,000.

The purchase price of CNC machine is Rs.27,00,000 and installation expenses of Rs.95,000 will be incurred. Subsidy equal to 15% of the purchase price will be received at the end of first year of its installation. It is subject to same rate of depreciation. It's realisable value after 7 years is Rs.5,70,000. With the CNC machine annual cash operating costs are expected to decrease by Rs.2,16,000. In addition, CNC machine would increase productivity on account of which net cash revenue would increase by Rs.2,76,000 per annum.

The tax rate applicable to firm is 30% and cost of capital is 11%

Required: Advise the firm whether to replace the existing machine with CNC machine on the basis of net present value.

The present value factor at 11% is as follows:

Year	1	2	3	4	5	6	7
PVF @ 11%	0.901	0.812	0.731	0.659	0.593	0.535	0.482

(A) (M19 (O) - 8M) (NPV = RS. 4,80,076, REPLACEMENT DECISION CAN BE ACCEPTED)

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

CONCEPT QUESTIONS:

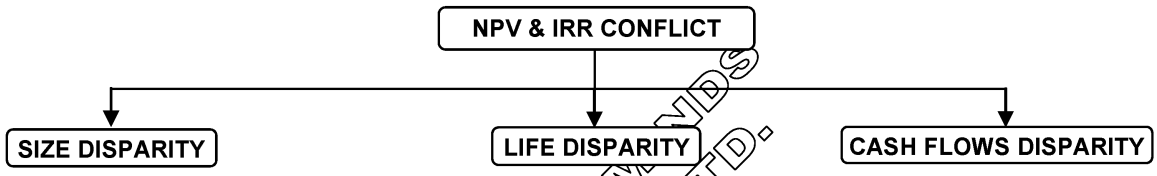
i) What would be the impact on NPV if annual maintenance cost from the 6th year onwards increase/ decrease by Rs.10,000?

ii) While providing depreciation on new machine, is there is any need to deduct the subsidy amount from the cost of new asset?

Note:_____

MODEL 3 - 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 3.1 - SCALE OR SIZE DISPARITY

PROBLEM 6: 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 the desirable choice? ***(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. 6 OF ASSIGNMENT PROBLEMS AS REWORK)

CONCEPT QUESTIONS: What would be the impact on additional NPV, if-

i) Cost of Plant B increases / decreases by Rs.1,00,000?

ii) Incremental overhead cost increases / decreases by Rs.50,000?

Note:_____

MODEL 3.2 - LIFE DISPARITY OR PROPOSALS WITH UNEQUAL LIVES

Sometimes firm may be faced with any of the following problems:

i) **Retaining** an old asset or replace it with new one.

ii) **Choosing** one proposal among two proposals (Mutually Exclusive).

Although, while evaluating the proposals the above scenarios do not pose any special problem if they have same life period. But problem arises in case projects have unequal lives.

In such situations we can deal with the problem by following any of the following method:

i) Replacement Chain Method

ii) Equivalent Annualized Criterion.

PROBLEM 7: Intel Plc is considering modernizing its production facilities and it has two proposals under consideration. The expected cash flows associated with these projects and their NPV as per discounting rate of 12% and IRR is as follows:

Year	Cash Flows	
	Project A	Project B
0	(40,00,000)	(20,00,000)
1	8,00,000	7,00,000
2	14,00,000	13,00,000
3	13,00,000	12,00,000
4	12,00,000	0
5	11,00,000	0
6	10,00,000	0
NPV @ 12%	6,49,094	5,15,488
IRR	17.47%	25.20%

Is there is any ranking conflict? Which Project should be accepted based on

i) Replacement chain (Common Life Method)

ii) Equivalent annualized criterion.

Year (t)	1	2	3	4	5	6
PVIF0.12,t	0.893	0.797	0.712	0.636	0.567	0.507

(ANS.: I) NPV (PROJECT B): RS. 8,82,300; IRR (PROJECT B): 25.20%; II) PROJECT A: RS.1,57,854, PROJECT B: RS. 2,14,608; BOTH METHODS RECOMMENDS PROJECT B) (SOLVE PROBLEM NO. 7 OF ASSIGNMENT PROBLEMS AS REWORK)

CONCEPT QUESTIONS:

i) What would be the impact on NPV, if discount rate increases by 2%?

ii) On which assumption replacement chain and Equivalent annualized criterion methods are applied?

Note:_____

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PROBLEM 8: (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, RTP M19)***

(ANS: A) XYZ - 1,12,014; ABC - 1,15,360; LEASE - 1,17,732: IT IS BETTER TO PURCHASE BRAND XYZ; B) XYZ - 4,99,732; ABC - 4,52,891; LEASE - 4,41,643: IT IS BETTER TO TAKE THE ASSET ON LEASE)

(SOLVE PROBLEM NO. 8 OF ASSIGNMENT PROBLEMS AS REWORK)

CONCEPT QUESTIONS:

i) What could be the impact on lease option, if penalty increases / decreases by Rs.5,000?

ii) What is the interlink between salvage value and rate of depreciation?

Note:_____

MODEL 3.3 - CASH FLOW DISPARITY

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

CONCEPT QUESTIONS:

i) Explain the inconsistency in ranking of two projects?

ii) Why do you recommend the project based on NPV in spite of higher IRR?

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 10:

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. 10 OF ASSIGNMENT PROBLEMS AS REWORK)

CONCEPT QUESTIONS:

i) Why does the modified NPV differs from original NPV?

ii) When does the modified NPV is more than (or) equal to (or) less than the original NPV?

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 11: 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
Amount (Rs.)	30,000	40,000	60,000	30,000	20,000

Year	4	3	2	1	0
FVF (8%)	1.3605	1.2597	1.1664	1.0800	1.000

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

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

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

CONCEPT QUESTIONS:

i) Why does the modified IRR differs from original IRR? ***ii) When does the modified IRR is equal to original IRR?***

MODEL 6 - 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 12: (PRINTED SOLUTION AVAILABLE) 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.

Year	1	2	3	4	5
PVF@13%	0.885	0.783	0.693	0.613	0.543

(B) (CA FINAL RST) (ANS.NPV-MODEL-1: 92,603; MODEL-2: 1,22,340 AS BOTH THE PROPOSALS HAVE POSITIVE NPV, BOTH ARE ACCEPTABLE. HOWEVER, MODEL II SHOULD BE PREFERRED BECAUSE IT HAS HIGHER NPV)

CONCEPT QUESTIONS:

i) What is the significance of block of assets while providing depreciation?

ii) "Section 50 of Income tax act has overriding effect on Section 32." Comment

Note:_____

PROBLEM 13: (PRINTED SOLUTION AVAILABLE) 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.

Year	1	2	3	4	5	6
PVF @ 10%	0.909	0.826	0.751	0.683	0.621	0.564

(A) (CA FINAL RST) (ANS.: INCREMENTAL NPV IS RS. 95,502; AS THE NPV OF THE REPLACEMENT PROPOSAL IS POSITIVE, THE PROPOSAL SHOULD BE IMPLEMENTED) (SOLVE PROBLEM NO. 12 OF ASSIGNMENT PROBLEMS AS REWORK)

CONCEPT QUESTIONS:

i) Is it possible to get capital gain in the year of transfer?

ii) What would be the impact on incremental NPV, if incremental revenue increases or decreases by Rs.1,00,000 (if all other variables remains constant)?

Note:_____

_____

PRINTED SOLUTIONS TO SOME SELECTIVE PROBLEMS

PROBLEM NUMBERS TO WHICH SOLUTIONS ARE PROVIDED: 4, 5, 8, 9, 12, 13

PROBLEM NO.4

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. in '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, $IRR = LR + \frac{NPV@LR}{NPV@LR - NPV@HR} x HR - LR$

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

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

PROBLEM NO.5

a) Present Value of cash outflow:

Particulars	Amount (Rs.)
Purchase price of CNC machine	27,00,000
Add: Installation expenses	95,000
Less: Subsidy (Rs. 27,00,000 × 0.15 × 0.901)	3,64,905
Less: Sale value of old machine	6,50,000
Less: Tax saving due to loss on sale of old machine (10,78,000 - 6,50,000) × 0.30	1,28,400
Total PV of cash outflows	**16,51,695**

Statement showing cash Inflows:

Particulars	Year 1 to 2	Year 3 to 7
Increase in revenue	2,76,000	2,76,000
Saving in cash operating cost	2,16,000	2,16,000
Saving in maintenance cost	-	40,000
Less: Incremental Depreciation	1,06,000	1,06,000
Incremental profit before tax	3,86,000	4,26,000
Less: T ax @ 30%	1,15,800	1,27,800
Incremental profit after tax	2,70,200	2,98,200
Add: Incremental depreciation	1,06,000	1,06,000
Incremental cash flow after tax	**3,76,200**	**4,04,200**

Year	CFAT	P V @ 11%	PV of cash flows (Rs.)
1 to 2	3,76,200	1.713	6,44,431
3 to 7	4,04,200	3.000	12,12,600
7^{th}	5,70,000	0.482	**2,74,740**
Total PV of cash Inflows			**21,31,771**
Less: PV of cash outflows			16,51,695
NPV			**4,80,076**

OR

Year	CFAT	P V @ 11%	PV of Cash Flows (Rs.)
1 to 7	3,76,200	4.713	17,73,031
7^{th}	5,70,000	0.482	**2,74,740**
3-7 (Saving in AMC net of taxes) (40,000 x 70%)	28,000	3.000	84,000
Total PV of cash Inflows			**21,31,771**
Less: PV of cash outflows			16,51,695
NPV			**4,80,076**

Decision: CNC machine should be purchased as NPV is positive.

Working Notes: Computation of Depreciation:

Depreciation on existing machine	15,40,000/10 = Rs. 1,54,000
Depreciation on CNC Machine (Rs. 27,00,000 + Rs. 95,000 - Rs. 4,05,000 - Rs. 5,70,000)/7	18,20,000/7 =Rs. 2,60,000
Incremental depreciation	**Rs. 1,06,000**

Note: While finding depreciation on new machinery, subsidy received has been deducted as a indirect benefit (sec 43(1) of income tax act).

PROBLEM NO.8

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 = $\frac{\text{Present Value of cost}}{\text{Present Value of Annuity Factor(r, n)}}$
- Equivalent Annual Cost = $\frac{\text{Rs.7,62,927}}{6.811}$ = 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 = $\frac{\text{Rs. 6,51,786}}{5.65}$ = 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 = $\frac{Rs.6,65,188}{5.65}$ = 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.9

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)

As per NPV, Project A should be accepted. However, as per IRR Project B should be accepted.

b) 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

PROBLEM NO.12

Initial Cash Outflow:

Particulars	Model I (Rs.)	Model II (Rs.)
Cost of the Machine	1,50,000	2,50,000
Working Capital Required	50,000	70,000
Total	2,00,000	3,20,000

Subsequent Inflows (Annual): **(Amount in Rs.)**

Model 1	Y1	Y2	Y3	Y4	Y5
Savings in Expenses	1,00,000	1,00,000	1,00,000	1,00,000	1,00,000
(-) Depreciation @ 25% WDV	37,500	28,125	21,094	15,820	-
Incremental Earnings	62,500	71,875	78,906	84,180	1,00,000
(-) Tax @ 35%	21,875	25,156	27,617	29,463	35,000
Profit After Tax	40,625	46,719	51,289	54,717	65,000
Depreciation added back	37,500	28,125	21,094	15,820	-
Cash flow	78,125	74,844	72,383	70,537	65,000
$PVF_{(13\%,n)}$	0.885	0.783	0.693	0.613	0.543
PV (Rs.)	69,140	58,603	50,161	43,239	35,295
Total Present Value					2,56,438
Model 2	**Y1**	**Y2**	**Y3**	**Y4**	**Y5**
Savings in Expenses	1,50,000	1,50,000	1,50,000	1,50,000	1,50,000
(-) Depreciation	62,500	46,875	35,156	26,367	-
Incremental Earnings	87,500	1,03,125	1,14,844	1,23,633	1,50,000
(-) Tax @ 35%	30,652	36,094	40,196	43,272	52,500
Profit After Tax	56,875	67,031	74,648	80,361	97,500
Depreciation added back	62,500	46,875	35,156	26,367	-

Cash flow	1,19,375	1,13,906	1,09,804	1,06,728	97,500
$PVF_{(13\%,n)}$	0.885	0.783	0.693	0.613	0.543
PV (Rs.)	1,05,647	89,188	76,094	65,424	52,943
Total Present Value					3,89,296

Terminal Cash Flows:

Particulars	Model I (Rs.)	Model II (Rs.)
Release of Working Capital (A)	50,000	70,000
Short term Capital Loss		
WDV of Asset	47,461	79,102
Salvage	Nil	Nil
Loss	47,461	79,102
Tax Savings @ 35% (B)	16,611	27,686
Net Cash Inflow (A + B)	66,611	97,686

Calculation of NPV:

Particulars	Model I (Rs.)	Model II (Rs.)
PV of Inflows (Annual)	2,56,438	3,89,296
PV of Terminal Cash Inflow @ 13%		
(66,611 x 0.543); (97,686 x 0.543)	36,170	53,044
	2,92,608	4,42,340
Less: Initial Outflow	2,00,000	3,20,000
Net Present Value	92,608	1,22,340

Though, both the proposals have positive NPV and hence acceptable. However, Model II should be preferred because it has higher NPV.

Note: As there is no other in the same block of assets, there will not be any depreciation in the last year. However, the loss at the time of disposing of the asset is tax deductible at normal tax rate of 35%.

PROBLEM NO.13

Initial Outflow:

Particulars	Amount (Rs.)
Cost of New Machine	15,00,000
Less: Scrap Value of Old Machine	2,00,000
Net Outflow	13,00,000

Subsequent Cash Inflow (Annual): **(Figures in Rs.)**

Year	Increase in Sales	Incremental Contribution	Depreciation	PBT	PAT	Cashflows
1	5,00,000	3,50,000	3,25,000	25,000	17,500	3,42,500
2	5,00,000	3,50,000	2,43,750	1,06,250	74,375	3,18,125
3	5,00,000	3,50,000	1,82,813	1,67,187	1,17,030	2,99,843
4	5,00,000	3,50,000	1,37,109	2,12,891	1,49,024	2,86,133
5	5,00,000	3,50,000	1,02,832	2,47,168	1,73,081	2,75,850
6	5,00,000	3,50,000	39,624	3,10,376	2,17,263	2,56,887

Terminal Cash Inflow:

Scrap Value of New Machine Rs.1,50,000

Calculation of NPV

Year	Cash flow (Rs.)	$PVF_{(10\%, n)}$	PV (Rs.)
0	(13,00,000)	1.000	13,00,000
1	3,42,500	0.909	3,11,333
2	3,18,125	0.826	2,62,771
3	2,99,843	0.751	2,25,182
4	2,86,133	0.683	1,95,429

5	2,75,850	0.621	1,71,303
6	2,56,887	0.564	1,44,884
6	1,50,000	0.564	84,600
Net Present Value (NPV)			95,502

As the NPV of the replacement proposal is positive, the proposal should be implemented.

Calculation of Depreciation: As there are other assets also in the same block of assets, the incremental cost of new machine (Rs.15,00,000 - Rs. 2,00,0000) = Rs.13,00,000 will be added to the cost of block of assets and depreciation on this amount of Rs.13,00,000 will be available @ 25% WDV for 6 years. In the beginning of last year (i.e. 6th year), the WDV of Rs.13,00,000 will be Rs.3,08,496 out of which the scrap value of Rs.1,50,000 will be deducted. So the amount available for depreciation in the 6th year is Rs.3,08,496 - Rs.1,50,000 = Rs. 1,58,496 and depreciation @ 25% would be Rs.39,624 only.

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 details 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%.

Year	1	2	3	4	5
PVF @ 12%	0.893	0.797	0.712	0.636	0.567

(B) (ANS.: NPV = RS.3,92,725)

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.

Year	1	2	3	4	5	6	7	8	9	10
PVF @ 10%	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386

(A) (ANS.: NPV: RS.7,94,340)

MODEL 2 - REPLACEMENT AND MODERNISATION DECISIONS

PROBLEM 3: 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 in 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:

Particulars	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 4: 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 (Depreciation & Allocated corporate over heads)	8.2	12.4

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. 5,80,813; NEW MACHINE SHOULD PURCHASED)*

PROBLEM 5: YOYO is considering a proposal to replace one of its existing machines by the New machine. In this connection, the following information is available:

The existing machine was bought 2 years ago for Rs.10,50,000. It was depreciated on straight line basis and has a remaining useful life of 8 years. It's annual maintenance cost is expected to increase by Rs.25,000 from the fifth year of its installation. It's present realisable value is Rs.4,50,000.

The purchase price of New machine is Rs.30,00,000 and installation expenses of Rs.2,67,900 will be incurred. Subsidy equal to 10% of the purchase price will be received at the end of first year of its installation. It is subject to same rate of depreciation. It's realisable value after 8 years is Rs.7,50,000. With the New machine annual cash operating costs are expected to decrease by Rs.3,25,000. In addition, New machine would increase productivity on account of which net cash revenue would increase by Rs.2,10,000 per annum.

The tax rate applicable to firm is 35% and cost of capital is 12%

Required: Advise the firm whether to replace the existing machine with CNC machine on the basis of net present value.

The present value factor at 12% is as follows:

Year	1	2	3	4	5	6	7	8
PVF @ 12%	0.893	0.797	0.712	0.636	0.567	0.507	0.452	0.404

(NPV = RS. (30,124); REPLACEMENT DECISION CAN NOT BE ACCEPTED)

MODEL 3 - NPV & IRR CONFLICT

MODEL 3.1 - SCALE OR SIZE DISPARITY

PROBLEM 6: 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.

Year	1	2	3
PVF @10%	0.909	0.826	0.751

(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 3.2 - LIFE DISPARITY OR PROPOSALS WITH UNEQUAL LIVES

PROBLEM 7: Origin Plc is considering modernizing its production facilities and it has two proposals under consideration. The expected cash flows associated with these projects and their NPV as per discounting rate of 10% and IRR is as follows:

Year	Cash Flows	
	Project A	Project B
0	72,00,000	36,00,000
1	14,40,000	12,60,000

2	25,20,000	23,40,000
3	23,40,000	21,60,000
4	21,60,000	-
5	19,80,000	-
6	18,00,000	-
NPV @ 10%	16,67,880	11,00,340
IRR	16.86%	23.03%

Is there is any ranking conflict? Which Project should be accepted based on

i) Replacement chain (Common Life Method)

ii) Equivalent annualized criterion.

Year (t)	1	2	3	4	5	6
PVF0.10	0.909	0.826	0.751	0.683	0.621	0.564
PVF0.14	0.877	0.769	0.675	0.592	0.513	0.456

(ANS.: I) PROJECT B SHOULD BE ACCEPTED, AS IT HAS HIGHER NPV AND IRR, II) PROJECT B SHOULD BE ACCEPTED)

PROBLEM 8: 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 lease 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%.

Year	1	2	3	4	5	6	7	8	9	10
PVF @12%	0.893	0.797	0.712	0.636	0.567	0.507	0.452	0.404	0.361	0.322
Year	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
PVF @12%	0.287	0.257	0.229	0.205	0.183	0.163	0.146	0.130	0.116	0.104

(B) (ANS.: A) MACHINE MNO SHOULD BE TAKEN ON LEASE B) MACHINE PQR SHOULD BE TAKEN ON LEASE)

MODEL 3.3 - CASH FLOW DISPARITY

PROBLEM 9: Suppose ABC Ltd. is considering two Project X and Project Y for investment. The cash flows associated with these projects are as follows:

Year	Project X	Project Y
0	(2,50,000)	(3,00,000)
1	2,00,000	50,000
2	1,00,000	1,00,000
3	50,000	3,00,000

Assuming Cost of Capital be 10%, IDENTIFY which project should be accepted as per NPV Method and IRR Method.

Year	0	1	2	3
PVF (10%)	1	0.909	0.826	0.751
PVF (20%)	1	0.833	0.694	0.579
PVF (25%)	1	0.800	0.640	0.512

(B) (NEW SM) (ANS.: NPV: PROJECT X: RS.51,950; PROJECT Y: RS.53,350; IRR: PROJECT X: 24.87%, PROJECT Y: 17.60%; CONFLICT IN RANKING MAY ALSO ARISE IF WE ARE COMPARING TWO PROJECTS (ESPECIALLY MUTUALLY EXCLUSIVE) HAVING UNEQUAL LIVES.)

MODEL 4 - MODIFIED NPV / TERMINAL VALUE METHOD

PROBLEM 10: 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)***

Year	1	2	3	4	5	6	7
FVF@15%	2.313	2.011	1.749	1.521	1.322	1.150	1.000

MODEL 5 - MODIFIED IRR

PROBLEM 11: 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%.

Year	1	2	3	4
FVF@4%	1.1040	1.082	1.125	1.170

(B) (ANS.: MIRR: 9%)

MODEL 6 - BLOCK OF ASSETS AND DEPRECIATION

PROBLEM 12: 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. (If Salvage Value is taken as Rs.10,000 (or) If Salvage Value is taken as Rs.50,000)

(A) (NEW SM, OLD SM) (ANS.: CASE 1: RS. 9,288; CASE 2: IF SALE VALUE IS RS.10,000: TAX BENEFIT: RS. 1,858; IF SALE VALUE IS RS.50,000: TAX: RS. 2,712)

ADDITIONAL QUESTIONS FOR STUDENT'S SELF PRACTICE

PROBLEM 1: 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)

PROBLEM 2: 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)

PROBLEM 3: 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 4: 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 OUTFLOW IS LESS IT IS BENEFICIAL TO PURCHASE MACHINE A)

PROBLEM 5: 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%)

THE END