# 6. ADVANCED CONCEPTS IN INVESTMENT DECISIONS

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

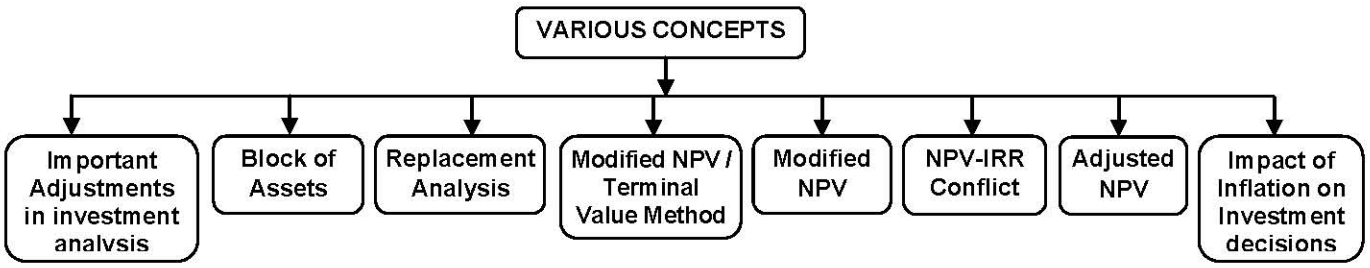
NO. OF PROBLEMS IN 41E OF CA INTER: CLASSROOM - 17, ASSIGNMENT – 15

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

## 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 | - | - | - | - | - | - | |
| CRD 7 | ILL-9 | ILL-9 | - | - | - | - | |
| CRD 8 | - | - | - | M14 | - | - | |
| CRD 9 | - | - | - | - | - | - | |
| CRD 10 | - | - | - | - | - | N13 - 8M | |
| CRD 11 | - | - | - | N15 | - | - | |
| CRD 12 | - | - | 17 | | - | - | |
| ASG 1 | - | - | - | | - | - | |
| ASG 2 | - | - | - | - | - | - | |
| ASG 3 | - | - | 18 | - | - | - | |
| ASG 4 | - | - | - | - | - | - | TULSIAN |
| ASG 5 | - | - | | - | - | - | |
| ASG 6 | - | - | | - | - | - | |
| ASG 7 | ILL-10 | ILL-10 | | - | - | - | |
| ASG 8 | - | - | - | - | - | - | |
| ASG 9 | - | - | 8 | - | - | - | |
| ASG 10 | - | - | - | - | - | - | |
| ASG 11 | - | - | - | - | - | - | RK |
| P 1 | - | - | - | - | - | - | RST |
| P 2 | - | - | - | - | - | - | RST |
| P 3 | EX (7.11) | EX (6.9) | - | - | - | - | |






## 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)***

**CONCEPT QUESTION:** How do you treat, if the land already owned by the company is rented for Rs.50,000 p.a.?

**Note:**_____

_____



## 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)***

**CONCEPT QUESTION:** What would be the impact on decision if research cost increases / decreases by Rs.10,000?

**Note:**_____

_____

# MODEL 2 - 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 improve operating efficiency and to reduce cost.

**PROBLEM 3: (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. 3 OF ASSIGNMENT PROBLEMS AS REWORK)*



**CONCEPT QUESTION:** What would be the impact on incremental investment if salvage value is given as Rs.3,00,000?

**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 QUESTION:** 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?

**Note:**_____



**PROBLEM 5: (PRINTED SOLUTION AVAILABLE)** Aar Cee 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% are 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 |

*(M19(O) – 8M)(NPV = Rs. 4,80,076, Replacement decision can be accepted)*

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

**Note:**_____

## MODEL 3 - 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 6:**

| | |
|---|---|
| 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. 5 OF ASSIGNMENT PROBLEMS AS REWORK)*

**CONCEPT QUESTION:** When will the modified NPV becomes more than (or) equals to (or) less than the original NPV?

**Note:**_____

_____



## MODEL 4 - 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 7: (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 |

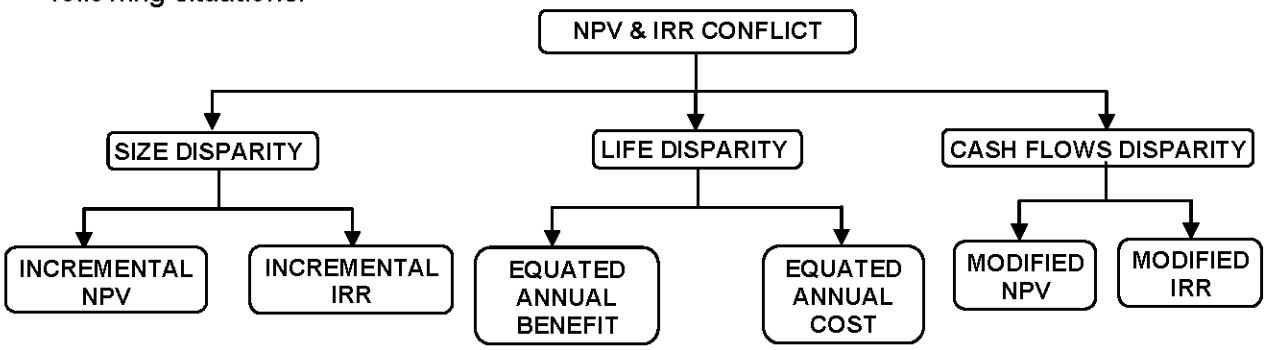
*(B) (NEW SM, OLD SM) (ANS.: MODIFIED IRR = 9% (APPROX.))*

*(SOLVE PROBLEM NO. 6 OF ASSIGNMENT PROBLEMS AS REWORK)*

**CONCEPT QUESTION:** When will be the modified IRR equals to original IRR?

## MODEL 5 - 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 5.1 - SCALE OR SIZE DISPARITY

**PROBLEM 8:** 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. 7 OF ASSIGNMENT PROBLEMS AS REWORK)*

**CONCEPT QUESTION:** What could be the impact on additional NPV if cost of Plant B increases / decreases by Rs. 1 Lakh?

**Note:**_____

_____

## MODEL 5.2 - LIFE DISPARITY OR PROPOSALS WITH UNEQUAL LIVES

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

**CONCEPT QUESTION:** When do you apply equated annual benefit technique?

**Note:**_____

_____

**PROBLEM 10:** 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. 9 OF ASSIGNMENT PROBLEMS AS REWORK)*

**CONCEPT QUESTION:** When do you apply equated annual cost technique?

**Note:**_____

_____

**PROBLEM 11: (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) MACHINE XYZ SHOULD BE PURCHASED B) MACHINE ABC SHOULD BE TAKEN ON RENT)*

*(SOLVE PROBLEM NO. 10 OF ASSIGNMENT PROBLEMS AS REWORK)*

**CONCEPT QUESTION:** What could be the impact on lease option, if penalty increases / decreases by Rs.5,000?

## MODEL 5.3 - CASH FLOW DISPARITY

**PROBLEM 12: (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. 11 OF ASSIGNMENT PROBLEMS AS REWORK)*

**CONCEPT QUESTION:** Explain the inconsistency in ranking of two projects.?

**Note:**_____

_____

## PRINTED SOLUTIONS TO SOME SELECTIVE PROBLEMS

**PROBLEM NUMBERS TO WHICH SOLUTIONS ARE PROVIDED: 1, 3, 4, 5,7, 11, 12**

### 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 $\left(\frac{15L-0}{5}\right)$ | (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.3

**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

Depreciation p.a = Cost - Scrap / Life

New Machine = 4,00,000 - 0 / 10

= 40,000

Existing Machine = 2,00,000 - 0 / 10

= 20,000

Incremental depreciation = 20,000 (40,000,- 20,000)

**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 |

| | | |
|---|---|---|
| Incremental PBDT | = | 2,00,000 |
| **Less:** Incremental Depreciation | = | 20,000 |
| PBT | = | 1,80,000 |
| Tax @ 50% | = | (90,000) |
| PAT | = | 90,000 |
| CFAT | = | 1,10,000 |

PV of OPCI = 1,10,000 X PVAF (15%, 10Y)

= 1,10,000 X 5.09 = 5,52,090

**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.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.('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 |
|---|---|---|---|
| 1 to 2 | 3,76,200 | 1.713 | 6,44,431 |
| 3 to 7 | 4,04,200 | 3.000 | 12,12,600 |
| 7th | 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 |
| 7th | 5,70,000 | 0.482 | **2,74,740** |
| 3-7 (Saving in AMC net of taxes) (40000 x 70%) | 28,000 | 3 | 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** |

## PROBLEM NO.7

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 $\frac{1,36,000}{2,13,587}=0.6367$ 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:



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

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

## PROBLEM NO.11

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 = $\frac{\text{Rs.6,65,188}}{5.65}$ = 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.12

**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.

# 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 - REPLACEMENT 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:

| | 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. 5,82,622; NEW MACHINE SHOULD PURCHASED)*

## MODEL 3 - MODIFIED NPV / TERMINAL VALUE METHOD

**PROBLEM 5:** 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 4 - MODIFIED IRR

**PROBLEM 6:** 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 5.1 - SCALE OR SIZE DISPARITY

**PROBLEM 7:** 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 5.2 - LIFE DISPARITY OR PROPOSALS WITH UNEQUAL LIVES

**PROBLEM 8:** 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 9:** 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 10:** 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]*



## MODEL 5.3 – CASH FLOW DISPARITY

**PROBLEM 11:** 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%)*

# ADDITIONAL QUESTIONS FOR STUDENT'S SELF PRACTICE

## MODEL - 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 1:** 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)*



**PROBLEM 2:** 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)*

**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)*

**THE END**