Assignments 1 Date: Shrawan 04

(BIST)

1. What do you mean by law of demand? Explain factors influencing demand.

→

Demand for a commodity refers to the desire backed by ability to pay and willingness to buy it. If a person below poverty to buy it, it is only desire not a demand. If a rich man wants to buy a car, it is demand as he will be able to pay for the car. Thus, desired backed by purchasing power is demand. The demand for any commodity mainly depends on the price of the commodity The demand for any commodity depends on the price of that commodity (वस्तु). The other determinants include price of related commodities, income of consumers, taste and preferences (प्राथमिकता) of consumers, and wealth of consumers. Hence, demand function can be written as:

$$D_x = f(P_x, P_s, Y, T, W)$$

where, D_x - demand for good x

P_x: Price of good x

P_s: Price of related goods

Y: income

T: taste and preferences of consumer

W: Wealth of consumer

Law of demand

The law of demand states that there is negative or inverse relationship between the price and quantity demanded of a commodity over period of time.

" Adam Smiths was 18th century father of modern economic

Alfred Marshall stated that 'the greater the amount sold, the smaller must be the price at which it is offered, in ordered that it may find purchasers; or in other words, the amounts demanded increases with a fall in price and diminishes with rise in price

According to ferguson, the law of demand is that the quantity demanded varies inversely with price
Thus the law of demand states that people will buy more at lower prices and buyy less at higher prices, other things remains the same. By other things remaining the same, we mean the following assumptions.

Assumption of the law:
1. No change in the consumer's income
2. No change in the consumer's tastes and preference
3. No change in the prices of others related goods.
4. No new substitutes for the goods have been discovered
5. People do not feel that the present fall in price is prelude (आउनु अघिको मुद्रा) to further decline of Price.

The factors influencing demands are:
1. Price of commodity
2. Income of consumer (उपभोक्ता)
3. Aice of related goods (Compeititive or Complimentary)
4. Weather
5. customer and fashion
6. Size of Population
7. future expectation

(आपूर्ति)

What do you mean by law of supply? Explain factors influencing supply.

Supply means the good offered for sale at a price during a specified period of time. It is the capacity and intention of the producers to produce goods and service for sale at a specific price.

The supply of a commodity at a given price may be defined as the amount of it which is actually offered for sale per unit of time at that price.

The law of supply establishes a direct relationship between price and supply. Firms will supply less at lower prices and more at higher prices.

Other things remaining the same, as the price of commodity rises, its supply ~~it rises~~ expands and as the price falls, it supply contracts.

Factors determining supply

- Production technology
- Prices of factors
- Price of other products
- Number of producers or firms (संख्या)
- Future price expectation
- Taxes (कर) and subsidies (सरकारी आर्थिक सहायता)
- Non-economic factors

All other things being equal, demand ~~price and quantity~~ varies ~~inf~~ inversly with time.

3. What do you mean by utility and marginal utility? State and explain the law of diminishing marginal utility with suitable example and figure.

① Utility:
- The level or power of satisfaction to a consumer by consuming goods and services
- Utility is defined as the power of commodity or a service to satisfy a human want. Utility is a subjective or psychological concept
Eg: for a vegetarian, mutton has no utility.

② Total utility
The sum of utilities of all units of a commodity consumed.
Ex: If a consumer consumes ten biscuits, then total utility is the sum of satisfaction of consuming all the ten biscuits

③ Marginal utility
The addition made to the total utility by consuming one more unit of a commodity
Ex: If a consumer consumes 10 biscuits, the marginal utility is the utility derived from the 10th unit. It is nothing but the total ~~uti~~ utility of 10 biscuits minus the total utility of 9 biscuit
Thus
$MU_n = TU_n - TU_{n-1}$
- MU_n → Marginal utility of 'nth' commodity.
- TU_n → Total utility of n unit
- TU_{n-1} → total utility of n-1 unit

The Law of diminishing marginal utility states that in the process of fulfiling human wants, when a consumer consumes additional units of commodity, the utility derived from each successive unit of the commodity goes decreasing.

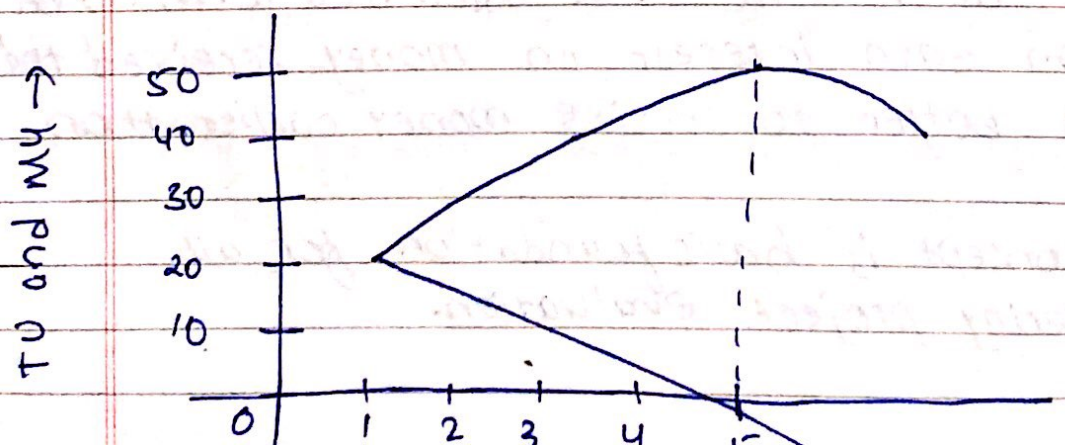
If a consumer takes more and more units of commodity the additional utility he derives from an extra unit of commodity goes on falling. Thus according to law: The marginal utility decreases, the total utility increases at diminishing rate.

Example:

Units of Apple	Total utility	Marginal utility
1	20	20
2	35	15
3	45	10
4	50	5
5	50	0
6	45	-5
7	35	-10

Suppose, Mr. X is hungry, and eats apple one by one. The first apple give him great pleasure as he is hungry; when he takes second apple, the extent of his hunger will reduce, Therefore he will derive less utility from the second apple.

If he continues to take additional apples, the table shows total utility and marginal utility.



4. Define Engineering Economics. What are the basic principle of Engineering economics.

→ Engineering Economics is the applications of economic techniques to the evaluation of engineering alternatives. The role of engineering economics is too access the appropriateness of a given project, estimates its value and justify it from an engineering standpoint - John M. Watts

It deals with the concepts and techniques of analysis useful in evaluating the worth of system, products and services in relation to their cost.

The principles of Engineering Economics are

A. According to Chan S. Park
Principles unite the concepts and techniques presented in any engineering economic book, thereby allowing us to focus on the logic underlying the practice of engineering economics.
There are 4 principles

a. Time value of money
- A nearby penny is worth a distant dollor.
- Money has a time value associated with it, because we can earn interest on money received today, it is better to receive money earlier than later
- This concept is basic foundation for all engineering project evaluation.

(ORIJIT) (ALOKA)

b. differential (incremental) cost and revenue
- All that counts are the differences among alternatives
- An economic decision should be based on the differences among the alternatives considered. All that is common is irrelevent to the decision.
- Whenever a choice is made, something is given up. The opportunity cost of a choice is the value of the best alternative given up.

c. Marginal reveneus must exceed marginal cost
- Marginal revenue means the additional revenue made possible by increasing the activity by one unit (or small unit). Marginal cost has an analogous definition
- Any increased economic activity must be justified on the basis of the fundamental economic principle that marginal revenue must exceed marginal cost.

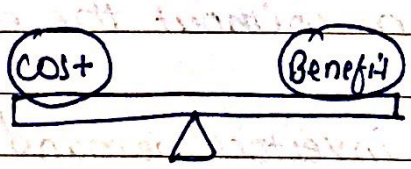
d. The trade-off between risk and reward
- Additional risk is not taken without the expected additional return.
- for delaying consumption, investors demand a minimum return that must be greater than the anticipated rate of inflation or any perceived risk
- If they didn't receive enough to compensate for anticipated inflation and these perceived investment risk, inventors risk

According to W. Sullivan
1. Develop Alternatives
2. Focus on the differences
3. Uses a consistent viewpoint [Economic ViewPoint]
4. Use common unit of measure
5. Consider all relevant criterial social and Environmental aspects)
6. Make uncertainty explicit
7. Revisit your decision (self evaluation

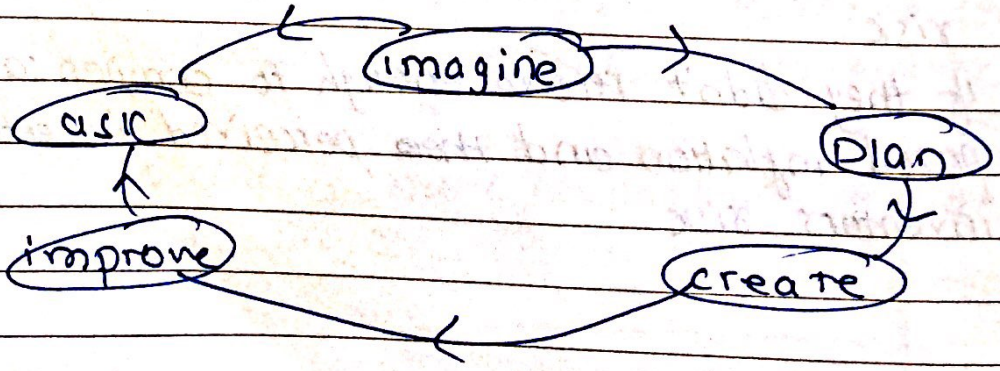
5. Why do you think studying the course is important for engineering students ? Justify.

Engineering Economy is a subset of economy for application to engineering projects. Engineers seek solutions to problems, and the economic viability of each potential alternative or design is normally considered along with the technical aspects.

Engineering economy involves the evaluation of the costs and benefits of proposed projects



Engineers play a major role in investment by making decisions based on economic analysis and design consideration



- Engineering economy analysis presents the best estimates of what is expected to occur

Steps
- understand the problem
- collect all relevant data/ information
- define the feasible alternatives
- evaluate each alternative
- select the best alternative
- implement and monitor

- Engineering students should prepared themselves with economics empowerement so that they could manage their wealth, help them in starting their own business or during managerial period.
- It is because, money is one of important factor in completing a project. Furthermore, fresh graduates also need to manage their wealth well since a lot of graduates facing problem because lack of information about the loans that they have made.
- for profit making organization have for goal to make money - now and in the future
- Not for-profit must remain financially sound.

6. "Engineering economics is all about decision making" Explain.

Engineering economic decision refers to all investment decisions relating to engineering projects. The most interesting fact of an economic decision, from an engineers point of view, is the evaluation of costs and benefits associated with making a capital investment.

The types of engineering economics decision are:
(i) Service or quality improvement
(ii) New products or product expansion
(iii) Equipment and process selection
(iv) Cost reduction
(v) Equipment replacement

Engineers play a vital role in capital investment decisions based on their ability and experience to design, analyze, and synthesize.

Engineering economy involves formulating estimating and evaluating the expected economic outcomes of alternatives designed to accomplish a defined purpose. Mathematical techniques simplify the economic evaluation of alternatives.

Because the formulas and techniques used in engineering economics are applicable to all type of money matters they are equally useful in business and government as well as for individuals.

Engineering economics teaches us
- engineering economics analysis
- capital allocation study
- economic analysis

The numbers used in engineering economy are best estimates of what is expected to occur.

7. Explain primary application of Engineering Economics

The primary application of engineering economy are

1. Seeking of New objectives
→ Engineers all over the world are constantly seeking new and wider application of their technical knowledge for the benefit of mankind.

2. Discovery of factors
→ Engineering Economy seeks to discover so-called limiting factors which may hinder the success of a project

3. Investment of capital
→ With the exception of few cases, capital is invested to earn profit for the owners of the capital.
→ EE enables engineers to consider all the aspects of the investment from both technical and financial viewpoints.

Assignment: 2 Shravan 06

1. Explain concepts of manufactoring and non-manufactu cost with suitable real example.

→ In Engineering economics, cost is used in many different ways because there are many types of costs, each classified ~~directly~~ differently according to the immediate needs of management:

A. Manufactaring cost
B. Non-Manufactaring cost

① Manufacturing Cost

→ Manufacturing cost is the sum of costs of all resources consumed in the process of making a product.
→ In converting raw materials into products (finished goods), a manufacturer incurs various costs associated with operating a factory.
→ The manufacturing cost is classified into 3 categories:

② Direct raw materials costs

- Direct raw materials are any materials that are used in the final products and that can be easily traced to it. Some examples are wood in furniture, steel in bridge construction, paper in printing firms and feabric for clothing manufacturs
- It is important to note that finished product of one company can become the raw materials of another company

Ex: Computer chips produced by Intel are a raw material for Dell in its personal computers.

b. Direct Labor Cost

- The direct labor cost is the cost of workers who can be easily identified with the unit of production.
- direct labor incurs cost that go into the production of a product
- The labor costs of assembly-line workers
  Ex: welders in metal-fabricating industries
  Carpenters or bricklayer in home building etc

c. Manufacturing overhead:

manufacturing overhead, the third element of manufacturing cost includes all the cost of manufacturing except the cost of direct materials and direct labors.

It includes:

i) indirect labor costs: Supervisors, material handling team
ii) indirect material costs: lubricants, geare and water
iii) other indirect: land rent, property insurance.

(ii) Non-Manufacturing cost:

- Two additional costs incurred in supporting any manufacturing operation are: (i) Marketing or selling cost (ii) Administrative costs
- Marketing cost include all the costs necessary to secure customer orders and get the finished product or service into the hands of the customer.
- Overhead: Heat and light, property taxes, depreciation
- Marketing: Advertising, shipping sales travel, sales commision, sales salaries.
- Administrative function: Executive compensation, general accounting, public relation and secreterial support.

2. Explain the different types of cost involved in manufacturing of products with suitable example

Manufacturing cost are the cost necessary to convert raw material into products. In coverting raw materials into finished goods, a manufacturer incurs various costs associated with operating a factory.

Manufacturing costs are typically divided into three categories...

1. Direct raw material cost.
2. Direct labor cost
3. Manufacturing overhead..

Example:

Consider a Noodle factory. We will discuss the cost relating with noodle factory.

① Direct material cost:

This is the cost of the materials which become the part of the finished product

Example: the cost of wheat, starches, water salt, flavor are considered as direct material cost

⑪ Direct-labor-cost

This is the cost of wages of the individuals who are physically involved in the converting raw into a finished product

Example: wages of the person cooking flour, putting on machine, packaging noodles etc (Assembly line workers)

(iii) Manufacturing overhead

The all other cost incurred in the manufacturing activity which cannot be directly traced to physical units in an economically feasible way.

Example: depreciation of the factory equipment
property taxes
insurance on manufacturing facilities
overtime premiums

3. Write short notes on:

(i) Differential cost
(ii) Differential revenue
(iii) Opportunity cost
(iv) Sunk cost
(v) Marginal cost

a. Differential cost:

- In business decisions, each alternative has certain costs and benefits that must be compared with the costs and benefit of the other available alternatives.
- A difference in cost between any two alternatives is called differential cost.
- A differential cost is also known as an incremental cost, although technically an incremental cost should refer only to an increase in cost from one alternative to another.
- In particular, they are useful in making a variety of short-term operational decision.
- Some common examples of short-run problems are:
  - method changes
  - operations planning
  - make-or buy decision

Oppurtunity Cost :

Oppurtunity cost may be defined as a potential benefit that is given up as you seek an alternative course of action. In fact, virtually every alternative has some oppurtunity cost associated with it.

For example, suppose you have a part time job while attending college that pays you Rs 20,000 per month, you would like to spend 1 month Annapurna Trail Spring break, and your employer has agreed to give you the month off.

The Rs 20,000 in lost wages would be an oppurtunity cost.

Oppurtunity cost could be mean contribution to income that is forgone by not using a limited resource in the best way possible.

or we may view oppurtunity cost as cash flows that could be generated from an asset the firm already owns, provide that such flows are not used for the alternative in question.

Sunk Cost (Retrospective opp. of prospective)

A sunk cost is a cost that has already be incurred by past action. Sunk cost are not relevent to decision, because they cannot be changed regardless of what decision is made now or in the future.

The only costs relevent to decision, ~~because they do not~~ are costs that are vary among the alternative courses of action being considered.

To illustrate a sunk cost, suppose you have a very old motorcycle that requires frequent

repairs. you want to sell it, and you figure that the current market value would be about Rs 1,20,000 at best. While you are in the process of advertising the bike, you find that the engine is leaking. You decided to have the engine repaired which cost you Rs 8,000. A friend of yours is intrested in buying your bike and has offerered Rs 1,20,000 for it. Would you take the offer, or would you decline it simply because you cannot recoup the repair cost with that offer

Here, Rs 8,000 is a sunk cost

A sunk cost is a cost that has already been incurred and cannot be recovered.

Marginal cost :

Another cost term useful in cost-volume analysis is marginal cost. We define marginal cost as the added cost that would result from increasing the rate of output by a single unit. The accountant's differential cost concept can be compared to the economist's marginal cost concept.

- In speaking of changes in cost and revenue, the economist employs the term marginal cost and marginal revenue.
- The revenue that can be obtained from selling one more unit of product is called marginal revenue. The cost involved in producing one more unit of product is called marginal cost.

Manufacturing cost (MC)	Non Manufacturing cost (NMC)
→ MC is the sum of costs of all resources consumed in the process of making a product.	NMC refer to those incurred outside the factory or production department.
→ MC refers to those that are spent to transform material into finished goals	→ NMC refers to that cost invest beside directly on the product
→ This cost is easily traced in the final product.	→ This cost is not easily traced in the final product.
→ The types are: (i) Direct raw material cost (ii) Direct labor (iii) Manufacturing overhead	→ The types are: (i) ~~overhead charges~~ (ii) Marketting cost (iii) Administrative ~~facilities~~
→ It is also called factory cost or production cost	→ It is also called Period cost
→ The cost of (salary) for the front line workers are considered as Manufacturing cost	→ The executive salaries are considered as Non-manufacturing cost

→ The level of Manufacturing cost are directly related to the level of production and directly involved in the creation of product and service.	→ The level of Non-manufacturing cost are not directly related to the level of production but related to the administration, sales and promotion related cost
→ Example of MC are: Factory supplies Salary of factory workers Freight-in	Example of NMC are: Legal expense Advertising Freight-out (delievery expense)

2017 Fall

(2-a) Calculate the future worth of the following cash flows deposited at 8·1· compounded continously for 5 years.

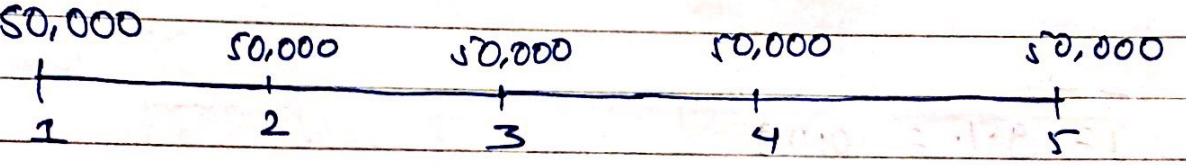
(i) Rs 50,000 at the begining of each year.

(ii) Rs. 50,000 at the end of each year

(i) Begining of each year

N (time) = 5 years

Rate (i) = 8·1· = 0·08



here all annuity earn certain amount as interest

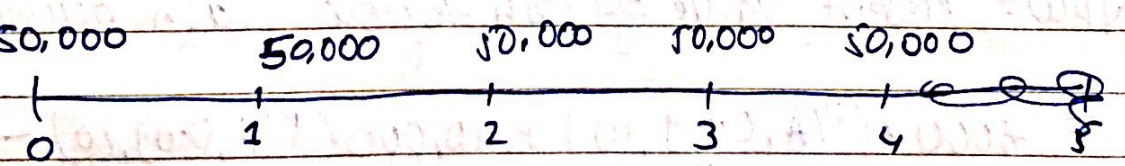
Future worth (FW) = $A * (F/A, i, N)$

$$= A * \left[\frac{(1+i)^N - 1}{i}\right]$$

$$= 50,000 * \left[\frac{(1+0.08)^5 - 1}{0.08}\right]$$

$$= 293,330.048$$

(ii) End of each year



here Annuity at (0, 1, 2, 3) earn but the 4th one was at the end, so it cannot earn any extra amount.

Future worth (FW) = $A * (F/A, i, N) + 50,000$

$50,000 * \left(\frac{(1+i)^N - 1}{i} \right) + 50,000$

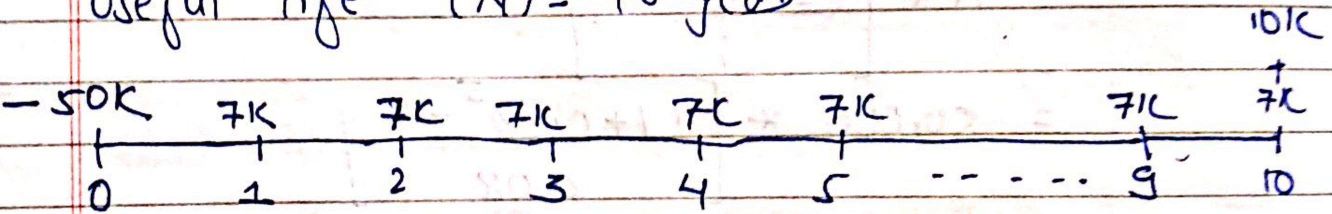
275305.6

I am confused at rate, continously भनेको छ त।
rate may be $r = e^{m} - 1$
$r = e^{0.08} - 1 = 8.32\% = 0.833$

(2/b)

→ $i = 9\% = 0.09$

Intial investment (I) = Rs. 50,000
Operating cost / Expense (AE) = Rs. 2000
Annual Income / Revenue (AR) = Rs. 9000
Net profit (P/Annuity) = AR − AE = Rs. 7,000
Salvage value (S) = Rs. 10,000
Useful life (N) = 10 year



Find a. Is this Investment worth investing?

NPW = Present value of (Cash inflow − Cash outflow)

$= 7,000 * (P/A, 0.09, 10) + 10,000 (P/F, 0.09, 10) - 50,000$

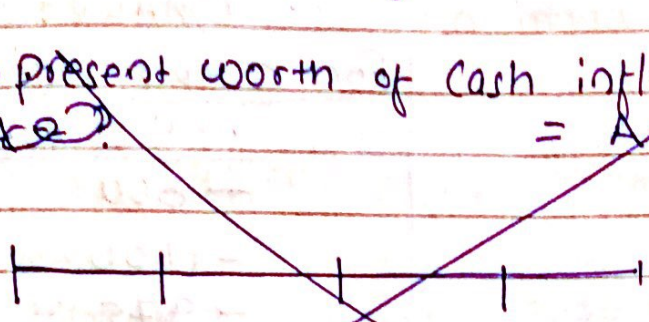
$= 7000 * \frac{1.09^{10} - 1}{0.09 * 1.09^{10}} + 10,000 * \frac{1}{1.09^{10}} - 50,000$

$= -852$

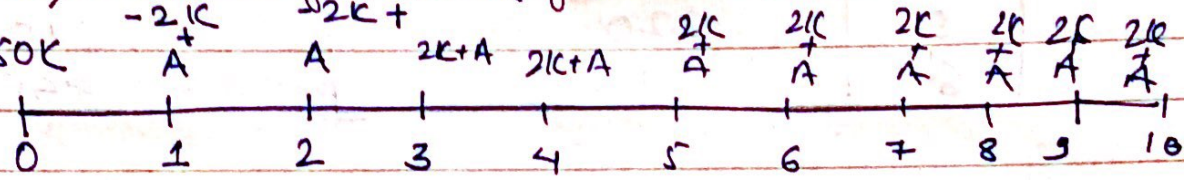
Here NPW < 0, It is not worth investing.

b. What should be min. annual benefit for making it a worthy of investment at 9% rate of return

- present worth of cash inflow = A(P/A, 9%, 10)
  = A * 6.418 +



- present worth of cash outflow = $50,000



let A be the min annual benefit for making it worthy

- present value of cashinflow =
  = A * (P/A, i, N) + 10,000 * (P/F, 9%, 10)
  = $A * \left[\frac{(1+i)^N - 1}{i(1+i)}\right] + 10,000 * \frac{1}{(1+i)^N}$
  = $A * \frac{1.09^{10} - 1}{0.09 * 1.09^{10}} + \frac{10,000}{1.09^{10}}$
  = A(6.418) + 4224.108

- Present value of cashoutflow =
  = A * (P/A, i, N) + 50,000
  = 2000 * (6.418) + 50,000
  = 62836

In this case, for minimum annual benefit
Net present worth = 0
Cash inflow - Cashoutflow = 0
cashinflow = cash outflow
A(6.418) + 4224.108 = 62836
6.418 * A = 58611.892
A = ~~9132.44~~ 9140.96

(3.a) Evaluate the following project whose cash flows are given below. Use simple payback period, present worth and future worth method. [MARR = 10% P.a]

Year	Net cash flow	For simple payback: Cummulative cash flow
0	−600	−600
1	−500	−1100
2	125	−975
3	300	−675
4	1000	325
5	220	545
6	320	865

a. Simple ~~pab~~ payback period method:

Simple payback period =
minimum year + $\frac{\text{Amount to be recovered}}{\text{Upcoming year cash flow}}$

$$3 + \frac{675}{1000}$$

$$3.675$$

Conclusion:
For six year project, the payback period is 3.675 which is good (अति राम्रो अति राम्रो)

b. Present worth method:

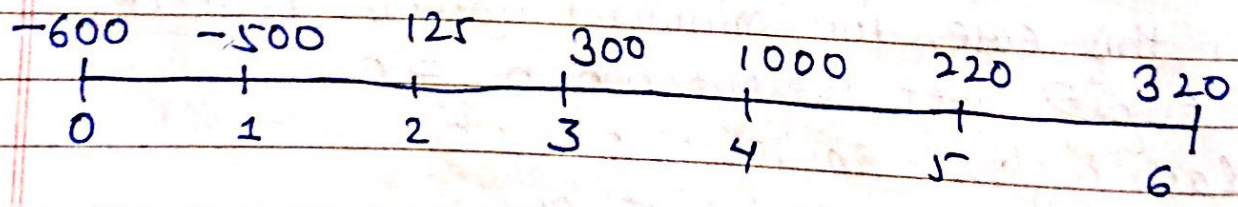


Fig: Cash flow diagram.

MARR = 10% = 0.1

$$\text{Net present worth} = \frac{-600}{(1+i)^0} + \frac{-500}{(1+i)^1} + \frac{125}{(1+i)^2} + \frac{300}{(1+i)^3}$$

$$+ \frac{1000}{(1+i)^4} + \frac{220}{(1+i)^5} + \frac{320}{(1+i)^6}$$

= ~~600~~ put $i = 0.1$

NPW = $-600 + (-454.545) + 103.30 + 225.394 +$
$683.013 + 136.602 + 180.631$
$= 274.395$

NPW is > 0, so accept the project

c. Future worth method

→ -600 future मा कति होला ह ? 6yrs मै

Future worth = $-600\,(F/P, 0.1, 0 \to 6) - 500\,(F/P, 0.1, 1 \to 5) +$
$125\,(F/P, 0.1, 2 \to 4) + 300\,(F/P, 0.1, 3) + 1000\,(F/P, 0.1, 4 \to 2)$
$+ 220\,(F/P, 0.1, 5 \to 1) + 320\,(F/P, 0.1, 6 \to 0)$

$= -600\,(1+0.1)^6 - 500(1+0.1)^5 + 125 * 1.1^4 + 320 * 1.01^3 +$
$1000 * 1.01^2 + 220 * 1.1^1 + 320 * 1.1^0$

$= -1062.9366 - 805.255 + 183.0125 + 425.92 +$
$1210 + 242 + 320$
$= 512.7409$

Since, future worth > 0, so accept the project.

(3b) Select which project is feasible to invest. MARR is 12·1· per year. use IRR method and incremental ~~me~~ analysis

Particulars	Project A (Rs)	Project B (Rs)
Intial investment	6,50,000	5,00,000
Net Anual revenue	2,50,000	2,00,000
Net Anual cost	50,000	40,000
salvage value	75,000	50,000
useful life	8 years	8 years

→ A. IRR method

a. Project A

(i) Triat at 12·1· per year

$NPW = -650,000 + 2,50,000\,(P/A, 0{\cdot}12, 8) - 50,000\,(P/A, 0{\cdot}12, 8) + 75,000\,(P/F, 0{\cdot}12, 8)$

$= -650,000 + (250000 - 50000)\,(P/A, 0{\cdot}12, 8) + 75000\,(P/F, 0{\cdot}12, 8)$

$= -650,000 + 200,000 * \left[\frac{1{\cdot}12^8 - 1}{0{\cdot}12 * 1{\cdot}12^8}\right] + 75000 * \frac{1}{1{\cdot}12^8}$

$= 373819{\cdot}1955$

(ii) Trial at 20·1· per year

$NPW = -650,000 + (250000 - 50,000)\,(P/A, 0{\cdot}2, 8) + 75000 * (P/F, 0{\cdot}2, 8)$

$= 147723{\cdot}2027$

Note: हामीलाई कुडा यस्तो NPW चाहिएको & यसको value को sign alternate होस्
ie at 12·1. , NPW is +ve
at ?·1., NPW is -ve
So we can interpolate.

iii) Trial at 30·1. per year

NPW = -650,000 + (250000 - 50,000)(P/A, 0·3, 8)
+ 75000 (P/F, 0·3, 8)
= -34768 [तल लिने बेला positive लिने]
So rate of return must be in between 12·1. to 30·1.

Note:
IRR is calculate when NPW = 0 ie cash inflow - cash outflow are equal.

Now Interpolating

$$IRR = \text{lower rate} + \frac{\text{Amount at LR}(HR - LR)}{\text{Amount at LR} + \text{Amount at HR}}$$

$$= 0.12 + \frac{37381.1955 (0.3 - 0.12)}{37381.1955 + 34376.8}$$

$$= 0.12 + 0.0937$$

$$= 0.2137$$

~~At IRR~~ IRR = 21.37 ·/.

Project B

(i) Trial at 12·1.

$NPW = -5,00,000 + (200,000 - 40,000)(P/A, 0.12, 8)$

$+ 50,000 (P/F, 0.12, 8)$

$= -500,000 + 1,60,000 * \frac{1.12^8 - 1}{0.12 * 1.12^8} + 50,000 * \frac{1}{(1+0.12)^8}$

$= 315016.5241$

(ii) Trial at 20·1.

$NPW = -5,00,000 + 1,60,000 * \frac{1.2^8 - 1}{0.2 * 1.2^8} + \frac{50,000}{(1+0.2)^8}$

$= 1,25,573.9705$

(iii) Trial at 30·1.

$NPW = -5,00,000 + 1,60,000 * \frac{1.3^8 - 1}{0.3 * 1.3^8} + \frac{50,000}{1.3^8}$

$= -25,918.245$

Interpolate in between 12·1. and 30·1.
Lower rate (LR) = 0.12 , Amt = 315016.524
higher rate (HR) = 30·1. , Amt = -25,918.245

$IRR = LR + \frac{|Amt \text{ at } LR| (HR - LR)}{|Amt \text{ at } LR| + |Amt \text{ at } HR|}$

$$IRR = 0.12 + \frac{315016.5241 * (0.3 - 0.12)}{315016.5241 + 25918.245}$$

$$= 0.12 + 0.1663$$

$$= 0.2863$$

$$IRR = 28.63\%$$

Conclusion

(भन्नको अर्थ यदि दुवै को rate of return भन्नाले कुन्ले दिदो investment return दिन्छ ।

Since IRR of proj A (21.37) < IRR of proj. B (28.63). so, I accept project A

→ **B. Incremental Analysis :**

IRR of A = 21.37 %.

IRR of B = 28.63 %.

~~Take A as the base project alternative~~

1. Sorting the project in order of increasing capital investment

Project	I	IRR
B	500,000	28.63%
A	6,50,000	21.37%

Take B as the base project

A	A - B	A - B
1	15,00	150,000
		50,000
		10,000

(i) At 12·1· for 8 years (trial 1)

$NPW_{A-B} = -150,000 + (50,000 - 10,000)(P/A, 0.12, 8)$

$+ 25,000 * (P/F, 0.12, 8)$

$= -150,000 + 40,000 * \frac{1.12^8 - 1}{0.12 * 1.12^8} + 25,000 * \frac{1}{1.12^8}$

$= 58802.67137$

(ii) At 20·1· for 8 years (trial 2)

NPW_{A-B} at 20·1· $= -150,000 + 40,000 * (P/A, 0.2, 8) +$
$25000 * (P/F, 0.2, 8)$
$= 9300.5931$

(iii) At 25·1· for 8 years (trial 3)

NPW_{A-B} at 25·1· $= -150,000 + 40,000 * (P/A, 0.25, 8)$
$+ 25000 * (P/F, 0.25, 8)$
$= -12649.2416$

Interpolating in between 12·1· and 25·1·

$IRR_{A-B} = LR + \frac{\text{Amt at LR } (HR - LR)}{\text{Amt at LR} + \text{Amt at HR}}$

$= 0.12 + \frac{58802.67137\ (0.25 - 0.12)}{58802.67137 + 12649.2416}$

$= 0.2269$
$= 22.69$ ·/·

$IRR_{A-B} = 22.69$ ·/· > MARR

Decision Rule:

If $\Delta IRR > MARR$, choose higher cost alternative

If $\Delta IRR < MARR$, Choose lower cost alternative

Conclusion

Here $\Delta IRR_{A-B} > MARR$, choose higher cost alternative that is project A.

(4b) Find simple and discounted payback period with following cash flow information

→ Given

Intial Investment(I) = Rs 4,00,000

Annual Revenue(AR) = Rs. 150,000

Annual cost(AC) = Rs. 30,000

salvage value(S) = Rs. 1,00,000

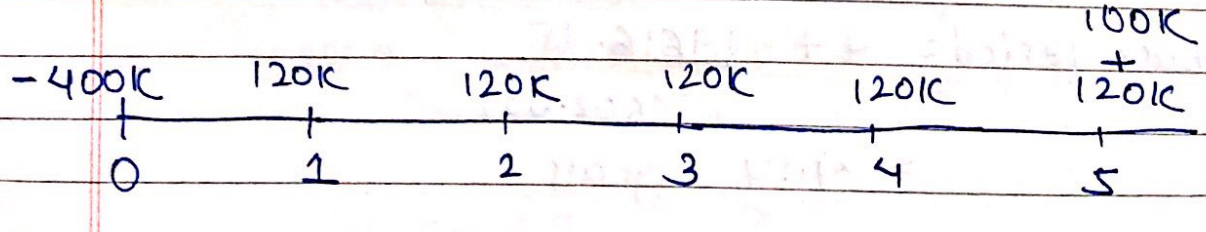
useful life(N) = 5 year

MARR = 10·1. = 0·1

Annual profit = 150,000 − 30,000 = 1,20,000

a. Simple payback information

Cash flow Amount	Action	Cash flow Amount	Cummulative cash flow
− 4,00,000	I		− 4,00,000
+ 150,000	AR		− 250,000
− 30,000	AC		
+ 1,00,000	S		



a. Simple payback period method

Year	Particulars	Net cash flow	cummulative cash flow
0		-4,00,000	-4,00,000
1		+120,000	-280,000
2		+120,000	-160,000
3		+120,000	-40000
4		+120,000	80,000
5		+220,000	3,00,000

simple payback period = min year + Ammount to be recover / upcoming year cash flow

$$= 3 + \frac{40,000}{120,000}$$

$$= 3 + 0.333$$

$$= 3.333$$

b. discounted payback period method (MARR = 10.1) i=

N / Year	A: Net cash flow	$(1+i)^{-N}$ (X): interest factor	(A * X): Discount cash flow	Σ(A*X): cummulative cash flow
0	-4,00,000	$(1+0.1)^{0} = 1$	-4,00,000	-4,00,000
1	+120,000	$(1+0.1)^{-1} = 0.909$	109090.909	-290909.090
2	+120,000	$(1+0.1)^{-2} = 0.8264$	99173.55	-191735.54
3	+120,000	$(1+0.1)^{-3} = 0.75131$	90157.77	-101577.77
4	+120,000	$(1+0.1)^{-4} = 0.6830$	81961.614	-19616.15
5	+220,000	$(1+0.1)^{-5} = 0.6209$	136602.691	116986.534

payback period = $4 + \frac{19616.15}{136602.691}$

= 4.14 years

(5)a) Solution

Given:

Intial investment (I) = Rs. 1,00,000

Salvage value (S) = Rs. 30,000

Useful life (N) = 10 year

Annual revenue (AR) = 20,000 p.a

Annual expenses (AE) = 6,000 p.a

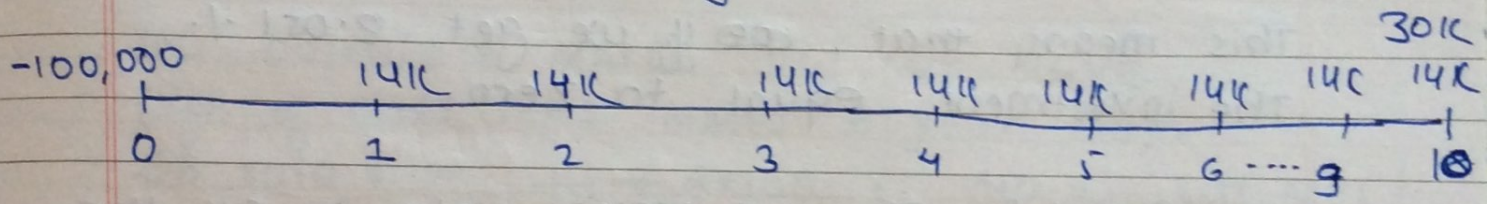
MARR = 8% p.a

IRR = ?

Now

Net profit = AR - AE = 14,000 per annum

~~(i) Trial at 8% per year~~



(i) Trial at 8% per year

$$NPW = -1,00,000 + 14,000(P/A, 0.08, 10) + 30,000(P/F, 0.08, 10)$$

$$= -100000 + 14000 * \frac{(1+0.08)^{10} - 1}{0.08 * (1+0.08)^{10}} + \frac{30,000}{(1+0.08)^{10}}$$

$$= 7836.944$$

(ii) Trial at 15% per year

$$NPW = -1,00,000 + 14000(P/B, 0.15, 10) + 30,000(P/F, 0.15, 10)$$

$$= -100000 + 14000 \times \frac{1.15^{10} - 1}{0.15 * 1.15^{10}} + \frac{30,000}{1.15^{10}}$$

$$= -99066.67$$

Interpolating in between 8·1· and 15·1·

LR = 0·08 ; Amount = 7836·944

HR = 0·15 ; Amount = -99066·67

$$IRR = LR + \frac{|Amt\ at\ LR|\,(HR - LR)}{|Amt\ at\ LR| + |Amt\ at\ HR|}$$

$$= 0.08 + \frac{7836.944\,(0.15 - 0.08)}{7836.944 + 99066.67}$$

$$= 0.08 + 0.005131$$

$$= 0.08051$$

$$= 8.051\ \%$$ > MARR

This means that, if we get 8·051·/·, The investment equal to zero

At 8·051·/·, The net present value of all the cash flows from a project equal to zero.

Decision Rule,

Hence the IRR (ie 8·051·/·) which is greate than MARR (8·/·), so we accept the project

(5|b) A construction equipment has intial cost and annual saving per year are of Rs ~~100,000~~ 40,000 & Rs 20,000 resp with O&M cost of Rs 7000 per year. It will depriciate by MACRS method and will have no salvage value. (N = 5 years). Estimate before and tax cash flow. The company pays income tax @ 40·/·

MACRS: Modified Accelerated cost Recovery System Allows the taxpayers to deduct greater amounts during first few years of an asset life.

→ Given (MACRS किन हेको बुझेन)

Income Tax = 40 %.

N = 5 years.

Year	BTCF (Given)
0	-40,000
1	
2	
3	
4	
5	

GOT it

TO calculate MACRS %, we have

Life of asset (N) = MACRS 5 year class

DB rate @ = $\frac{1}{N} * 2 * 100$ = 40 %. (at N=5)

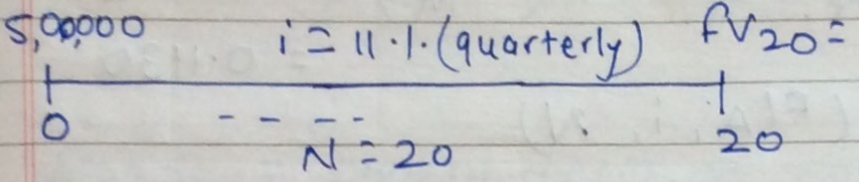
Year	calculation	MACR %
1		

Annual profit = 20,000 - 7000 = 13000

Year	BTCF	Macrs Dep	Depreciation	Taxable income BTCF - Depr	Income Tax (40%)	ATCF BTCF-To
0	-Rs 40,000	-	-	-	-	-40,000
1	13000 * 0.5 = 6500	20.1.	8,000	-1500	No Tax	6500
2	13,000	32.1.	12,800	200	80	12,920
3	13,000	19.2.1.	7620	5380	2152	10,848
4	13,000	11.52				
5	13,000	11.52				
6	13000 * 0.5 = 6500	5.76				

2016 spring

(21b) A man aged 40 years now had borrowed Rs. 500,000 from bank for his further studies at the age of 20 years. Interest was charged at 11·1% per year compounded quarterly. He wish to pay semiannual equal installment with the first installment begining 5 year after receiving the loan. He has just clear his loan now what amt did he pay in each installments.



man Age 20

$FV_{20} = 50,000 * (1+i)^N$

$= \cancel{50,000 *}$

$i_{eff} = \left(1 + \frac{r}{M}\right)^M - 1$

$= \left(1 + \frac{0.11}{4}\right)^4 - 1$

$= 0.1146$

$= 11.46\%$

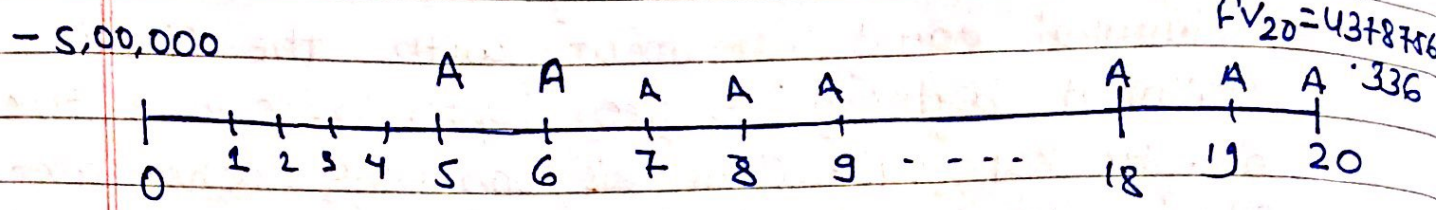
$\therefore FV_{20} = 500000 * (1 + 0.1146)^{20}$

$= 500000 * 8.7575$

$= 4378756.336$

The man have to pay is 4378756.336 in total, he started paying from after 5 years to 20 years equally to contribut 4378756.336

let he pay 'A' amount after 5 year of borrowed time (ie 5) to until now (20) ie N = 15



Now we have,

$$i_{eff} = \left(1 + \frac{r}{M}\right)^{M} - 1 = \left(1 + \frac{0.11}{2}\right)^{2} - 1$$

$$= 0.1130$$

$$FV_{20} = A(F/A, i, N)$$

$$= A(F/A, 0.1130, 16)$$

$$43787756.336 = A * \left[\frac{(1+i)^N - 1}{i}\right]$$

$$43787756.336 = A * \frac{1.1130^{16} - 1}{0.1130}$$

$$A = \frac{43787756.336}{40.2236}$$

$$A = 108860.3229$$

He paid 108860.3229 in each installment

(3|b) Determine both types of BIC ratio using present and annual worth if rate is 12%.

I = 6,00,000

life = 8 year

AR = 2,00,000 → benefit

AE = 60,000 → O&M

S = 2,00,000

(i) Present worth formulation

~~benefit = 200,000 - 60,000 = 1,40,000~~

PW(B) = present worth of benefit

= 200,000 (P/A, 0.12, 8)

= 200,000 * $\frac{1.12^8 - 1}{0.12 * 1.12^8}$

= ~~695469.5674~~ 993527.9534

PW(I) = present worth of intial investment

= 600,000

PW(S) = present worth of salvage value

= 2,00,000 * (P/F, 0.12, 8)

= 200000 * $(1 + 0.12)^{-8}$

= 80776.6456

PW(O&M) = present worth of Operation & maintaine cost

= 60,000 * (P/A, 0.12, 8)

= 60,000 * $\frac{1.12^8 - 1}{0.12 * 1.12^8}$

= 298058.386

BIC (Conventional) = $\frac{PW(B)}{PW(I) - PW(S) + PW(O\&M)}$

= $\frac{993527.9534}{600,000 - 80776.6456 + 298058.386}$

= 1.1163

BIC (Modified) = $\frac{PW(B) - PW(O\&M)}{PW(I) - PW(S)}$

= $\frac{993527.9534 - 298058.386}{600000 - 80776.6456}$

= 1.17

(b) Annual worth Formulation

$AW(I) = 6,00,000\ (A/P, @\ 0.12, 8)$

$= 6,00,000 * \left[\frac{(1+i)^N * i}{(1+i)^N - 1}\right]$

$= 600000 * \frac{1.12^8 * 0.12}{1.12^8 - 1}$

$= 120781.7048$

$AW(B) = 2,00,000$

$AW(O\&M) = 60,000$

$AW(S) = 200000 * (A/f, 0.12, 8)$

$= 200000 * \left[\frac{i}{(1+i)^N - 1}\right]$

$= 200000 * \frac{0.12}{1.12^8 - 1}$

$= 16260.568 >$ good

Now

$B/C\ (Conventional) = \frac{AW(B)}{AW(I) - AW(S) + AW(O\&M)}$

$= \frac{200000}{120781.7048 - 16260.568 + 60,000}$

$= 1.2156$

$B/C\ (Modified) = \frac{AW(B) - AW(O\&M)}{AW(I) - AW(S)}$

$= \frac{200000 - 60000}{120781.7048 - 16260.568}$

$= 1.3394 > 0$ good

(4)a) Use Repeatability Assumptions to recommend the best project

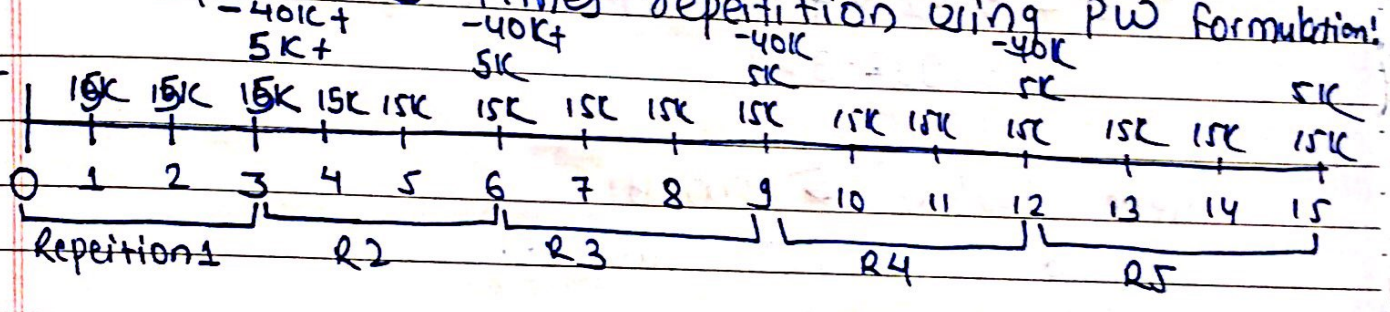
Project	A	B
Intial Investment (Rs)	40,000	50,000
Net Annual Revenue (Rs)	15,000	20,000
Salvage value (Rs)	5,000	6,000
Life	3	5
MARR	15 ·1.	15 ·1.

a. Repeatability project)

LCM of 3 and 5 years = 15 years

for project A

it requires 5 times repeition using PW formulation!



$PW(15\cdot1\cdot) = -40{,}000 - 40000\,(P/F, 0.15, 3) - 40000\,(P/F, 0.15, 6)$

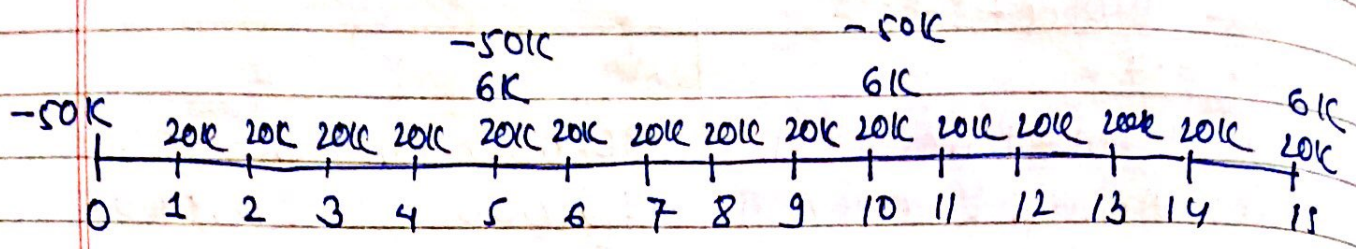
$- 40000\,(P/F, 0.15, 9) - 40000\,(P/F, 0.15, 12) +$

$15000\,(P/A, 0.15, 15) + 5000\,(P/F, 0.15, 3) +$

$5000\,(P/F, 0.15, 6) + 5000\,(P/F, 0.15, 9) +$
$5000\,(P/F, 0.15, 12) + 5000\,(P/F, 0.15, 15)$

$= -40{,}000 - 26300.64 - 17293.10 - 11370.49 - 7476.28$
$+ 87710.55 + 3287.58 + 2161.63 + 1421.312 +$
$934.53 + 614.47$
$= -6310.438$

For project B : it has 3 repetition



PW(15·1·) : −50000 − 50000(P/f, 0·15, 5) − 50000 (P/f, 0·15, 10) + 20000 × (P/A, 0·15, 15) + 6000(P/f, 0·11) + 6000 (P/f, 0·15, 10) + 6000 (P/f, 0·15, 15)

= ~~−50~~ −50,000 − 24858·83 − 12359·23531 + 116947·4 ~~20000 + 3945·09 + 2593·96 + 1705·577 + 298 1121·44 + 737·36~~ + 2983·06 + 1483·10 + 737·36

= −87218 + 116947·402 + 5203·52

= 34932·922

here PW(A) & PW(B)
So B is better, than A.

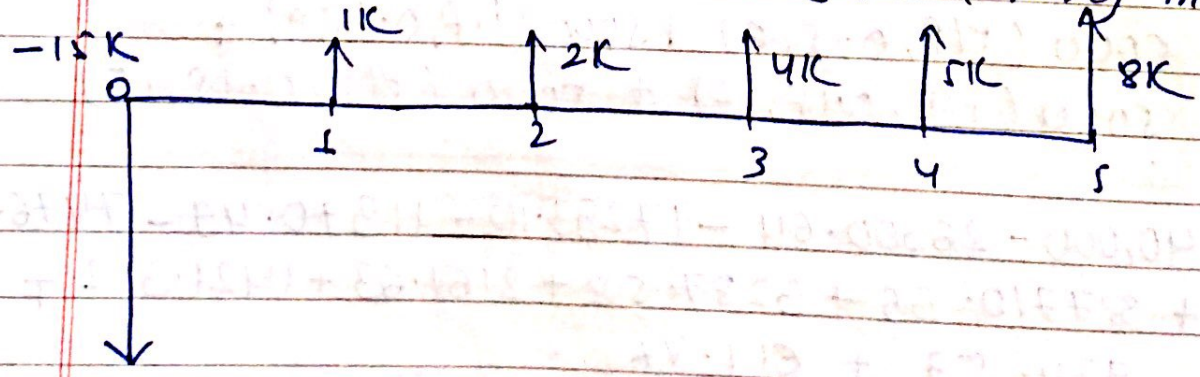
(4b) find IRR, MIRR, both payback period

MARR = 10·1·

Year	0	1	2	3	4	5
Amount	(15000)	1000	2000	4000	5000	8000

↳ -ve होला :P

coz invest गरी income हुँदैन (money makes money)



(i) Internal rate of return (IRR)

Trial at 10 %.

$$NPW = -15000 + \frac{1000}{1.1^1} + \frac{2000}{1.1^2} + \frac{4000}{1.1^3} + \frac{5000}{1.1^4} + \frac{8000}{1.1^5}$$

$$= -1050.3194$$

Triat at 5 %.

$$NPW = -15000 + \frac{1000}{1.05^1} + \frac{2000}{1.05^2} + \frac{4000}{1.05^3} + \frac{5000}{1.05^4} + \frac{8000}{1.05^5}$$

$$= 1603.512$$

Interpolating between 10 % and 5 %.

LR = 5 % Amt = 1603.512

HR = 10 % Amt = -1050.3194

$$IRR = LR + \frac{|Amt \text{ at } LR|}{|Amt \text{ at } LR| + |Amt \text{ at } HR|}(HR - LR)$$

$$= 0.05 + \frac{1603.512 + 0.05}{1603.512 + 1050.3194}$$

$$= 0.05 + 0.03021$$

$$= 0.0802$$

$$= 8.02\ \% < MARR$$

Not a good project. So Reject.

mistake

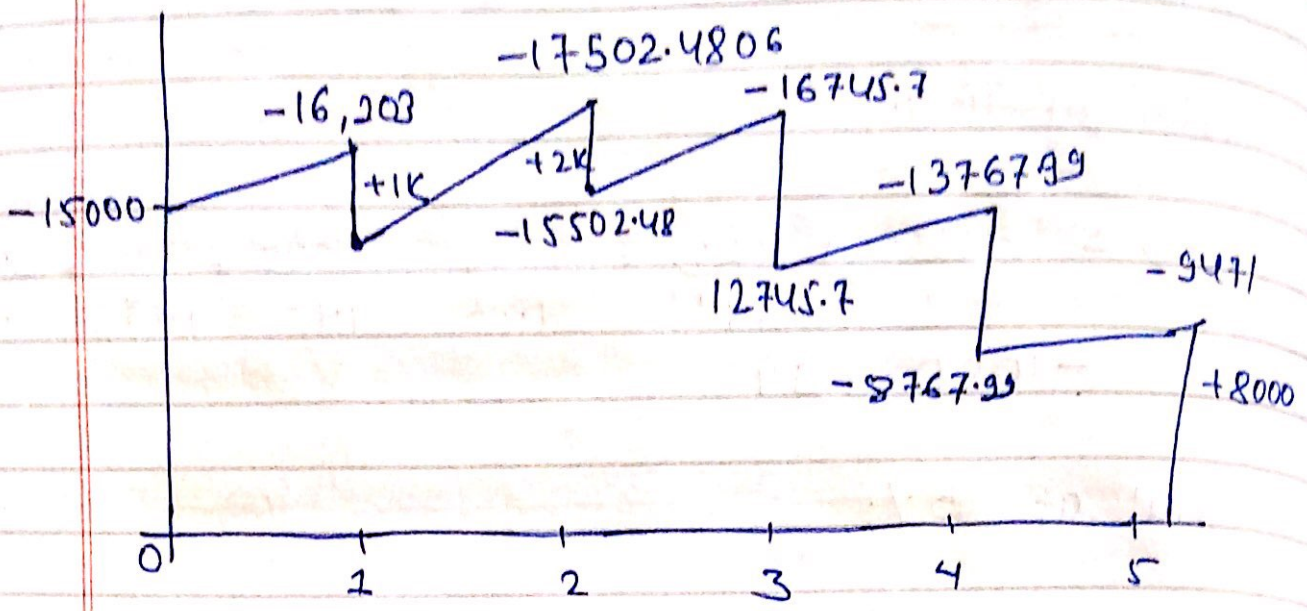


fig: Investment balance Diagram

(ii) MIRR.

PV of outflow = $\frac{\text{FV of inflow}}{(1+MIRR)^N}$

PV of outflow = -15000

FV of inflow = $1000 * 1.1^4 + 2000 \times 1.1^3 + 4000 \times 1.1^2 + 5000 \times 1.1^1 + 8000 \times 1.1^0$

= 22466.1

MIRR = ?

Now

$PV_0 = \frac{FV_i^0}{(1+MIRR)^N}$

$-15000 = \frac{22466}{(1+MIRR)^5} \Rightarrow 1+MIRR = \sqrt[5]{22466/15000}$

MIRR = 8.414 %

(iii) Simple payback period

EOY	Cash Flow Amount	cummulative frequency
0	-15000	-15000
1	1000	-14000
2	2000	-12000
3	4000	-8000
4	5000	-3000
5	8000	5000

payback period = minimum year + |Amt to be recovered| / upcoming yr cash flow

$= 4 + \frac{3000}{8000}$

$= 4.375$

(iv) Discounted payback period

EOY	Net cash flow	Intrest factor	Dicount cash flow	cummulative cash flow
0	-15000	$1.1^0 = 1$	-15000	-15000
1	1000	$1.1^{-1} = 0.9090$	909.0909	-14090.9091
2	2000	$1.1^{-2} = 0.8264$	1652.8925	-12438.01
3	4000	$1.1^{-3} = 0.7513$	3005.2592	-9432.75
4	5000	$1.1^{-4} = 0.6830$	3415.0672	-6017.68
5	8000	$1.1^{-5} = 0.6209$	4967.37	-1050.3128

Not feasible for Discounted

(5b) Find annual depreciation and book value of each year by SL, DB, SOYD and Sinking fund method

Intial cost (I) = Rs. 7000 salvage value = Rs 2000

useful life (N) = 5 year MARR = 10 %.

(i) Straight line method

$$\text{Annual depreciation} = \frac{I - S}{N} = \frac{7000 - 2000}{5}$$

$$= \frac{5000}{5} = \text{Rs. } 1000$$

$$\text{rate of depreciation} = \frac{1}{N} * 100 = \frac{1}{5} * 100 = 20\%$$

To find Book value

Year	Book value Begining	Depreciation	Book value at End
0	7000	—	7000
1	7000	1000	6000
2	6000	1000	5000
3	5000	1000	4000
4	4000	1000	3000
5	3000	1000	2000

(ii) Declining Balance method

we define

B = I

R = R [0 to 1]

K = N

d = depreciation

BV_K = Book value

relationship

$d_1 = B(R)$

$d_K = B(1-R)^{K-1} * R$ — (i)

$d_K^* = B[1-(1-R)^K]$ — (ii)

$BV_K = B(1-R)^K$ — (iii)

Using (i), (ii) and (iii), we can calculate annual depreciation, cummulative depreciation and Book value

DB rate = $\frac{1}{7} * 200 = 10\% = 0.1$

d_5 = depreciation at year 5

$= B(1-R)^{K-1} * R$

$= 7000 * (1-0.1)^4 * (0.1)$

$= 459.27$

$d_5^* = B[1-(1-R)^K] = 7000 * [1-(1-0.1)^5]$

$= 2407 \quad 2866.57$

$BV_5 = B(1-R)^K = 7000 * (1-0.1)$

$= 4133.43$

EOY	BV begin	0.1 * BV begin dk	BV begin - dk BV end
0	–	–	7000
1	7000	700	6300
2	6300	630	5670
3	5670	567	5103
4	5103	510.3	4592.7
5	4592.7	459.27	4133.43

) Sum of year digit (SOYD)

$SOYD = \frac{N(N+1)}{2} = \frac{5*6}{2} = 15$

Depreciation portion for each year = 5:4:3:2:1

SOYD = remaining useful year $\frac{(I-S)}{\text{SOYD total life}}$

here

I = Rs. 7000

S = Rs 2000

SOYD total life = 15

remaining useful life, 5 : 4 : 3 : 2 : 1

Year	Book value Begining	Depreciation Proportion	SOYD Depreciation	Book value at end
0	-	-	-	7000
1	7000	5	$\frac{5*(7000-2000)}{21}$ = 1190.47	5809.53
2	5809.53	4	$\frac{4*5000}{21}$ = 952.38	4857.15
3	4857.15	3	$\frac{3*5000}{21}$ = 714.28	4142.86
4	4142.86	2	$\frac{2*5000}{21}$ = 476.19	3666.66
5	3666.66	1	238.09	3428 ≠ SV (wrong)

(iv) Sinking fund method

Year	BV begin	Depr portion	SOYD Depreciation	Book value at ₹
0	-	-	-	7000
1	7000	5	5*(7000-2000)/15 = 1666.67	5333.33
2	5333.33	4	4* 5000/15 =1333.33	4000
3	4000	3	3* 5000/15 =1000	3000
2	3000	2	2* 5000/15 = 666.67	2333.33
1	2333.33	1	5000/15 = 333.33	2000

(iv) Sinking fund method :

Fixed Annual depreciation (A) = $(I-S) * (A/F, i\%, N)$

$$= (7000-2000)\left[\frac{i}{(1+i)^N - 1}\right] = 5000 * 0.163$$

$$= 818.98$$

Net depreciation for year k

$$d_k = (I-S)(A/F, i\%, N) \times (F/P, i\%, k-1)$$

Book value at end of year k,

$$BV_k = I - (I-S) \times (A/F, i\%, N) \times (F/A, i\%, k)$$

$(A|f, 0.1, 5) = 0.1637$

using this formula,

(A)

Year	Fixed depriciation (A)	Net (dic) depreciation	Book value on End (BVC)
0	~~818.98~~ -		7000
1	818.98	818.5	6181.5
2	818.98	900.35	5281.15
3	818.98	990.385	4290.765
4	818.98	1089.42	3201.34
5	818.98	1198.36	≈2002

(6b) perform sensitivity analysis using PW

I = 1,00,000

AR = 40,000 [Done in brinde's Assignment]

AE = 5000

S = 1000

N = 6 years — It should be given

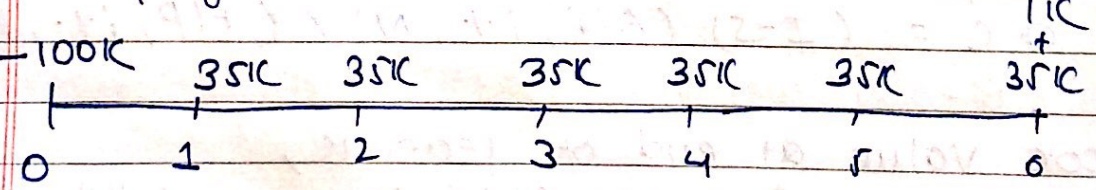
MARR = 12% = 0.12 — fluctuate % = ± 20%

→ Solution

AR = 40,000

AE = -5,000

Net profit = 35,000



present coorth(12%) = $-100000 + 35000(P/A, 0.12, 6)$

$+ 1000(P/F, 0.12, 6)$

$= -100000 + 35000 \frac{1.12^6 - 1}{0.12 * 1.12^6} + \frac{1000}{1.12^6}$

PW(12·1·) = 73185.73

when Intial Investment varies by ±20·1·, we have

At I(+20·1·) = -100000 × 1·2 + 35000(P/A, 0·12, 6) + 1000 * (P/F, 0·12, 6)
= 53185.73871

At I(-20·1·) = -100000 × 0·8 + 35000(P/A, 0·12, 6) + 1000(P/F, 0·12, 6)
= 93185.738

when AR varies by ±20·1·, we have

At AR(+20·1·) = -100000 + 40000 * 1·2 * (P/A, 0·12, 6)
- 5000(P/A, 0·12, 6) + 1000 * (P/F, 0·12, 6)
= -100000 + (48000 - 5000) * 4·111 + 1000 * 0·5066
= -100000 + 176773 + 506·6
= 77279·6

At AR(-20·1·) = -100000 + 40000 * 0·8 * (P/A, 0·12, 6)
- 5000(P/A, 0·12, 6) + 1000 * (P/F, 0·12, 6)
= -100000 + 131552 - 20555 + 506·6
= 11503·6

When useful life varies by ±20·1·
At +20·1·, N = 6 + 0·2 × 6 = 7·2
-20·1· N = 6 - 0·2 * 6 = 4·8

At N(+20·1·) = -100000 + 35000(P/A, 012, 7·2)
+ 1000 (P/F, 0·12, 7·2)
= 63130·46

At N(-20·1·) = 22953·9

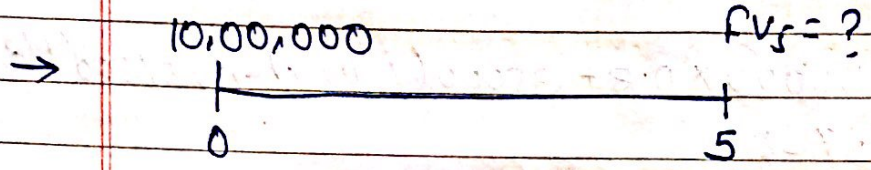
2018 Fall

(21a) Sabina deposits a sum of Rs. ~~10,00,000~~ 10,00,000 in a bank in an bank at an $i = 12.1..$ what will be future amount after 5 yea if compounded:

(i) weekly

(ii) quarterly

(iii) Annually



$I = 10,00,000$

$i = 0.12$

$N = 5$ years

(i) weekly ($M = 52$ weeks in a year)

$$I_{eff} = \left(1 + \frac{i}{M}\right)^{M} - 1$$

$$= \left(1 + \frac{0.12}{52}\right)^{52} - 1$$

$$= 0.1273$$

$$= 12.73\ \%$$

$FV_5 = P(F|P, 0.1273, 5)$

$= 10,00,000 * (1 + 0.1273)^5$

$= 1820528.722$

(ii) quarterly (M = 4)

$$i_{eff} = \left(1 + \frac{0.12}{4}\right)^4 - 1 = 0.1255$$

$$FV_5 = P(F/P, 0.1255, 5)$$
$$= 10,00,000 \times (1+0.1255)^5$$
$$= 1806040.548$$

(iii) Annualy

$$FV_5 = P(F/P, 0.12, 5)$$
$$= 10,00,000 \times (1+0.12)^5$$
$$= 1762341.683$$

(2b) Use simple payback period, PW and FW.
If MARR is 12 %.

EOY	0	1	2	3	4	5	6
Net cash flow	-700	-400	125	200	800	220	320

(i) Simple payback

EOY	cash flow	CF
0	-700	-700
1	-400	-1100
2	125	-975
3	200	-775
4	800	25
5	220	245
6	320	565

pp = min year + recover / upcoming

payback period = $3 + \frac{775}{800} = 3.968$ yrs.

(ii)

$$NPW = \frac{-700}{1.12^0} - \frac{400}{1.12^1} + \frac{125}{1.12^2} + \frac{200}{1.12^3} + \frac{800}{1.12^4}$$

$$+ \frac{220}{1.12^5} + \frac{320}{1.12^6}$$

$$= -700 - 357.142 + 99.64 + 142.35 + 508.414$$

$$+ 124.83 + 162.121$$

$$= -19.787$$

(iii) Decision

NPW < 0, reject the project

(iii)

$$NFW = NPW(F/P, 0.12, 5)$$

$$= -19.787 * (1+0.12)^5$$

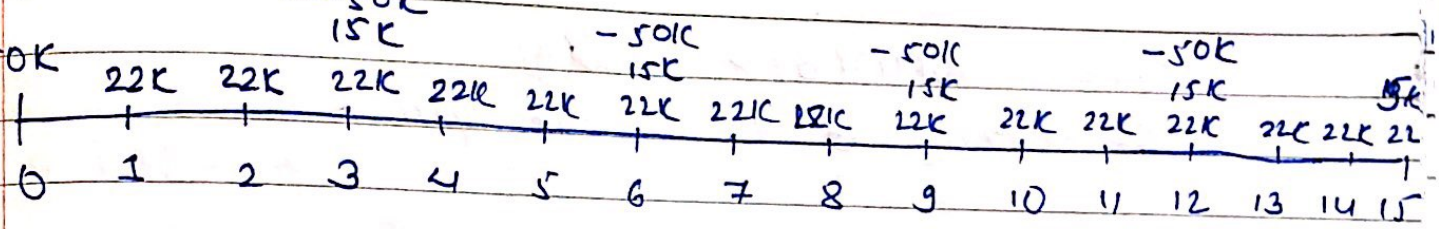
$$= -34.871 < 0$$, reject the project

(3(a)) Use Repeatability with PW formulation if MARR is 10% to evaluate two feasible investment A and B.

Particulars	Invest A (Rs)	Invest B (Rs)
Investment	50000	150000
Net annual revenue	25000	70000
Net annual cost	3000	2000
Salvage value	15,000	40,000
useful life	3	5 yrs

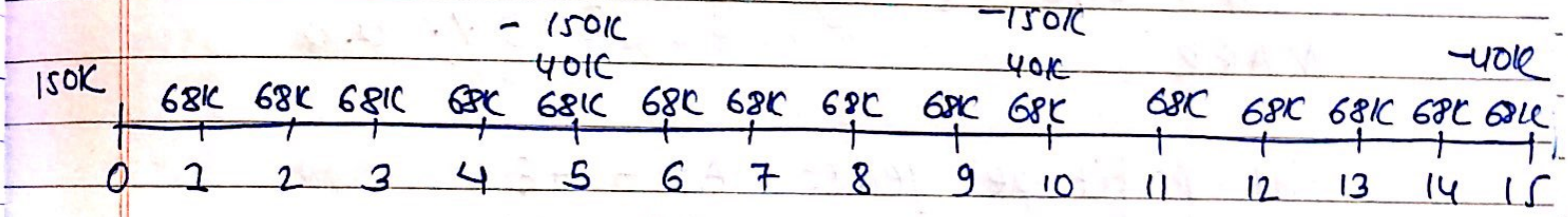
→ Using Repeatability with PW formulation

LCM = 15 yrs



profit = AR - AE = 25000 - 3000 = 22,000

fig: Cash flow Diagram for project A



Net profit = 70000 - 2000 = 68000

fig: Cash flow Diagram for Invest B

$$NPW(A) = -50000 + (50000 + 15000)(P/f, 0.1, 3) + (-50000 + 15000)(P/f, 0.1, 6) + (-50000 + 15000)(P/f, 0.1, 9) + (-50000 + 15000)(P/f, 0.1, 12) + 15000(P/f, 0.1, 15) + 22000(P/A, 0.1, 15)$$

NPW(B) = -150000 + (-150000 + 40000) (P/F, 0.1, 5) + (-150000 + 40000)(P/F, 0.1, 10) + 40000 (P/F, 0.1, 15) + 68000 (P/A, 0.1, 15)

= -150000 - 68301.34 - 42409.76 + 9575.68 + 517213.4064

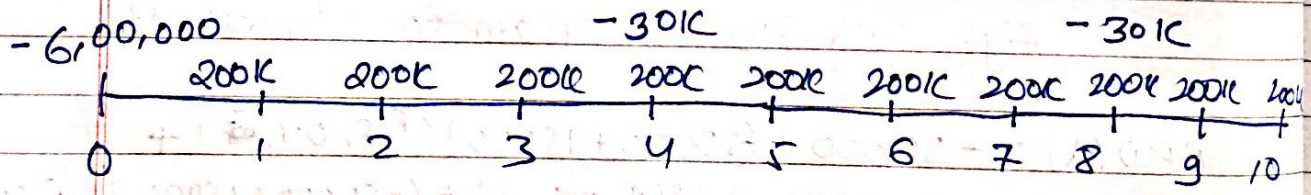
= 266077.9864

Here NPW(B) > NPW(A)
selecting B is best option

(3b) Evaluate IRR if

I = Rs 6,00,000 AR = Rs 2,50,000
N = 10 yrs AE = 50,000
Repair & maintaince cost at 4th and 8th year = Rs 30,000
MARR = 10% p.a

Net profit per year = AR - AE
= 250,000 - 50000
= 200000



i = 10% = 0.1

→ Solution:

Trial at 10%

NPW(10%) = −600000 − 30000 (P/F, 0.1, 4) − 30000 (P/F, 0.1, 8) + 200000 (P/A, 0.1, 10)

$= -600000 - 30000 * 1.1^{-4} - 30000 * 1.1^{-8} + 200000 * \frac{1.1^{10} - 1}{0.1 * 1.1^{10}}$

= −60,0000 ~~−30000×~~ − 20490.40 − 13995.22 + 1228913.421

= 594427.8011

NPW(20%) = −60000 − 30000 (P/F, 0.2, 4) − 30000 (P/F, 0.2, 8) + 200000 (P/A, 0.2, 10)

= 217049.78

NPW(30%) = 4126.38

NPW(35%) = −68742.75035

We get two NPW which have alternate sign

LR = 10% Amt = 594427.8011

HR = 35% Amt = 68742.75

$IRR = LR + \frac{|Amt\ at\ LR| (HR - LR)}{|Amt\ at\ LR| + |Amt\ at\ HR|}$

$= 0.1 + \frac{594427.8011 * 0.25}{594427.8011 + 68742.75}$

= 0.1 + 0.2240

= 0.3240

= 32.40% yes it is feasible

Coz IRR >> MARR

(4a) Use SL and SOYD if

I = 100,000 N = 10 yr

S = 20000

→ Using Straight Line method

depreciation = $\frac{I-S}{N} = \frac{80000}{10} = 8000$

rate of depreciation = $\frac{1}{N} * 100 = 10\%$

EOY	Book value at begining	Depreciation	Book value at end
0	—	—	100,000
1	1,00,000	8000	92000
2	92000	8000	84000
3	84000	8000	76000
4	76000	8000	68000
5	68000	8000	60000
6	60000	8000	52000
7	52000	8000	44000
8	44000	8000	36000
9	36000	8000	28000
10	28000	8000	20000

→ Using SOYD

SOYD (total) = $\frac{n(n+1)}{2} = \frac{10*11}{2} = 55$

Depreciation portion: 10:9:8:7:6:5:4:3:2:1

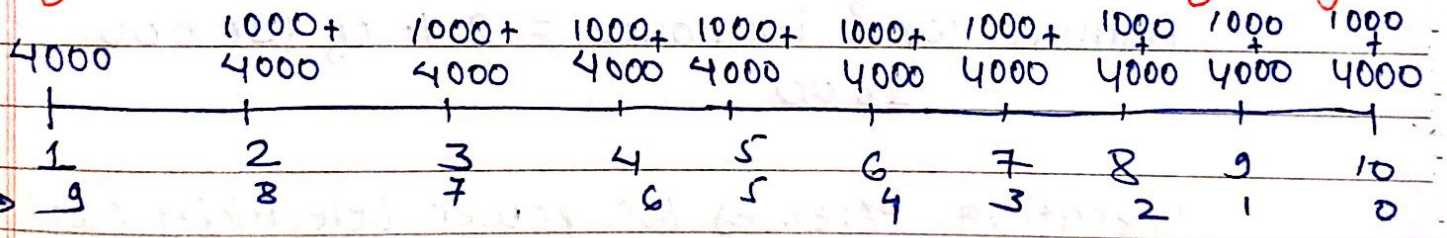
SOYD = remaining useful year * $\frac{I-S}{\text{SOYD total life}}$

I - S = 80,000

Year	SOYD calculation		Depreciation =	Book value at End of year
0	-	-	-	100,000
1	10	10 * 80000/55	14545	85455
2	9	9 * 80000/55	13090.90	72364.1
3	8	8 * 80000/55	11636.36	60727.74
4	7	7 * 80000/55	10181.81	50545.93
5	6	6 * 80000/55	8727.27	41818.66
6	5	5 * 80000/55	7272.72	34545.95
7	4	4 * 80000/55	5818.18	28727.76
8	3	3 * 80000/55	4363.63	24364.13
9	2	2 * 80000/55	2909.09	21455.04
10	1	1 * 80000/55	1454.54	20000

2015 spring (21a)

(21a) Mrs. Sharma is planning for her retired life and has 10 more years of service. She would like to deposit 20% of her salary, which is Rs 4000 at the end of first year and thereafter she wishes to deposit it the amt with an annual increase of Rs 1000 for 9 next years with interest of 10%. Find total amount at the end of 10th yr.



$$FV_{10} = 4000 * (f/A, 0.1, 9) + 1000 (f/A, 0.1, 8)$$

$$= 4000 \times \frac{1.1^9 - 1}{0.1} + 1000 \frac{1.1^8 - 1}{0.1}$$

$$= 65753.79574$$

(6b) following information has be obtained

Particulars	Standard Motor	New motor
size	100 hp	100 hp
cost	130000	156000
life	20	20
salvage	0	0
efficience	89 %	93 %
Annual O & M	8000	2500
Annual tax/Insurance	2 % of investment	
MARR	10 % per year.	

find at what operating hours are they equivalent

Solution: for Motor standard

Calculating annual equivalent cost:

capital recovery cost = $130000 (A/P, 10\%, 20)$

$$= 130000 * \frac{0.1 * 1.1^{20}}{1.1^{20} - 1}$$

$$= 15269.75$$

Maintainance cost = 8000

Annual tax & insurance = 2 % of 130000

= 2600

operating expenses for power (electricity cost)

let x be the no: of hours of operation per year.

operating ~~expense~~ (hours) = Input * rate * hours of operation

$$= \frac{\text{output}}{\text{Efficiency}} * \text{rate} * \text{hours of operation}$$

Note: 1 hp = 0.746 kilowar

$= \left(\frac{100}{0.74}\right) * 0.746 *$