

CA INTERMEDIATE

FINANCIAL MANAGEMENT

VOLUME II

By
CA. Namit Arora Sir

This book is dedicated to my Father

'MR. SURESK KUMAR ARORA'

ABOUT THE AUTHOR

Mr. Namit Arora is a First class commerce graduate and member of The Institute of Chartered Accountants of India (ICAI). He has cleared both groups of PCC examination and final examination in his first attempt.

He has vast experience of teaching even at such young age. He has taught large number of students of various professional courses such as CA, CS, CMA and also of undergraduate and post graduate course for university examinations. He is also author of Taxmann.

His specialized knowledge helps the students to understand the topic easily and his expert advice makes the revision very easy and fast.

He gives practical examples that help students to visualize the concepts and his teaching style is very famous among the students.

PREFACE TO THIS EDITION

This is a comprehensive book having thoroughly explained concepts with lucid and systematic presentation of the subject matter. All attempts are made in this book to keep concept easier to understand and remember.

A special attention is given to presentation keeping in mind the examination needs to the student. The book is primarily written for CA – INTERMEDIATE exams.

For any suggestion please mail me at canamitarora@gmail.com

A word to the students

My dear student, hard work is the key to success. Though smart work is publicized in today's world but to be smart, you have to work hard. So always be attentive in class and have thorough revision after the class. It is also important to be motivated and inspired for working hard. The key for success is:

***“Work hard in class, be attentive and grab the concepts
&
Work smart during revision, select important questions for next
revision.”***

***ALL THE BEST
CA. NAMIT ARORA***

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CHAPTER 7 CAPITAL BUDGETING OR INVESTMENT DECISION

TRADITIONAL TECHNIQUES

BQ 1

A project requiring an investment of ₹10,00,000 and it yields profit after tax and depreciation which is as follows:

<i>Year</i>	<i>Profit after tax and depreciation (₹)</i>
1	50,000
2	75,000
3	1,25,000
4	1,30,000
5	80,000

At the end of the 5th year, the plant and machinery of the project can be sold for ₹80,000.

Determine Accounting (Book) Rate of Return.

Answer

Alternative 1 (Average Investment Basis):

$$\begin{aligned}
 \text{Accounting Rate of Return} &= \frac{\text{Average Profit After Tax}}{\text{Average Investment}} \times 100 \\
 &= \frac{92,000}{5,40,000} \times 100 = 17.04\%
 \end{aligned}$$

Alternative 2 (Total Investment Basis):

$$\begin{aligned}
 \text{Accounting Rate of Return} &= \frac{\text{Average Profit After Tax}}{\text{Initial Investment}} \times 100 \\
 &= \frac{92,000}{10,00,000} \times 100 = 9.20\%
 \end{aligned}$$

Alternative 3 (Annual Basis):

$$\begin{aligned}
 \text{Accounting Rate of Return} &= \frac{\text{Profit After Tax}}{\text{Investment at the beginning of the year}} \times 100 \\
 \text{Year 1} &= \frac{50,000}{10,00,000} \times 100 = 5.00\% \\
 \text{Year 2} &= \frac{75,000}{8,16,000} \times 100 = 9.19\% \\
 \text{Year 3} &= \frac{1,25,000}{6,32,000} \times 100 = 19.78\% \\
 \text{Year 4} &= \frac{1,30,000}{4,48,000} \times 100 = 29.02\% \\
 \text{Year 5} &= \frac{80,000}{2,64,000} \times 100 = 30.30\%
 \end{aligned}$$

$$\begin{aligned} \text{Average ARR} &= (5\% + 9.19\% + 19.78\% + 29.02\% + 30.30\%) \div 5 \text{ years} \\ &= \mathbf{18.66\%} \end{aligned}$$

Working Notes:

$$\begin{aligned} \text{Average Profit After Tax} &= (50,000 + 75,000 + 1,25,000 + 1,30,000 + 80,000) \div 5 \\ &= 92,000 \text{ per annum} \end{aligned}$$

$$\text{Average Investment} = (10,00,000 + 80,000) \div 2 = 5,40,000$$

$$\text{Depreciation per annum} = (10,00,000 - 80,000) \div 5 \text{ years} = 1,84,000$$

BQ 2

Times Ltd. is going to invest in a project a sum of ₹3,00,000 having a life span of 3 years. Salvage value of machine is ₹90,000. The profit before depreciation for each year is ₹1,50,000.

Determine Accounting (Book) Rate of Return.

Answer

Alternative 1 (Average Investment Basis):

$$\begin{aligned} \text{Accounting Rate of Return} &= \frac{\text{Average Profit After Tax}}{\text{Average Investment}} \times 100 \\ &= \frac{80,000}{1,95,000} \times 100 = \mathbf{41.03\%} \end{aligned}$$

Alternative 2 (Total Investment Basis):

$$\begin{aligned} \text{Accounting Rate of Return} &= \frac{\text{Average Profit After Tax}}{\text{Initial Investment}} \times 100 \\ &= \frac{80,000}{3,00,000} \times 100 = \mathbf{26.67\%} \end{aligned}$$

Alternative 3 (Annual Basis):

$$\begin{aligned} \text{Accounting Rate of Return} &= \frac{\text{Profit After Tax}}{\text{Investment at the beginning of the year}} \times 100 \\ \text{Year 1} &= \frac{80,000}{3,00,000} \times 100 = \mathbf{26.67\%} \\ \text{Year 2} &= \frac{80,000}{2,30,000} \times 100 = \mathbf{34.78\%} \\ \text{Year 3} &= \frac{80,000}{1,60,000} \times 100 = \mathbf{50.00\%} \\ \text{Average ARR} &= (26.67\% + 34.78\% + 50.00\%) \div 3 = \mathbf{37.15\%} \end{aligned}$$

Working Notes:

$$\begin{aligned} \text{Average Profit After Tax} &= \text{Profit before depreciation} - \text{depreciation} \\ &= 1,50,000 - 70,000 = 80,000 \end{aligned}$$

$$\text{Average Investment} = (3,00,000 + 90,000) \div 2 = 1,95,000$$



$$\text{Depreciation per annum} = (3,00,000 - 90,000) \div 3 \text{ years} = 70,000$$

BQ 3

Times Ltd. is going to invest in a project a sum of ₹3,00,000 having a life span of 3 years. Salvage value of machine is ₹90,000. The profit after depreciation for each year is ₹80,000. Additional working capital requirement is ₹45,000

Determine Accounting (Book) Rate of Return on the basis of average investment.

Answer

$$\begin{aligned} \text{Accounting Rate of Return} &= \frac{\text{Average Profit After Tax}}{\text{Average Investment}} \times 100 \\ &= \frac{80,000}{2,40,000} \times 100 = 33.33\% \\ \text{Average Investment} &= [(3,00,000 + 45,000) + (45,000 + 90,000)] \div 2 \\ &= 2,40,000 \end{aligned}$$

BQ 4

Project A costs ₹2,00,000 and Project B costs ₹3,00,000 both have a ten year life. Uniform cash receipts expected are A ₹40,000 p.a. and B ₹80,000 p.a.

Calculate traditional payback period.

Answer

$$\begin{aligned} \text{Payback Period} &= \frac{\text{Total Initial Capital Investment}}{\text{Annual Expected CFAT}} \\ \text{Project A} &= \frac{2,00,000}{40,000} = 5 \text{ Years} \\ \text{Project B} &= \frac{3,00,000}{80,000} = 3.75 \text{ Years} \end{aligned}$$

BQ 5

The project involves a total initial expenditure of ₹2,00,000 and it is estimated to generate future cash inflow of ₹30,000, ₹38,000, ₹25,000, ₹22,000, ₹36,000, ₹40,000, ₹40,000, ₹28,000, ₹24,000 and ₹24,000 in its last year.

Calculate traditional payback period.

Answer

$$\text{Payback Period} = 6 \text{ year} + 9,000/40,000 = 6.225 \text{ Years}$$

Working Notes:

Calculation of Cumulative Cash Inflows:

Year	Annual Cash Inflows	Cumulative Cash Inflows
1	₹30,000	₹30,000

2	₹38,000	₹68,000
3	₹25,000	₹93,000
4	₹22,000	₹1,15,000
5	₹36,000	₹1,51,000
6	₹40,000	₹1,91,000
7	₹40,000	₹2,31,000
8	₹28,000	₹2,59,000
9	₹24,000	₹2,83,000
10	₹24,000	₹3,07,000

DISCOUNTED PAYBACK, NPV & PI TECHNIQUES (DCF)

BQ 6

Geeta Ltd. is implementing a project with capital outlay of ₹7,600. Its cash inflows are as follows:

Year	₹
1	6,000
2	2,000
3	1,000
4	5,000

The expected rate of return on the capital invested is 12% p.a.

Calculate the discounted payback period of the project.

Answer

Calculation of Cumulative Discounted Cash Flow

Year	Cash Inflow	DF @ 12% p.a.	Discounted CF	Cumulative DCF
1	6,000	0.8929	5,357	5,357
2	2,000	0.7972	1,594	6,951
3	1,000	0.7118	712	7,663
4	5,000	0.6355	3,178	10,841

$$\text{Discounted Payback period} = 2 \text{ years} + \frac{7,600 - 6,951}{712} = 2.91 \text{ years}$$

BQ 7

Compute the net present value for a project with a net investment of ₹1,00,000 and net cash flows year one is ₹55,000; for year two is ₹80,000 and for year three is ₹15,000. Further, the company's cost of capital is 10%? [PVIF @ 10% for three years are 0.909, 0.826 and 0.751]

Answer

Statement of NPV

Years	Particulars	₹	DF @ 10%	PV
0	Investment (outflow)	(1,00,000)	1.000	(1,00,000)
1	Cash inflow	55,000	0.909	49,995
2	Cash inflow	80,000	0.826	66,080
3	Cash inflow	15,000	0.751	11,265
NPV				27,340

Since the net present value is positive, investment in the project should be made.



BQ 8

ABC Ltd. is a small company that is currently analyzing capital expenditure proposals for the purchase of equipment; the company uses the net present value technique to evaluate projects. The capital budget is limited to ₹500,000 which ABC Ltd believes is the maximum capital it can raise. The initial investment and projected net cash flows for each project are shown below. The cost of capital of ABC Ltd is 12%.

You are required to compute the NPV of the different projects.

<i>Particulars</i>	<i>Project A</i>	<i>Project B</i>	<i>Project C</i>	<i>Project D</i>
Initial Investment (outflow)	2,00,000	1,90,000	2,50,000	2,10,000
Projected Cash Inflows:				
Year 1	50,000	40,000	75,000	75,000
Year 2	50,000	50,000	75,000	75,000
Year 3	50,000	70,000	60,000	60,000
Year 4	50,000	75,000	80,000	40,000
Year 5	50,000	75,000	1,00,000	20,000

Answer

Statement of NPV

<i>Period</i>	<i>PV factor</i>	<i>Project A</i>	<i>Project B</i>	<i>Project C</i>	<i>Project D</i>
0	1.000	(2,00,000)	(1,90,000)	(2,50,000)	(2,10,000)
1	0.893	44,650	35,720	66,975	66,975
2	0.797	39,850	39,850	59,775	59,775
3	0.712	35,600	49,840	42,720	42,720
4	0.636	31,800	47,700	50,880	25,440
5	0.567	28,350	42,525	56,700	11,340
Net Present Value		(19,750)	25,635	27,050	(3,750)

BQ 9

Suppose we have three projects involving discounted cash outflow of ₹5,50,000, ₹75,000 and ₹1,00,20,000 respectively. Suppose further that the sum of discounted cash inflows for these projects are ₹6,50,000, ₹95,000 and ₹1,00,30,000 respectively.

Calculate the desirability factors for the three projects.

Answer

<i>Desirability factor</i>	=	$\frac{\text{PV of Inflows}}{\text{PV of Outflows}}$	
<i>Project 1</i>	=	$\frac{6,50,000}{5,50,000}$	= 1.18
<i>Project 2</i>	=	$\frac{95,000}{75,000}$	= 1.27
<i>Project 3</i>	=	$\frac{1,00,30,000}{1,00,20,000}$	= 1.001

BQ 10

A Company is considering whether it should spend ₹4,00,000 on a project to manufacture and sell a new product. The unit variable cost of the product is ₹6. It is expected that the new product can be sold at ₹10 per unit. The annual fixed costs (only cash) will be ₹20,000. The project will have a life of six years

with a scrap value of ₹20,000. The cost of capital of the company is 15%. The only uncertain factor is the volume of sales. To start with the company expects to sell at least 40,000 units during the first year.

Required:

- (1) Net present value of the project based on the sales expected during the first year and on the assumption that it will continue at the same level during the remaining years.
- (2) The minimum volume of sales required to justify the project.

Note: Annuity of ₹1 at 15% for six years has a present value of ₹3.7845 and present value of ₹1 received at the end of sixth year at 15% is ₹0.4323.

[(1) NPV 1,38,476; (2) 30,853 units]

BQ 11

Cello Limited is considering buying a new machine which would have a useful economic life of five years, a cost of ₹1,25,000 and a scrap value of ₹30,000, with 80 per cent of the cost being payable at the start of the project and 20 per cent at the end of the first year. The machine would produce 50,000 units per annum of a new project with an estimated selling price of ₹3 per unit. Direct costs would be ₹1.75 per unit and annual fixed costs, including depreciation calculated on a straight line basis, would be ₹40,000 per annum. In the first year and the second year, special sales promotion expenditure, not included in the above costs, would be incurred, amounting to ₹10,000 and ₹15,000 respectively.

Evaluate the project using the NPV method of investment appraisal, assuming the company's cost of capital to be 10 percent.

Answer

Statement of NPV

Year	Particulars	₹	DF @ 10%	PV
0	Initial outflows (80% of 1,25,000)	(1,00,000)	1.000	(1,00,000)
1	Cash inflow – Outflow (31,500 – 20% of 1,25,000)	6,500	0.909	5,909
2	Cash inflow	26,500	0.826	21,889
3 - 5	Cash inflow	41,500	2.055	85,283
5	Salvage	30000	0.621	18,630
NPV				31,710

Working Note:

(a) Calculation of Annual Cash Inflow

Particulars	1	2	3 - 5
Sales value @ ₹3 per unit of 50,000 units	1,50,000	1,50,000	1,50,000
Less: Direct costs @ ₹1.75 per unit	87,500	87,500	87,500
Less: Annual cash fixed cost (40,000 – 19,000)	21,000	21,000	21,000
Less: Special sales promotion expenses	10,000	15,000	-
Cash Inflow	31,500	26,500	41,500

- (b) **Depreciation** = (Cost of machine – Scrap value) ÷ Life
 = (1,25,000 – 30,000) ÷ 5 years
 = **19,000 per annum**

Advise: Cello limited should buy machine having positive NPV.



BQ 12

XYZ Ltd is planning to introduce a new product with a projected life of 8 years. The project to be set up in a backward region, qualifies for a one time (as its starting) tax free subsidy from the government of ₹20,00,000 equipment cost will be ₹140 lakhs and additional equipment costing ₹10,00,000 will be needed at the beginning of the third year. At the end of 8 years the original equipment will have no resale value but the supplementary equipment can be sold for ₹1,00,000. A working capital of ₹15,00,000 will be needed.

The sales volume over the eight years period has been forecasted as follows:

Year	Units
1	80,000
2	1,20,000
3-5	3,00,000
6-8	2,00,000

A sale price of ₹100 per unit is expected and variable expenses will amount to 40% of sales revenue. Fixed cash operating costs will amount to ₹16,00,000 per year. In addition an extensive advertising campaign will be implemented requiring annual outlays as follows:

Year	(₹ in lakhs)
1	30
2	15
3-5	10
6-8	4

The company is subject to 50% tax rate and considers 12% to be an appropriate after tax cost of capital for this project. The company follows the straight line method of depreciation.

Should the project be accepted?

Answer

Net Present Value

Year	Particulars	₹	DF @ 12%	PV
0	Initial outflows (140 – 20 + 15) Lakhs	(1,35,00,000)	1.000	(1,35,00,000)
1	CFAT	2,00,000	0.893	1,78,600
2	CFAT less Additional Equipment (34,50,000 – 10,00,000)	24,50,000	0.797	19,52,650
3 - 5	CFAT	85,25,000	1.915	1,63,25,375
6 - 8	CFAT	58,25,000	1.363	79,39,475
8	Working Capital and Salvage (15,00,000 + 1,00,000)	16,00,000	0.404	6,46,400
NPV				1,35,42,500

Company should accept the proposal having positive NPV of the project.

Working Notes:

1. Statement of CFAT

Particulars	1	2	3 - 5	6 - 8
Units sold	80,000	1,20,000	3,00,000	2,00,000

Sales @ ₹100 p.u.	80,00,000	1,20,00,000	3,00,00,000	2,00,00,000
Less: VC @ 40%	32,00,000	48,00,000	1,20,00,000	80,00,000
Contribution	48,00,000	72,00,000	1,80,00,000	1,20,00,000
Less: Advertisement expenses	(30,00,000)	(15,00,000)	(10,00,000)	(4,00,000)
Less: Cash fixed cost	(16,00,000)	(16,00,000)	(16,00,000)	(16,00,000)
Less: Depreciation	(15,00,000)	(15,00,000)	(16,50,000)	(16,50,000)
PBT	(13,00,000)	26,00,000	1,37,50,000	83,50,000
Less: Tax @ 50%	-	(6,50,000)	(68,75,000)	(41,75,000)
PAT	(13,00,000)	19,50,000	68,75,000	41,75,000
Add: Depreciation	15,00,000	15,00,000	16,50,000	16,50,000
CFAT	2,00,000	34,50,000	85,25,000	58,25,000

2. Depreciation:

$$\begin{aligned} \text{Main equipment (} t_0 - t_8 \text{)} &= \frac{\text{Original Cost} - \text{Subsidy} - \text{Salvage}}{\text{Life of Equipment}} = \frac{1,20,00,000}{8 \text{ Years}} \\ &= \mathbf{15,00,000} \end{aligned}$$

$$\begin{aligned} \text{Additional equipment (} t_3 - t_8 \text{)} &= \frac{\text{Original Cost} - \text{Salvage}}{\text{Life of Equipment}} = \frac{9,00,000}{6 \text{ Years}} \\ &= \mathbf{1,50,000} \end{aligned}$$

$$\mathbf{3. Tax for year 2} = 50\% \text{ of } (26,00,000 - 13,00,000) = \mathbf{6,50,000}$$

Note: As per section 32 of Income Tax Act “Depreciation is not allowed on subsidized part of asset”

BQ 13

XYZ Ltd. is planning to introduce a new product with a project life of 8 years. Initial equipment cost will be ₹3.5 crores. Additional equipment costing ₹25,00,000 will be purchased at the end of the third year from the cash inflow of this year. At the end of 8 years, the original equipment will have no resale value, but additional equipment can be sold for ₹2,50,000. A working capital of ₹40,00,000 will be needed and it will be released at the end of eighth year. The project will be financed with sufficient amount of equity capital. The sales volumes over eight years have been estimated as follows:

Year	1	2	3	4-5	6-8
Units	72,000	1,08,000	2,60,000	2,70,000	1,80,000

A sales price of ₹240 per unit is expected and variable expenses will amount to 60% of sales revenue. Fixed cash operating costs will amount ₹36,00,000 per year. The loss of any year will be set off from the profits of subsequent two years. The company is subject to 30 per cent tax rate and considers 12 per cent to be an appropriate after tax cost of capital for this project. The company follows straight line method of depreciation.

Calculate the net present value of the project and advise the management to take appropriate decision.

The PV factors at 12% are

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



Answer

Net Present Value

Year	Particulars	₹	DF @ 12%	PV
0	Initial Equipment cost plus working capital (350 + 40) Lakhs	(3,90,00,000)	1.000	(3,90,00,000)
1	CFAT	33,12,000	0.893	29,57,616
2	CFAT	63,69,000	0.797	50,76,093
3	CFAT less Additional Equipment (1,62,64,500 – 25,00,000)	1,37,64,500	0.712	98,00,324
4-5	CFAT	1,70,71,500	1.203	2,05,37,015
6-8	CFAT	1,10,23,500	1.363	1,50,25,031
8	Working Capital and Salvage (40,00,000 + 2,50,000)	42,50,000	0.404	17,17,000
NPV				1,61,13,079

Company should accept the proposal having positive NPV of the project.

Working Notes:

1. Statement of CFAT

Particulars	1	2	3	4-5	6 – 8
Units sold	72,000	1,08,000	2,60,000	2,70,000	1,80,000
Sales @ ₹240 p.u.	1,72,80,000	2,59,20,000	6,24,00,000	6,48,00,000	4,32,00,000
Less: VC @ 60%	1,03,68,000	1,55,52,000	3,74,40,000	3,88,80,000	2,59,20,000
Contribution	69,12,000	1,03,68,000	2,49,60,000	2,59,20,000	1,72,80,000
Less: Cash fixed cost	36,00,000	36,00,000	36,00,000	36,00,000	36,00,000
Less: Depreciation	43,75,000	43,75,000	43,75,000	48,25,000	48,25,000
PBT	(10,63,000)	23,93,000	1,69,85,000	1,74,95,000	88,55,000
Less: Tax @ 30%	-	(3,99,000)	(50,95,500)	(52,48,500)	(26,56,500)
PAT	(10,63,000)	19,94,000	1,18,89,500	1,22,46,500	61,98,500
Add: Depreciation	43,75,000	43,75,000	43,75,000	48,25,000	48,25,000
CFAT	33,12,000	63,69,000	1,62,64,500	1,70,71,500	1,10,23,500

2. Depreciation:

$$\text{Main equipment } (t_0 - t_8) = \frac{\text{Original Cost}}{\text{Life of Equipment}} = \frac{3,50,00,000}{8 \text{ Years}} = 43,75,000$$

$$\text{Additional equipment } (t_4 - t_8) = \frac{\text{Original Cost} - \text{Salvage}}{\text{Life of Equipment}} = \frac{22,50,000}{5 \text{ Years}} = 4,50,000$$

$$3. \text{ Tax for year 2} = 30\% \text{ of } (23,93,000 - 10,63,000) = 3,99,000$$

BQ 14

A chemical company is presently paying an outside firm ₹1 per gallon to dispose off the waste resulting from its manufacturing operations. At normal operating capacity, the waste is about 50,000 gallons per year.

After spending ₹60,000 on research, the company discovered that the waste could be sold for ₹10 per gallon if it was processed further. Additional processing would, however, require an investment of ₹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 for the costs incurred in advertising ₹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:

Variable	:	₹5 per gallon of waste put into process.
Fixed	:	₹30,000 per year (Excluding Depreciation).

There will be no losses in processing, and it is assumed that the total waste processed in a given year will be sold in the same year. Estimates indicate that 50,000 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. You should consider Present value of Annuity of ₹ 1 per year @ 15% p.a. for 10 years as 5.019.

Which alternative would you recommend? Assume that the firm's cost of capital is 15% and it pays on an average 50% Tax on its income.

Answer

Statement of NPV

Year	Particulars	₹	DF @ 15%	PV
0	Initial outflows	(6,00,000)	1.000	(6,00,000)
1 - 10	Annual CFAT	1,55,000	5.019	7,77,945
NPV				1,77,945

Working Note:

Calculation of CFAT

Particulars	₹
Sales value of waste (50,000 gallon × ₹10)	5,00,000
Add: Saving in Disposal cost (50,000 gallon × ₹1)	50,000
Less: Variable processing cost (50,000 gallon × ₹5)	(2,50,000)
Less: Fixed processing cost (excluding depreciation)	(30,000)
Less: Advertisement cost	(20,000)
Less: Depreciation (6,00,000 ÷ 10 years)	(60,000)
PBT	1,90,000
Less: Tax @ 50%	(95,000)
PAT	95,000
Add: Depreciation	60,000
Annual CFAT	1,55,000

Recommendation: Processing of waste is a better option as it gives a positive NPV.

Note: Research cost of 60,000 is not relevant for decision making as it is sunk cost.

BQ 15

Manoranjan Ltd is a News broadcasting channel having its broadcasting Centre in Mumbai. There are total 200 employees in the organisation including top management. As a part of employee benefit expenses, the company serves tea or coffee to its employees, which is outsourced from a third-party. The company offers tea or coffee three times a day to each of its employees. 120 employees prefer tea all three times, 40 employees prefer coffee all three times and remaining prefer tea only once in a day. The third-party charges ₹10 for each cup of tea and ₹15 for each cup of coffee. The company works for 200 days in a year.



Looking at the substantial amount of expenditure on tea and coffee, the finance department has proposed to the management an installation of a master tea and coffee vending machine which will cost ₹10,00,000 with a useful life of five years. Upon purchasing the machine, the company will have to enter into an annual maintenance contract with the vendor, which will require a payment of ₹75,000 every year. The machine would require electricity consumption of 500 units p.m. and current incremental cost of electricity for the company is ₹12 per unit. Apart from these running costs, the company will have to incur the following consumables expenditure also:

1. Packets of Coffee beans at a cost of ₹90 per packet.
2. Packet of tea powder at a cost of ₹70 per packet.
3. Sugar at a cost of ₹50 per Kg.
4. Milk at a cost of ₹50 per litre.
5. Paper cup at a cost of 20 paise per cup.

Each packet of coffee beans would produce 200 cups of coffee and same goes for tea powder packet. Each cup of tea or coffee would consist of 10g of sugar on an average and 100 ml of milk. The company anticipate that due to ready availability of tea and coffee through vending machines its employees would end up consuming more tea and coffee.

It estimates that the consumption will increase by on an average 20% for all class of employees. Also, the paper cups consumption will be 10% more than the actual cups served due to leakages in them.

The company is in the 25% tax bracket and has a current cost of capital at 12% per annum. Straight line method of depreciation is allowed for the purpose of taxation.

You as a financial consultant is required to ADVISE on the feasibility of acquiring the vending machine.

PV factors @ 12%:

Year	1	2	3	4	5
PVF	0.8929	0.7972	0.7118	0.6355	0.5674

Answer

Statement of NPV

Year	Particulars	₹	DF @ 12%	PV
0	Initial outflows	(10,00,000)	1.000	(10,00,000)
1 – 5	Annual CFAT	2,39,438	3.6048	8,63,126
NPV				(1,36,874)

Since NPV of the machine is negative, it should not be purchased.

Working Note:

Calculation of CFAT

Particulars	₹
Saving in Existing Tea & Coffee Charges (120 × 10 × 3 × 200) + (40 × 15 × 3 × 200) + (40 × 10 × 1 × 200)	11,60,000
Less: AMC of Machine	(75,000)
Less: Electricity Charges (500 × 12 × 12)	(72,000)
Less: Coffee beans (144 × 90)	(12,960)
Less: Tea powder (480 × 70)	(33,600)
Less: Sugar (1,248 × 50)	(62,400)
Less: Milk (12,480 × 50)	(6,24,000)

Less: Paper cup (1,37,280 × 0.20)	(27,456)
Less: Depreciation (10,00,000 ÷ 5 years)	(2,00,000)
PBT	52,584
Less: Tax @ 25%	(13,146)
PAT	39,438
Add: Depreciation	2,00,000
Annual CFAT	2,39,438

Computation of Qty of consumable:

No. of Tea Cups	=	[(120 × 3 × 200 days) + (40 × 1 × 200 days) × 1.2	=	96,000
No. of Coffee cups	=	40 × 3 × 200 days × 1.2	=	28,800
No. of coffee beans packet	=	28,800/200	=	144
No. of Tea Powder Packets	=	96,000/200	=	480
Qty of Sugar	=	(96,000 + 28,800) × 6,000/1,000 g	=	1,248 kgs
Qty of Milk	=	(96,000 + 28,800) × 6,000/1,000 ml	=	12,480 litres
No. of paper cups	=	(96,000 + 28,800) × 1.1	=	1,37,280

UNEQUAL LIFE OF PROJECTS

BQ 16

APZ limited is considering selecting a machine between two machines 'A' and 'B'. The two machines have identical capacity, do exactly the same job, but designed differently.

Machine A costs ₹8,00,000, having useful life of three years. It costs ₹1,30,000 per year to run. Machine B is an economic model costing ₹6,00,000, having useful life of two years. It costs ₹2,50,000 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 10%.

The present value factors at 10% are:

Years	t_1	t_2	t_3
PVIF _{0.10t}	0.9091	0.8264	0.7513
PVIFA _{0.10.2} = 1.7355			
PVIFA _{0.10.3} = 2.4868			

Which machine would you recommend the company to buy?

Answer

Statement Showing Evaluation of Two Machines

Particulars	Machine 'A'	Machine 'B'
Initial outflow/ Purchase cost of machines	8,00,000	6,00,000

Annual running cost	1,30,000	2,50,000
Life of machines	3 years	2 years
PV of annual running cost (Annual running cost × PVIFA)	3,23,284 (1,30,000 × 2.4868)	4,33,875 (2,50,000 × 1.7355)
Present value of total outflow (Initial outflow + PV of annual running cost) ÷ PVIFA	11,23,284 ÷ 2.4868	10,33,875 ÷ 1.7355
Equivalent Annual outflow	4,51,699	5,95,722

Select the Machine A having lower equivalent annualized outflow.

BQ 17

Ae Bee Cee Ltd. is planning to invest in machinery, for which it has to make a choice between the two identical machines, in terms of Capacity, 'X' and 'Y'. Despite being designed differently, both machines do the same job. Further, details regarding both the machines are given below:

<i>Particulars</i>	<i>Machine 'X'</i>	<i>Machine 'Y'</i>
Purchase Cost of the Machine (₹)	15,00,000	10,00,000
Life (years)	3	2
Running cost per year (₹)	4,00,000	6,00,000

The opportunity cost of capital is 9%.

You are required to identify the machine the company should buy?

The present value (PV) factors at 9% are:

<i>Year</i>	<i>t₁</i>	<i>t₂</i>	<i>t₃</i>
PVIF _{0.09.t}	0.917	0.842	0.772

Answer

Statement Showing Evaluation of Two Machines

<i>Particulars</i>	<i>Machine 'X'</i>	<i>Machine 'Y'</i>
Initial outflow/ Purchase cost of machines	15,00,000	10,00,000
Annual running cost	4,00,000	6,00,000
Life of machines	3 years	2 years
PV of annual running cost (Annual running cost × PVIFA)	10,12,400 (4,00,000 × 2.531)	10,55,400 (6,00,000 × 1.759)
Present value of total outflow (Initial outflow + PV of annual running cost) ÷ PVIFA	25,12,400 ÷ 2.531	20,55,400 ÷ 1.759
Equivalent Annual outflow	9,92,651	11,68,505

Select the Machine X having lower equivalent annualized outflow.

CAPITAL RATIONING

BQ 18

Shiva Limited is planning its capital investment programme for next year. It has five projects all of which give a positive NPV at the company cut-off rate of 15 percent, the investment outflows and present values being as follows:

Project Name	Initial Investment	NPV @ 15%
A	₹50,000	₹15,400
B	₹40,000	₹18,700
C	₹25,000	₹10,100
D	₹30,000	₹11,200
E	₹35,000	₹19,300

The company is limited to a capital spending of ₹1,20,000.

You are required to optimise the returns from a package of projects within the capital spending limit. The projects are independent of each other and are (a) divisible, (b) indivisible.

Answer

**(a) Statement of Rank and Selection of Projects
(Divisible Situation)**

Projects	PI (1+ NPV/Investment)	Rank	Project Cost	Project (%)	Investment
A	$1 + 15,400/50,000 = 1.31$	5	₹50,000	-	-
B	$1 + 18,700/40,000 = 1.47$	2	₹40,000	100%	₹40,000
C	$1 + 10,100/25,000 = 1.40$	3	₹25,000	100%	₹25,000
D	$1 + 11,200/30,000 = 1.37$	4	₹30,000	66.67%	₹20,000 (b.f.)
E	$1 + 19,300/35,000 = 1.55$	1	₹35,000	100%	₹35,000
Total Investment					₹1,20,000

Optimum investment: 100% of B, C, E and 2/3 D.

**(b) Statement of Possible Combinations and Combined NPV
(Indivisible Situation)**

Possible Combinations	Combined Investment	Combined NPV
A + B + C	₹1,15,000	₹44,200
A + B + D	₹1,20,000	₹45,300
A + C + D	₹1,05,000	₹36,700
A + C + E	₹1,10,000	₹44,800
A + D + E	₹1,15,000	₹45,900
B + C + D	₹95,000	₹40,000
B + C + E	₹1,00,000	₹48,100
B + D + E	₹1,05,000	₹49,200
C + D + E	₹90,000	₹40,600

Invest in combination of B, D and E having highest combined NPV and invest remaining ₹15,000 elsewhere.

REPLACEMENT DECISION

BQ 19

P Ltd. has a machine having an additional life of 5 years which costs ₹10,00,000 and has a book value of ₹4,00,000.

A new machine costing ₹20,00,000 is available. Though its capacity is the same as that of the old machine, it will mean a saving in variable costs to the extent of ₹7,00,000 per annum. The life of the machine will be 5 years at the end of which it will have a scrap value of ₹2,00,000.

The rate of income tax is 46% and P Ltd's policy is not to make an investment if the yield is less than 12% per annum.

The old machine, if sold today will realise ₹1,00,000; it will have no salvage value if sold at the end of 5th year. Advise P Ltd. whether or not the old machine should be replaced.

Present value of ₹1 receivable annually for 5 years at 12% is 3.605, present value of ₹1 receivable at the end of 5 year at 12% per annum is 0.567. **Capital gain is tax free. Ignore income tax savings on depreciation as well as on loss due to sale of existing machine.**

Answer**Statement of NPV**

Years	Particulars	₹	PVF @ 12%	PV
0	Initial outflow	(19,00,000)	1.000	(19,00,000)
1 - 5	CFAT	3,78,000	3.605	13,62,690
5	Scrap value of new assets	2,00,000	0.567	1,13,400
NPV				(4,23,910)

Working notes:**1. Calculation of initial outflow:**

Cost of new machine	₹20,00,000
Less: Sale proceeds of old machine	₹1,00,000
Initial outflow	₹19,00,000

2. Calculation of incremental CFAT:

Annual savings	₹7,00,000
Less: Tax @ 46%	₹3,22,000
Profit after tax/ CFAT	₹3,78,000

Analysis: P Ltd should not replace the machine.

BQ 20

ABC Ltd. is considering the replacement of one of its molding machines. The existing machine is in good operation condition but is smaller than required if the firm is to expand its operations. The old machine is 5 years old and has remaining depreciable life of 10 years. The machine was originally purchased for ₹1,50,000 and is being depreciated at ₹10,000 per year for tax purposes.

The new machine will cost ₹2,20,000 or ₹1,70,000 if exchanged with the existing machine. It will be depreciated on a straight line basis for 10 years with no salvage value. The management anticipates that with the increased operations there will be need for an additional net working capital of ₹30,000.

The new machine will allow the company to expand current operations thereby increasing

annual revenue by ₹60,000 and variable operating costs from ₹2,00,000 to ₹2,20,000. The company's tax rate is 35% and its cost of capital is 10%.

Should the company replace its existing machine? Assume that the loss on exchange of existing machine can be claimed as short term capital loss in the current year itself.

Answer

Statement of NPV

Years	Particulars	₹	PVF @ 10%	PV
0	Initial outflow	(1,82,500)	1.000	(1,82,500)
1 - 10	CFAT	30,200	6.145	1,85,579
10	Working capital	30,000	0.386	11,580
NPV				14,659

Working notes:

a. Calculation of initial outflow:

Cost of new machine	₹2,20,000
Less: Exchange value of old machine	(₹50,000)
Less: Tax saving on loss on sale of old machine	(₹17,500)
[50,000 – 1,00,000 (1,50,000 – 10,000 × 5 years)] × 35%	
Add: Additional working capital	₹30,000
Initial outflow	₹1,82,500

b. Calculation of incremental CFAT:

Increase in sales	₹60,000
Less: Increase in operating cost	(₹20,000)
Less: Increase in depreciation (22,000 – 10,000)	(₹12,000)
Profit before tax	₹28,000
Less: Tax @ 35%	(₹9,800)
Profit after tax	₹18,200
Add: Depreciation	₹12,000
CFAT	₹30,200

Decision: ABC Ltd should exchange the machine.

BQ 21

MNP Limited is thinking of replacing its existing machine by a new machine which would cost ₹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 ₹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)	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 OH	10.00	12.50	2.50
Total	183.25	165.50	(17.75)



The existing machine has an accounting book value of ₹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 ₹2,50,000. However, the market price of old machine today is ₹1,50,000 and it is expected to be ₹35,000 after 5 years. The new machine has a life of 5 years and a salvage value of ₹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:

- (i) Estimate net present value of the replacement decision.
- (ii) Should Company go ahead with the replacement decision? Suggest.

Year (t)	1	2	3	4	5
PVIF _{0.15,t}	0.8696	0.7561	0.6575	0.5718	0.4972
PVIF _{0.20,t}	0.8333	0.6944	0.5787	0.4823	0.4019
PVIF _{0.25,t}	0.8000	0.6400	0.5120	0.4096	0.3277
PVIF _{0.30,t}	0.7692	0.5917	0.4552	0.3501	0.2693
PVIF _{0.35,t}	0.7407	0.5487	0.4064	0.3011	0.2230

Answer

(i) Statement of NPV

Year	Particulars	₹	DF @ 15%	PV
0	Initial outflows	(58,50,000)	1.0000	(58,50,000)
1 - 5	Cash Flow After Tax	22,84,000	3.3522	76,56,425
5	Net Salvage 2,50,000 – 35,000 (1 – 0.40)	2,29,000	0.4972	1,13,859
NPV				19,20,284

Working Notes:

1. Calculation of initial outflow:

Cost of new machine	₹60,00,000
Less: Exchange value of old machine	(₹2,50,000)
Add: Tax payment on profit on exchange of old machine (2,50,000 – Nil) × 40%	₹1,00,000
Initial outflow	₹58,50,000

2. Calculation of incremental CFAT:

Increase in sales (200 × 20,000 units)	₹40,00,000
Less: Increase in operating cost (1,00,000 × 148) – (80,000 × 173) (excluding Depreciation and Allocated overheads)	₹9,60,000
Less: Increase in depreciation [(60,00,00 – 2,50,000) ÷ 5] – Nil	₹11,50,000
Profit before tax	₹18,90,000
Less: Tax @ 40%	₹7,56,000
Profit after tax	₹11,34,000
Add: Depreciation	₹11,50,000
Incremental CFAT	₹22,84,000

3. Calculation of Incremental Salvage:

Salvage of new machine (Salvage = WDV; no gain or loss)	₹2,50,000
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Less: Salvage of old machine (Salvage > WDV)	₹35,000	
Tax on gain 40% of 35,000 (35,000 - Nil)	₹14,000	₹21,000
Incremental Salvage		₹2,29,000

Notes:

- (a) The old machine could be sold for ₹1,50,000 in the market. Since exchange value is more than the market value, company will exchange it at ₹2,50,000.
- (b) Old machine has fully depreciated for tax purpose, therefore depreciation of old machine as well as WDV are NIL.
- (c) Allocated overheads are allocations from corporate office therefore they are irrelevant for computation of CFAT.

(ii) Advise: The company should go ahead with replacement project, since it has positive NPV.

BQ 22

HMR Ltd. is considering replacing a manually operated old machine with a fully automatic new machine. The old machine had been fully depreciated for tax purpose but has a book value of ₹2,40,000 on 31st March. The machine has begun causing problems with breakdowns and it cannot fetch more than ₹30,000 if sold in the market at present.

It will have no realizable value after 10 years. The company has been offered ₹1,00,000 for the old machine as a trade in on the new machine which has a price (before allowance for trade in) of ₹4,50,000. The expected life of new machine is 10 years with salvage value of ₹35,000.

Further, the company follows straight line depreciation method but for tax purpose, written down value method depreciation @ 7.5% is considering that this is the only machine in the block of assets.

Given below are the expected sales and costs from both old and new machine:

<i>Particulars</i>	<i>Old Machine (₹)</i>	<i>New Machine (₹)</i>
Sales	8,10,000	8,10,000
Material cost	1,80,000	1,26,250
Labour cost	1,35,000	1,10,000
Variable overhead	56,250	47,500
Fixed overhead	90,000	97,500
Depreciation	24,000	41,500
PBT	3,24,750	3,87,250
Tax @30%	97,425	1,16,175
PAT	2,27,325	2,71,075

From the above information, ANALYSE whether the old machine should be replaced or not if required rate of return is 10%? Ignore capital gain tax.

PV factors @ 10%:

<i>Year</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>
<i>PVF</i>	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386

Answer

Calculation of Incremental CFAT & NPV

<i>Year</i>	<i>PVF</i>	<i>PBDT</i>	<i>Dep @ 7.5%</i>	<i>PBT</i>	<i>Tax @ 30%</i>	<i>Cash Inflow</i>	<i>PV</i>
1	0.909	80,000	26,250	53,750	16,125	63,875	58,062
2	0.826	80,000	24,281	55,719	16,716	63,284	52,273

3	0.751	80,000	22,460	57,540	17,262	62,738	47,116
4	0.683	80,000	20,776	59,224	17,767	62,233	42,505
5	0.621	80,000	19,217	60,783	18,235	61,765	38,356
6	0.564	80,000	17,776	62,224	18,667	61,333	34,592
7	0.513	80,000	16,443	63,557	19,067	60,933	31,259
8	0.467	80,000	15,210	64,790	19,437	60,563	28,283
9	0.424	80,000	14,069	65,931	19,779	60,221	25,534
10	0.386	80,000	13,014	66,986	20,096	59,904	23,123
Add: PV of salvage of new machine (35,000 × 0.386)							3,81,103
							13,510
Less: Initial Outflow							3,94,613
							(3,50,000)
Incremental NPV							44,613

Analysis: Since the Incremental NPV is positive, the old machine should be replaced.

Working Notes:

1. Calculation of Base for Depreciation or Cost of New Machine:

Cost of new machine	₹4,50,000
Less: Sale value of old machine	(₹1,00,000)
	₹3,50,000

2. Calculation of Profit before tax and depreciation (PBT) as per books:

Particulars	Old Machine (₹)	New Machine (₹)	Difference (₹)
PBT as per books	3,24,750	3,87,250	62,500
Add: Depreciation as per books	24,000	41,500	17,500
PBT	3,48,750	4,28,750	80,000

BQ 23

Xavly Ltd. has a machine which has been in operation for 3 years. The machine has a remaining estimated useful life of 5 years with no salvage value in the end. Its current market value is ₹2,00,000. The company is considering a proposal to purchase a new model of machine to replace the existing machine. The relevant information is as follows:

Particulars	Existing machine	New machine
Cost of machine	₹3,30,000	₹10,00,000
Estimated life	8 years	5 years
Salvage value	Nil	₹40,000
Annual output	30,000 units	75,000 units
Selling price per unit	₹15	₹15
Annual operating hours	3,000	3,000
Material cost per unit	₹4	₹4
Labour cost per hour	₹40	₹70
Indirect cash cost per annum	₹50,000	₹65,000

The company uses written down value of depreciation @ 20% and it has several other machines in the block of assets. The Income tax rate is 30 per cent and Xavly Ltd. does not make any investment, if it yields less than 12 per cent.

PV factors @12%:

<i>Year</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
<i>PVF</i>	0.893	0.797	0.712	0.636	0.567

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

Answer

Statement of NPV

<i>Year</i>	<i>Particulars</i>	<i>₹</i>	<i>DF @ 12%</i>	<i>PV</i>
0	Initial outflows	(8,00,000)	1.000	(8,00,000)
1	Incremental CFAT	3,21,000	0.893	2,86,653
2	Incremental CFAT	3,11,400	0.797	2,48,186
3	Incremental CFAT	3,03,720	0.712	2,16,249
4	Incremental CFAT	2,97,576	0.636	1,89,258
5	Incremental CFAT + Incremental Salvage (2,92,661 + 40,000)	3,32,661	0.567	1,88,619
NPV				3,28,965

Advise: The company should go ahead with replacement of machine, since it has positive NPV.

Working Notes:

1. Calculation of initial outflow:

Cost of new machine	₹10,00,000
Less: Sales value of old machine	(₹2,00,000)
Initial outflow	₹8,00,000

2. Increase in output = 75,000 units – 30,000 units = 45,000 units

3. Base for incremental Depreciation:

<i>Particulars</i>	<i>₹</i>
(A) WDV of Existing Machine:	
Purchase price of existing machine	3,30,000
Less: Depreciation year 1 (3,30,000 × 20%)	(66,000)
Less: Depreciation year 2 (2,64,000 × 20%)	(52,800)
Less: Depreciation year 3 (2,11,200 × 20%)	(42,240)
WDV of Existing Machine (A)	1,68,960
(B) Depreciation Base of New Machine:	
Purchase price of new machine	10,00,000
Add: WDV of existing Machine	1,68,960
Less: Sale value of existing machine	(2,00,000)
Depreciation Base of New Machine (B)	9,68,960
(C) Base for incremental Depreciation (B - A)	8,00,000

4. Calculation of incremental CFAT:

<i>Particulars</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
Increase in Sales (45,000 × ₹15)	6,75,000	6,75,000	6,75,000	6,75,000	6,75,000
Less: Increase in Material cost (45,000 units × ₹4)	(1,80,000)	(1,80,000)	(1,80,000)	(1,80,000)	(1,80,000)

Less: Increase in Labour cost {3,000 hours × (70-40)}	(90,000)	(90,000)	(90,000)	(90,000)	(90,000)
Less: Increase in Indirect cash cost (65,000 – 50,000)	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)
Less: Increase in Depreciation (Base: 8,00,000)	(1,60,000)	(1,28,000)	(1,02,400)	(81,920)	(65,536)
Incremental PBT	2,30,000	2,62,000	2,87,600	3,08,080	3,24,464
Less: Tax @ 30%	(69,000)	(78,600)	(86,280)	(92,424)	(97,339)
Incremental PAT	1,61,000	1,83,400	2,01,320	2,15,656	2,27,125
Add: Incremental Depreciation	1,60,000	1,28,000	1,02,400	81,920	65,536
Incremental CFAT	3,21,000	3,11,400	3,03,720	2,97,576	2,92,661

Notes: Since company has several machines in 20% block of assets, there is no tax benefit or tax payment on loss or profit on sale of machine respectively because block will remain in existence.

BQ 24

A & Co. is contemplating whether to replace an existing machine or to spend money on overhauling it. A & Co. currently pays no taxes. The replacement machine costs ₹90,000 now and requires maintenance of ₹10,000 at the end of every year for eight years. At the end of eight years it would have a salvage value of ₹20,000 and would be sold. The existing machine requires increasing amounts of maintenance each year and its salvage value falls each year as follows:

Year	Maintenance (₹)	Salvage (₹)
Present	0	40,000
1	10,000	25,000
2	20,000	15,000
3	30,000	10,000
4	40,000	0

The opportunity cost of capital for A & Co. is 15%. **When should the company replace the machine?**

Note: Present value of an annuity of Re. 1 per period for 8 years at interest rate of 15% : 4.4873; present value of Re. 1 to be received after 8 years at interest rate of 15% : 0.3269

Answer

PV of Cost of Replacing the Old Machine in each 4 years with New Machine

Scenario	Year	Cash Flow (₹)	PV @ 15%	PV (₹)
Replace Immediately	0	(28,600)	1.000	(28,600)
		40,000	1.000	40,000
				11,400
Replace in one year	1	(28,600)	0.870	(24,882)
	1	(10,000)	0.870	(8,700)
	1	25,000	0.870	21,750
				(11,832)
Replace in 2 years	1	(10,000)	0.870	(8,700)
	2	(28,600)	0.756	(21,622)
	2	(20,000)	0.756	(15,120)
	2	15,000	0.756	11,340
				(34,102)
Replace in 3 years	1	(10,000)	0.870	(8,700)
	2		0.756	(15,120)

	3	(20,000)	0.658	(18,819)
	3	(28,600)	0.658	(19,740)
	3	(30,000)	0.658	6,580
		10,000		(55,799)
Replace in 4 years	1	(10,000)	0.870	(8,700)
	2	(20,000)	0.756	(15,120)
	3	(30,000)	0.658	(19,740)
	4	(28,600)	0.572	(16,359)
	4	(40,000)	0.572	(22,880)
				(82,799)

Working Notes:

Calculation of Equivalent Cost of New Machine:

<i>Particulars</i>	<i>₹</i>
Cost of new machine now	90,000
Add: PV of annual repairs @ 10,000 per annum for 8 years (10,000 × 4.4873)	44,873
Less: PV of salvage value at the end of 8 years (20,000 × 0.3269)	(6,538)
Total PV of Outflows	1,28,335
Equivalent annual cost (1,28,335 ÷ 4.4873)	28,600

Advice: The company should replace the old machine immediately because the PV of cost of replacing the old machine with new machine is least.

ADJUSTED PV & ADJUSTED DISCOUNT RATE

BQ 25

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

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

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

You are required to:

- (a) Calculate the adjusted present value of the investment,
- (b) Calculate the adjusted discount rate and
- (c) Explain the circumstances under which this adjusted discount rate may be used to evaluate future investments.

Answer

(a) Calculation of Adjusted Present Value of Investment (APV):

$$\text{Adjusted PV} = \text{Base Case PV} + \text{PV of financing decisions associated with the project}$$



Base Case NPV for the project:

$$\begin{aligned}
 (-) ₹270 \text{ lakhs} + (₹42 \text{ lakhs} / 0.14) &= (-) ₹270 \text{ lakhs} + ₹300 \text{ lakhs} = ₹30 \text{ lakhs} \\
 \text{Issue costs} &= ₹10 \text{ lakhs} \\
 \text{Thus, the amount to be raised} &= ₹270 \text{ lakhs} + ₹10 \text{ lakhs} = ₹280 \text{ lakhs} \\
 \text{Annual tax relief on interest} &= ₹280 \times 0.1 \times 0.3 = ₹8.4 \text{ lakhs p.a.} \\
 \text{The value of tax relief in perpetuity} &= ₹8.4 \text{ lakhs} / 0.1 = ₹84 \text{ lakhs} \\
 \text{Therefore, APV} &= \text{Base case PV} - \text{Issue Costs} + \text{PV of Tax Relief on debt interest} \\
 &= ₹30 \text{ lakhs} - ₹10 \text{ lakhs} + ₹84 \text{ lakhs} = \mathbf{₹104 \text{ lakhs}}
 \end{aligned}$$

(b) Calculation of Adjusted Discount Rate (ADR):

Annual Income or Savings required to allow an NPV to zero

$$\begin{aligned}
 (-) ₹280 \text{ lakhs} + (\text{Annual Income} / 0.14) &= (-) ₹104 \text{ lakhs} \\
 \text{Annual Income} / 0.14 &= (-) ₹104 \text{ lakhs} + ₹280 \text{ lakhs} \\
 \text{Therefore, Annual income} &= ₹176 \times 0.14 = ₹24.64 \text{ lakhs} \\
 \text{Adjusted discount rate} &= (₹24.64 \text{ lakhs} / ₹280 \text{ lakhs}) \times 100 \\
 &= \mathbf{8.8\%}
 \end{aligned}$$

(c) Useable circumstances:

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

INTERNAL RATE OF RETURN (IRR)

BQ 26

Using details given below, calculate IRR of an investment of ₹1,36,000:

Year	Cash Inflows
1	₹30,000
2	₹40,000
3	₹60,000
4	₹30,000
5	₹20,000

Answer

Let us calculate NPV by 10% randomly:

Years	₹	PVF @ 10%	PV
0	(1,36,000)	1.000	(1,36,000)
1	30,000	0.909	22,270
2	40,000	0.826	33,040

3	60,000	0.751	45,060
4	30,000	0.683	20,490
5	20,000	0.621	12,420
NPV			2,280

The net present value at 10% comes to ₹2,280. Therefore, a higher discount rate is suggested, say, 12%.

NPV by 12% randomly:

Years	₹	PVF @ 12%	PV
0	(1,36,000)	1.000	(1,36,000)
1	30,000	0.893	26,790
2	40,000	0.797	31,880
3	60,000	0.712	42,720
4	30,000	0.636	19,080
5	20,000	0.567	11,340
NPV			(4,190)

The internal rate of return is, thus, more than 10% but less than 12%. The exact rate can be obtained by interpolation:

$$\begin{aligned} \text{IRR} &= L + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times (H - L) = 10\% + \frac{2,280}{2,280 - (-4,190)} \times (12\% - 10\%) \\ &= \mathbf{10.70\%} \end{aligned}$$

BQ 27

A Ltd. is evaluating a project involving an outlay of ₹10,00,000 resulting in an annual cash inflow of ₹2,50,000 for 6 years. Assuming salvage value of the project is zero determine the IRR of the project.

Answer

First of all we shall find an approximation of the payback (PVIFA_{IRR}) period:

$$\text{PVIFA}_{\text{IRR}} = 10,00,000 \div 2,50,000 = 4$$

Now we shall search this figure in the PVAF table corresponding to 6 years row. The value 4 lies between values 4.111 and 3.998 correspondingly discounting rates 12% and 13% respectively.

$$\text{NPV}_{12\%} = (10,00,000) + 4.111 \times 2,50,000 = 27,750$$

$$\text{NPV}_{13\%} = (10,00,000) + 3.998 \times 2,50,000 = (500)$$

The internal rate of return is, thus, more than 12% but less than 13%. The exact rate can be obtained by interpolation:

$$\text{IRR} = 12\% + \frac{2,775}{2,775 - (-50)} \times (13\% - 12\%) = \mathbf{12.98\%}$$

BQ 28

A Company proposes to install a machine involving a capital cost of ₹3,60,000. The life of the machine is 5 years and its salvage value at the end of the life is nil. The machine will produce the net operating income after depreciation of ₹68,000 per annum. The Company's tax rate is 45%.

The Net Present Value factors for 5 years as under:



Discounting Rate:	14%	15%	16%	17%	18%
Cumulative factor:	3.43	3.35	3.27	3.20	3.13

You are required to calculate the internal rate of return of the proposal.

Answer

$$\text{Sum of DF @ IRR for 4 years} = \frac{\text{PV of outflow}}{\text{Annual CFAT}} = \frac{3,60,000}{1,09,400} = 3.29$$

The internal rate of return is, thus, more than 15% but less than 16%. The exact rate can be obtained by interpolation:

$$\begin{aligned} \text{IRR} &= \text{LR} + \frac{\text{NPV}_{\text{LR}}}{\text{NPV}_{\text{LR}} - \text{NPV}_{\text{HR}}} \times (\text{HR} - \text{LR}) = 15\% + \frac{6,490}{6,490 + 2,262} \times (16\% - 15\%) \\ &= 15.74\% \end{aligned}$$

Calculation of NPV at 15% and 16%:

$$\begin{aligned} \text{NPV}_{15\%} &= (3,60,000) + 3.35 \times 1,09,400 = 6,490 \\ \text{NPV}_{16\%} &= (3,60,000) + 3.27 \times 1,09,400 = (2,262) \end{aligned}$$

Computation of cash inflow per annum:

Net operating income per annum	₹68,000
Less: Tax @ 45%	₹30,600
Profit after tax	₹37,400
Add: Depreciation (₹3,60,000 ÷ 5 years)	₹72,000
Cash inflow (CFAT)	₹1,09,400

BQ 29

The cash of flows of projects X and Y are given below:

Cash Flow (₹)

Projects	Year 0	Year 1	Year 2	Year 3	NPV @ 10%	IRR
X	-10,000	+2,000	+4,000	+12,000	+4,134	26.5%
Y	-10,000	+10,000	+3,000	+3,000	+3,821	37.6%

- (a) Why is there a conflict in ranking?
- (b) Why should you recommend project X in spite of a lower rate of return?

Answer

(a) Out of the two projects X and Y, the former is having higher NPV (10% rate) of ₹4,134 and is preferable. However, as per the IRR method the Project Y is preferable as it having IRR of 37.6%. So, there is a conflict in ranking of projects.

The reason for this conflict may be traced in the pattern of cash inflows estimating from two projects. It may be noticed that inflows from project X are higher in later years while from Project Y the cash inflows are higher in earlier years. The reinvestment rate assumption implies that inflows are reinvested in the NPV method at the discount rate, while in case of IRR method the inflows are reinvested at IRR rate itself. The pattern of inflows and the reinvestment rate assumption make the ranking to differ from each other.

(b) In spite of lower IRR of 26.5% the project X may be recommended as it is having the incremental NPV of ₹313 (₹4,134 - ₹3,821) and will lead to higher increase in the wealth of the shareholders.

MODIFIED INTERNAL RATE OF RETURN (MIRR)

BQ 30

Using details given below, calculate MIRR considering 8% cost of Capital.

<i>Year</i>	<i>Cash Flow</i>
0	(₹1,36,000)
1	₹30,000
2	₹40,000
3	₹60,000
4	₹30,000
5	₹20,000

Answer

Statement of Compounding Value

<i>Years</i>	<i>Particulars</i>	<i>₹</i>	<i>CVF @ 8%</i>	<i>CV</i>
1	Cash inflow	30,000	1.3605	40,815
2	Cash inflow	40,000	1.2597	50,388
3	Cash inflow	60,000	1.1664	69,984
4	Cash inflow	30,000	1.0800	32,400
5	Cash inflow	20,000	1.0000	20,000
Compound Value of Cash Inflow				2,13,587

Calculation of MIRR:

$$\text{Compound Factor} = \frac{\text{Compound value of inflow}}{\text{Initial outflow}} = \frac{2,13,587}{1,36,000} = 1.5705$$

$$\text{MIRR} = \sqrt[5]{1.5705} - 1 = 9.45\%$$

MISCELLANEOUS

BQ 31

Navjeevani hospital is considering to purchase a machine for medical projectional radiography which is priced at ₹2,00,000. The projected life of the machine is 8 years and has an expected salvage value of ₹18,000 at the end of 8th year. The annual operating cost of the machine is ₹22,500. It is expected to generate revenues of ₹1,20,000 per year for eight years. Presently, the hospital is outsourcing the radiography work to its neighbour Test Center and is earning commission income of ₹36,000 per annum, net of taxes. Consider tax @30%.

Analyse whether it would be profitable for the hospital to purchase the machine? Give your recommendation under:

- (i) Net Present Value method,
- (ii) Profitability Index method.

PV factors at 10% are given below:

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467

Answer

(i) Net Present Value

Year	Particulars	₹	DF @ 10%	PV
0	Initial outflows	(2,00,000)	1.000	(2,00,000)
1 – 8	Cash Flow After Tax	39,075	5.334	2,08,426
8	Salvage	18,000	0.467	8,406
NPV				16,832

(ii) Profitability Index = $\frac{\text{PV of Inflows}}{\text{PV of Outflows}}$ = $\frac{2,16,832}{2,00,000}$ = **1.084**

Working Notes:

Calculation of CFAT:

Particulars	₹
Sales	1,20,000
Less: Operating cost	22,500
Less: Depreciation (2,00,000 – 18,000) ÷ 8 years	22,750
Net Income	74,750
Less: Tax @ 30%	22,425
PAT	52,325
Add: Depreciation	22,750
Cash inflows after tax per annum	75,075
Less: Loss of commission income	36,000
Net CFAT	39,075

Advise: Since the net present value (NPV) is positive and profitability index is also greater than 1, the hospital may purchase the machine.

BQ 32

Lockwood Limited wants to replace its old machine with a new automatic machine. Two models A and B are available at the same cost of ₹5 lakhs each. Salvage value of the old machine is ₹1 lakh. The utilities of the existing machine can be used if the company purchases A. Additional cost of utilities to be purchased in that case are ₹1 lakh. If the company purchases B then all the existing utilities will have to be replaced with new utilities costing ₹2 lakhs. The salvage value of the old utilities will be ₹0.20 lakhs. The cash flows after taxation are expected to be:

Year	A	B
1	₹1,00,000	₹2,00,000
2	₹1,50,000	₹2,10,000
3	₹1,80,000	₹1,80,000
4	₹2,00,000	₹1,70,000
5	₹1,70,000	₹40,000
Salvage Value at the end of Year 5	₹50,000	₹60,000

The targeted return on capital is 15%.

You are required to:

- (a)** Compute, for the two machines separately, Net Present Value, Discounted Payback Period and Desirability Factor and

(b) Advice which of the machines is to be selected?

Answer

(a) Net Present Value

Year	NPV Factor @ 15%	Machine A		Machine B	
		Cash Inflows	Discounted CF	Cash Inflows	Discounted CF
0	1.0000	(5,00,000)	(5,00,000)	(5,80,000)	(5,80,000)
1	0.8696	1,00,000	86,960	2,00,000	1,73,920
2	0.7561	1,50,000	1,13,415	2,10,000	1,58,781
3	0.6575	1,80,000	1,18,350	1,80,000	1,18,350
4	0.5718	2,00,000	1,14,360	1,70,000	97,206
5	0.4972	1,70,000	84,524	40,000	19,888
Salvage	0.4972	50,000	24,860	60,000	29,832
NPV			42,469		17,977

Discounted Payback Period

Year	Machine A		Machine B	
	Discounted CF	Cum Discounted CF	Discounted CF	Cum Discounted CF
1	86,960	86,960	1,73,920	1,73,920
2	1,13,415	2,00,375	1,58,781	3,32,701
3	1,18,350	3,18,725	1,18,350	4,51,051
4	1,14,360	4,33,085	97,206	5,48,257
5	1,09,384	5,42,469	49,720	5,97,977

$$\text{Machine A} = 4 \text{ years} + \frac{5,00,000 - 4,33,085}{1,09,384} = 4.612 \text{ years}$$

$$\text{Machine B} = 4 \text{ years} + \frac{5,80,000 - 5,48,257}{49,720} = 4.638 \text{ years}$$

$$\text{Profitability Index (PI)} = \frac{\text{PV of Inflows}}{\text{PV of Outflows}}$$

$$\text{Machine A} = \frac{5,42,469}{5,00,000} = 1.085$$

$$\text{Machine B} = \frac{5,97,977}{5,80,000} = 1.031$$

Working note:

Calculation of Initial Investment

Particulars	Machine A	Machine B
Cost of Machine	5,00,000	5,00,000
Add: Cost of Utilities	1,00,000	2,00,000
Less: Salvage of Old Machine	(1,00,000)	(1,00,000)
Less: Salvage of Old Utilities	-	(20,000)
Initial Investment	₹5,00,000	₹5,80,000

(b) Since the absolute surplus in the case of A is more than B and also the desirability factor, it is better to choose A. The discounted payback period in both the cases is same, also the net present value is



positive in both the cases but the desirability factor (profitability index) is higher in the case of Machine A, it is therefore better to choose Machine A.

BQ 33

Hindlever Company is considering a new product line to supplement its range line. It is anticipated that the new product line will involve cash investments of ₹7,00,000 at time 0 and ₹10,00,000 in year 1. After-tax cash inflows of ₹2,50,000 are expected in year 2, ₹3,00,000 in year 3, ₹3,50,000 in year 4 and ₹4,00,000 each year thereafter through year 10. Although the product line might be viable after year 10, the company prefers to be conservative and end all calculations at that time.

- (a) If the required rate of return is 15 per cent, what is the net present value of the project? Is it acceptable?
- (b) What would be the case if the required rate of return were 10 per cent?
- (c) What is its internal rate of return?
- (d) What is the project's payback period?

Answer

(a) Statement of NPV

Years	Cash Inflow (₹)	PVF @ 15%	Present Value
0	(7,00,000)	1.000	(7,00,000)
1	(10,00,000)	0.870	(8,70,000)
2	2,50,000	0.756	1,89,000
3	3,00,000	0.658	1,97,400
4	3,50,000	0.572	2,00,200
5 - 10	4,00,000	2.164	8,65,600
NPV			(1,17,800)

(b) Statement of NPV

Years	₹	PVF @ 10%	PV
0	(7,00,000)	1.000	(7,00,000)
1	(10,00,000)	0.909	(9,09,000)
2	2,50,000	0.826	2,06,500
3	3,00,000	0.751	2,25,300
4	3,50,000	0.683	2,39,050
5 - 10	4,00,000	2.975	11,90,000
NPV			2,51,850

(c) **IRR** = $LR + \frac{NPV_{LR}}{NPV_{LR} - NPV_{HR}} \times (HR - LR) = 10\% + \frac{2,51,850}{2,51,850 + 1,17,800} \times (15\% - 10\%)$
 = **13.41%**

(d) **Payback Period** = $-7,00,000 - 10,00,000 + 2,50,000 + 3,00,000 + 3,50,000 + 4,00,000 + 4,00,000$
 = **6 Years**

BQ 34

Elite Cooker Company is evaluating three investment situations: (1) produce a new line of aluminum skillets, (2) expand its existing cooker line to include several new sizes, and (3) develop a new, higher-quality line of cookers. If only the project in question is undertaken, the expected present values and the amounts of investment required are:

<i>Project</i>	<i>Investment required</i>	<i>PV of future cash flows</i>
1	₹2,00,000	₹2,90,000
2	₹1,15,000	₹1,85,000
3	₹2,70,000	₹4,00,000

If projects 1 and 2 are jointly undertaken, there will be no economies; the investments required and present values will simply be the sum of the parts. With projects 1 and 3, economies are possible in investment because one of the machines acquired can be used in both production processes. The total investment required for projects 1 and 3 combined is ₹4,40,000. If projects 2 and 3 are undertaken, there are economies to be achieved in marketing and producing the products but not in investment. The expected present value of future cash flows for projects 2 and 3 is ₹6,20,000. If all three projects are undertaken simultaneously, the economies noted will still hold. However, a ₹1,25,000 extension on the plant will be necessary, as space is not available for all three projects.

Which project or projects should be chosen?

Answer

Statement of Cumulative NPV of Different Combinations

<i>Project</i>	<i>Investment required</i>	<i>PV of future CF</i>	<i>Net Present Value</i>
1	₹2,00,000	₹2,90,000	₹90,000
2	₹1,15,000	₹1,85,000	₹70,000
3	₹2,70,000	₹4,00,000	₹1,30,000
1 and 2	₹3,15,000	₹4,75,000	₹1,60,000
1 and 3	₹4,40,000	₹6,90,000	₹2,50,000
2 and 3	₹3,85,000	₹6,20,000	₹2,35,000
1, 2 and 3 (Refer working note)	₹6,80,000*	₹9,10,000	₹2,30,000

Calculation of total investment required if all the three projects are undertaken simultaneously:

$$\begin{aligned} \text{Total investment} &= \text{Investment in project 1\&3} + \text{Investment in project 2} + \text{Plant extension cost} \\ &= 4,40,000 + 1,15,000 + 1,25,000 = \mathbf{₹6,80,000} \end{aligned}$$

Advise: Projects 1 and 3 should be chosen, as they provide the highest net present value.

BQ 35

Following data has been available for a capital project:

Annual cost of saving	₹1,00,000
Useful life	4 years
Salvage value	zero
Internal rate of return	12%
Profitability index	1.064

You are required to calculate the following for this project:

- (a)** Cost of the project
- (b)** Cost of capital
- (c)** Net present value
- (d)** Payback period

PV factors at different rates are given below:

Discount Factor	Years			
	1	2	3	4
12%	0.893	0.797	0.712	0.636
11%	0.901	0.812	0.731	0.659
10%	0.909	0.826	0.751	0.683
9%	0.917	0.842	0.772	0.702

Answer

(a) Cost of the project:

At IRR,

$$\begin{aligned}
 \text{Present value of inflows} &= \text{Present value of outflows} \\
 \text{Present value of outflows} &= \text{Annual cost of saving} \times \text{Cumulative discount factor} \\
 &\quad \text{@ IRR 12\% for 4 years} \\
 &= ₹1,00,000 \times 3.038
 \end{aligned}$$

$$\text{Cost of project} = ₹3,03,800$$

(b) Cost of Capital:

$$\begin{aligned}
 \text{Cum DF @ cost of capital for 4 years} &= \frac{\text{Present Value of Inflows}}{\text{Annual Inflows}} = \frac{3,23,243.20}{1,00,000} \\
 &= 3.232
 \end{aligned}$$

From the discount factor table, at discount rate of 9%, the cumulative discount factor for four years is 3.233 (0.917 + 0.842 + 0.772+ 0.702)

$$\text{Hence, Cost of capital} = 9\%$$

(c) Net Present Value of cash inflows:

$$\begin{aligned}
 \text{PI} &= \frac{\text{PV of Inflows}}{\text{PV of Outflows}} \\
 1.064 &= \frac{\text{PV of Inflows}}{3,03,800} \\
 \text{PV of Inflows} &= 3,03,800 \times 1.064 = ₹3,23,243 \\
 \text{NPV} &= \text{PV of inflows} - \text{PV of outflows} \\
 &= ₹3,23,243.20 - ₹3,03,800 = ₹19,443.20
 \end{aligned}$$

(d) Payback Period:

$$\begin{aligned}
 \text{Payback period} &= \frac{\text{Initial Outflow}}{\text{Equal Annual Cash Inflows}} = \frac{3,03,800}{1,00,000} \\
 &= 3.038 \text{ years}
 \end{aligned}$$

BQ 36

Alley Pvt. Ltd. is planning to invest in a machinery that would cost ₹1,00,000 at the beginning of year 1. Net cash inflows from operations have been estimated at ₹36,000 per annum for 3 years. The company has two options for smooth functioning of the machinery: one is service, and another is replacement of parts. If the company opts to service a part of the machinery at the end of year 1 at ₹20,000, in such a case, the scrap value at the end of year 3 will be ₹25,000. However, if the company decides not to service the part, then it will have to be replaced at the end of year 2 at ₹30,800 and in this case, the machinery

will work for the 4th year also and get operational cash inflow of ₹36,000 for the 4th year. It will have to be scrapped at the end of year 4 at ₹18,000.

Assuming cost of capital at 10% and ignoring taxes, determine the purchase of this machinery based on the net present value of its cash flows? If the supplier gives a discount of ₹10,000 for purchase, what would be your decision?

The PV factors at 10% are:

<i>Year</i>	0	1	2	3	4	5	6
<i>PV Factor</i>	1	0.9091	0.8264	0.7513	0.6830	0.6209	0.5645

Answer

Option 1 (Part of the Machine is serviced):

Statement of NPV

<i>Year</i>	<i>Particulars</i>	<i>₹</i>	<i>PV Factor @ 10%</i>	<i>PV of Cash flow</i>
0	Initial Outflows	(1,00,000)	1.0000	(1,00,000)
1	Inflows – Service	36,000 – 20,000	0.9091	14,546
2	Charges	36,000	0.8264	29,750
3	Inflows	36,000 + 25,000	0.7513	45,829
	Inflows + Salvage			
NPV				(9,875)

Option 2 (Part of the Machine is replaced):

Statement of NPV

<i>Year</i>	<i>Particulars</i>	<i>₹</i>	<i>PV Factor @ 10%</i>	<i>PV of Cash flow</i>
0	Initial Outflows	(1,00,000)	1.0000	(1,00,000)
1	Inflows	36,000	0.9091	32,728
2	Inflows – Replacement	36,000 – 30,800	0.8264	4,297
3	Inflows	36,000	0.7513	27,047
4	Inflows + Salvage	36,000 + 18,000	0.6830	36,882
NPV				954

Decision: Option I has a negative NPV whereas option II has a positive NPV ₹954. Therefore, option II (replacement of part) shall be opted.

If the supplier gives a discount of ₹10,000 for purchases:

Option 1: **NPV** = (9,875) + 10,000 = **125**

Option 2: **NPV** = 954 + 10,000 = **10,954**

Decision: Option I with very small NPV is not considerable, Option II having higher NPV shall be opted (student can also show annualized NPV due to difference in life of projects).

BQ 37

A large profit making company is considering the installation of a machine to process the waste produced by one of its existing manufacturing process to be converted into a marketable product. At present, the waste is removed by a contractor for disposal on payment by the company of ₹150 lakh per



annum for the next four years. The contract can be terminated upon installation of the aforesaid machine on payment of a compensation of ₹90 lakh before the processing operation starts. This compensation is not allowed as deduction for tax purposes.

The machine required for carrying out the processing will cost ₹600 lakh. At the end of the 4th year, the machine can be sold for ₹60 lakh and the cost of dismantling and removal will be ₹45 lakh.

Sales and direct costs of the product emerging from waste processing for 4 years are estimated as under:

<i>Year</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Sales	966	966	1,254	1,254
Material consumption	90	120	255	255
Wages	225	225	255	300
Other expenses	120	135	162	210
Factory overheads	165	180	330	435
Depreciation (as per income tax rules)	150	114	84	63

Initial stock of materials required before commencement of the processing operations is ₹60 lakh at the start of year 1. The stock levels of materials to be maintained at the end of year 1, 2 and 3 will be ₹165 lakh and the stocks at the end of year 4 will be nil. The storage of materials will utilise space which would otherwise have been rented out for ₹30 lakh per annum. Labour costs include wages of 40 workers, whose transfer to this process will reduce idle time payments of ₹45 lakh in the year 1 and ₹30 lakh in the year 2. Factory overheads include apportionment of general factory overheads except to the extent of insurance charges of ₹90 lakh per annum payable on this venture. The company's tax rate is 30%.

Present value factors for four years are as under:

<i>Year</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
<i>PV Factors @14%</i>	0.877	0.769	0.674	0.592

Advise the management on the desirability of installing the machine for processing the waste. All calculations should form part of the answer.

Answer

<i>Net Present Value</i>			<i>(₹In Lakh)</i>	
<i>Year</i>	<i>Particulars</i>	<i>₹</i>	<i>DF @ 14%</i>	<i>PV</i>
0	Initial outflows (Cost of Machine + Compensation + Material stock) (600 + 90 + 60)	(750)	1.000	(750)
1	CFAT – Increase in stock (469.2 – 105)	364.2	0.877	319.40
2	CFAT	416.4	0.769	320.21
3	CFAT	453.6	0.674	305.73
4	CFAT + Decrease in stock + Net salvage (382.2 + 165 + 15)	562.2	0.592	332.82
<i>NPV</i>				<i>528.16</i>

Advice: Since the net present value of cash flows is ₹528.16 lakhs which is positive the management should install the machine for processing the waste.

Working Notes:

<i>Statement of CFAT</i>			<i>(₹In Lakh)</i>	
<i>Particulars</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Sales	966	966	1,254	1,254
Add: Saving in Contract payment	150	150	150	150

Less: Material consumption	(90)	(120)	(255)	(255)
Less: Wages (net of reduction in idle time)	(180)	(195)	(255)	(300)
Less: Other expenses	(120)	(135)	(162)	(210)
Less: Factory overheads (only insurance charges)	(90)	(90)	(90)	(90)
Less: Loss of rent (opportunity cost)	(30)	(30)	(30)	(30)
Less: Depreciation (as per income tax rules)	(150)	(114)	(84)	(63)
PBT	456	432	528	456
Less: Tax @ 30%	(136.8)	(129.6)	(158.4)	(136.8)
PAT	319.2	302.4	369.6	319.2
Add: Depreciation	150	114	84	63
CFAT	469.2	416.4	453.6	382.2

Notes:

1. Material stock increases are taken in cash flows.
2. Idle time wages have also been considered.
3. Apportioned factory overheads are not relevant only insurance charges of this project are relevant.
4. Sale of machinery - Net income after deducting removal expenses taken. Tax on Capital gains is ignored.
5. Saving in contract payment and income tax thereon is considered in the cash flows.

BQ 38

Alpha Company is considering the following investment projects:

Projects	Cash Flows (₹)			
	C₀	C₁	C₂	C₃
A	-10,000	+10,000		
B	-10,000	+7,500	+7,500	
C	-10,000	+2,000	+4,000	+12,000
D	-10,000	+10,000	+3,000	+3,000

- (a) Rank the projects according to each of the following methods: (i) Payback, (ii) ARR, (iii) IRR and (iv) NPV, assuming discount rates of 10 and 30 per cent.
- (b) Assuming the projects are independent, which one should be accepted? If the projects are mutually exclusive, which project is the best?

Answer

(a) **Calculation of Payback, ARR, IRR and NPV:**

(i) **Payback Period:**

Project A	=	$10,000 \div 10,000$	=	1 year
Project B	=	$7,500 + 2,500 \div 7,500$	=	1.33 years
Project C	=	$2,000 + 4,000 + 4,000 \div 12,000$	=	2.33 years
Project D	=	$10,000 \div 10,000$	=	1 year

(ii) **ARR using average investment base:**

Project A	=	$\frac{(10,000 - 10,000)}{10,000 \times \frac{1}{2}} \times 100$	=	0%
Project B	=	$\frac{(15,000 - 10,000) \div 2}{10,000 \times \frac{1}{2}} \times 100$	=	50%



$$\begin{aligned} \text{Project C} &= \frac{(18,000 - 10,000) \div 3}{10,000 \times \frac{1}{2}} \times 100 = 53.33\% \\ \text{Project D} &= \frac{(16,000 - 10,000) \div 3}{10,000 \times \frac{1}{2}} \times 100 = 40\% \end{aligned}$$

Note: Average book profit is found by deducting initial investment, otherwise student may deduct depreciation year wise.

(iii) IRR:

Project A (The net cash proceeds in year 1 are just equal to investment):

$$\text{IRR} = 0\%$$

Project B (Uniform cash inflow, so we can calculate IRR by PVAF):

$$\begin{aligned} \text{PVAF for 2 years} &= 10,000 \div 7,500 = 1.33 \text{ (This factor is found under 32\%)} \\ \text{IRR} &= 32\% \end{aligned}$$

Project C (Unequal cash inflow, so we can calculate IRR by computing NPV using random rates):

$$\text{NPV at 20\%} = 2,000 \times 0.833 + 4,000 \times 0.694 + 12,000 \times 0.579 - 10,000 = +1,390$$

$$\text{NPV at 30\%} = 2,000 \times 0.769 + 4,000 \times 0.592 + 12,000 \times 0.455 - 10,000 = -634$$

$$\begin{aligned} \text{IRR} &= L + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times (H - L) = 20\% + \frac{1,390}{1,390 - (-634)} \times (30\% - 20\%) \\ &= 26.87\% \end{aligned}$$

Project D (Unequal cash inflow, so we can calculate IRR by computing NPV using random rates):

$$\begin{aligned} \text{NPV at 30\%} &= 10,000 \times 0.769 + 3,000 \times 0.592 + 3,000 \times 0.455 - 10,000 \\ &= +831 \end{aligned}$$

$$\begin{aligned} \text{NPV at 40\%} &= 10,000 \times 0.714 + 3,000 \times 0.510 + 3,000 \times 0.364 - 10,000 \\ &= -238 \end{aligned}$$

$$\begin{aligned} \text{IRR} &= L + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times (H - L) = 30\% + \frac{831}{831 - (-238)} \times (40\% - 30\%) \\ &= 37.77\% \end{aligned}$$

(iv) NPV:

Project A:

$$\text{NPV at 10\%} = 10,000 \times 0.909 - 10,000 = -910$$

$$\text{NPV at 30\%} = 10,000 \times 0.769 = -2,310$$

Project B:

$$\text{NPV at 10\%} = 7,500 \times (0.909 + 0.826) - 10,000 = +3,013$$

$$\text{NPV at 30\%} = 7,500 \times (0.769 + 0.592) - 10,000 = +208$$

Project C:

$$\text{NPV at 10\%} = 2,000 \times 0.909 + 4,000 \times 0.826 + 12,000 \times 0.751 - 10,000$$

$$\begin{aligned}
 &= +4,134 \\
 \text{NPV at 30\%} &= 2,000 \times 0.769 + 4,000 \times 0.592 + 12,000 \times 0.455 - 10,000 \\
 &= -633
 \end{aligned}$$

Project D:

$$\begin{aligned}
 \text{NPV at 10\%} &= 10,000 \times 0.909 + 3,000 \times (0.826 + 0.751) - 10,000 = +3,821 \\
 \text{NPV at 30\%} &= 10,000 \times 0.769 + 3,000 \times (0.592 + 0.455) - 10,000 = +831
 \end{aligned}$$

The projects are ranked as follows according to the various methods:

<i>Projects</i>	<i>Ranks</i>				
	<i>PBP</i>	<i>ARR</i>	<i>IRR</i>	<i>NPV 10%</i>	<i>NPV 30%</i>
A	1	4	4	4	4
B	2	2	2	3	2
C	3	1	3	1	3
D	1	3	1	2	1

(b) Payback and ARR are theoretically unsound method for choosing between the investment projects. Between the two time-adjusted (DCF) investment criteria, NPV and IRR, NPV gives consistent results. If the projects are independent (and there is no capital rationing), either IRR or NPV can be used since the same set of projects will be accepted by any of the methods. In the present case, except Project A all the three projects should be accepted if the discount rate is 10%. Only Projects B and D should be undertaken if the discount rate is 30%.

If it is assumed that the projects are mutually exclusive, then under the assumption of 30% discount rate, the choice is between B and D (A and C are unprofitable). Both criteria IRR and NPV give the same results – D is the best. Under the assumption of 10% discount rate, ranking according to IRR and NPV conflict (except for Project A). If the IRR rule is followed, Project D should be accepted. But the NPV rule tells that Project C is the best. The NPV rule generally gives consistent results in conformity with the wealth maximization principle. Therefore, Project C should be accepted following the NPV rule.

BQ 39

The expected cash flows of three projects are given below. The cost of capital is 10 per cent.

- (a)** Calculate the payback period, net present value, internal rate of return and accounting rate of return using average investment base of each project.
- (b)** Show the rankings of the projects by each of the four methods.

<i>Period</i>	<i>Project A (₹)</i>	<i>Project B (₹)</i>	<i>Project C (₹)</i>
0	(5,000)	(5,000)	(5,000)
1	900	700	2,000
2	900	800	2,000
3	900	900	2,000
4	900	1,000	1,000
5	900	1,100	-
6	900	1,200	-
7	900	1,300	-
8	900	1,400	-
9	900	1,500	-



10	900	1,600	-
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Answer

(a) Calculation of Payback, NPV, IRR and ARR:

Payback Period:

$$\text{Project A} = 5,000 \div 900 = 5.56 \text{ years}$$

$$\text{Project B} = 700 + 800 + 900 + 1,000 + 1,100 + 500 \div 1,200 = 5.42 \text{ years}$$

$$\text{Project C} = 2,000 + 2,000 + 1,000 \div 2,000 = 2.50 \text{ years}$$

NPV:

Project A:

$$\text{NPV at 10\%} = 900 \times 6.145 - 5,000 = 530.50$$

Project B:

$$\begin{aligned} \text{NPV at 10\%} &= 700 \times 0.909 + 800 \times 0.826 + 900 \times 0.751 + 1,000 \times 0.683 + 1,100 \times 0.621 \\ &+ 1,200 \times 0.564 + 1,300 \times 0.513 + 1,400 \times 0.467 + 1,500 \times 0.424 + 1,600 \times 0.386 - 5,000 \\ &= 1,590.20 \end{aligned}$$

Project C:

$$\begin{aligned} \text{NPV at 10\%} &= 2,000 \times 0.909 + 2,000 \times 0.826 + 2,000 \times 0.751 + 1,000 \times 0.683 - 5,000 \\ &= 655 \end{aligned}$$

IRR:

Project A (Uniform cash inflow, so we can calculate IRR by PVAF):

$$\begin{aligned} \text{PVAF}_{10 \text{ years}} &= 5,000 \div 900 = 5.55 \\ &\text{(This factor is found between 12\% and 13\%)} \end{aligned}$$

$$\text{NPV at 12\%} = 900 \times 5.650 - 5,000 = 85.00$$

$$\text{NPV at 13\%} = 900 \times 5.426 - 5,000 = (116.60)$$

$$\begin{aligned} \text{IRR} &= L + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times (H - L) = 12\% + \frac{85}{85 + 116.60} (13\% - 12\%) \\ &= 12.42\% \end{aligned}$$

Project B (Unequal cash inflow, so we can calculate IRR by computing NPV using random rates):

$$\text{NPV at 10\%} = 1,590.20$$

$$\begin{aligned} \text{NPV at 20\%} &= 700 \times 0.833 + 800 \times 0.694 + 900 \times 0.579 + 1,000 \times 0.482 + 1,100 \times 0.402 \\ &+ 1,200 \times 0.335 + 1,300 \times 0.279 + 1,400 \times 0.233 + 1,500 \times 0.194 + 1,600 \times 0.162 - 5,000 \\ &= (775.30) \end{aligned}$$

$$\begin{aligned} \text{IRR} &= L + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times (H - L) = 10\% + \frac{1,590.20}{1,590.20 + 775.30} (20\% - 10\%) \\ &= 16.72\% \end{aligned}$$

Project C (Unequal cash inflow, so we can calculate IRR by computing NPV using random rates):

$$\begin{aligned} \text{NPV at 15\%} &= 2,000 \times 0.870 + 2,000 \times 0.756 + 2,000 \times 0.658 + 1,000 \times 0.572 - 5,000 \\ &= \mathbf{140} \end{aligned}$$

$$\begin{aligned} \text{NPV at 18\%} &= 2,000 \times 0.847 + 2,000 \times 0.718 + 2,000 \times 0.609 + 1,000 \times 0.516 - 5,000 \\ &= \mathbf{(136)} \end{aligned}$$

$$\begin{aligned} \text{IRR} &= L + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times (H - L) \\ &= 15\% + \frac{140}{140 + 136} (18\% - 15\%) \\ &= \mathbf{16.52\%} \end{aligned}$$

ARR using average investment base:

$$\text{ARR} = \frac{\text{Average Profit}}{\text{Average investment}} \times 100$$

$$\text{Project A} = \frac{400}{5,000 \times 1/2} \times 100 = \mathbf{16\%}$$

$$\text{Project B} = \frac{650}{5,000 \times 1/2} \times 100 = \mathbf{26\%}$$

$$\text{Project C} = \frac{500}{5,000 \times 1/2} \times 100 = \mathbf{20\%}$$

Working Note:

$$\text{Average Profit} = \frac{\text{Total Cash Inflow} - \text{Initial Investment}}{\text{Life}}$$

$$\text{Project A} = \frac{9,000 - 5,000}{10 \text{ Years}} = \mathbf{400 \text{ per annum}}$$

$$\text{Project B} = \frac{11,500 - 5,000}{10 \text{ Years}} = \mathbf{650 \text{ per annum}}$$

$$\text{Project A} = \frac{7,000 - 5,000}{4 \text{ Years}} = \mathbf{500 \text{ per annum}}$$

Note: Average book profit is found by deducting initial investment, otherwise student may deduct depreciation year wise.

(b) The projects are ranked as follows according to the various methods:

Projects	PBP (Years)	ARR (%)	IRR (%)	NPV (₹)	PBP	ARR	IRR	NPV
A	5.56	16	12.42	530.50	3	3	3	3
B	5.42	26	16.72	1,590.20	2	1	1	1
C	2.50	20	16.52	655	1	2	2	2

BQ 40



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

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

Identify which project should R plc accept?

Answer

Although from NPV point of view Project A appears to be better but from IRR point of view Project B appears to be better. Since, both projects have unequal lives selection on the basis of these two methods shall not be proper. In such situation we shall use Equivalent Annualized Criterion:

<i>Year</i>	<i>Project A</i>	<i>Project B</i>
NPV @ 12%	₹6,49,094	5,15,488
÷ PVAF @ 12%	÷ 4.112	÷ 2.402
Equivalent Annualized Criterion	₹1,57,854	₹2,14,608

Thus, Project B should be selected.

PAST YEAR QUESTIONS

PYQ 1

FH Hospital is considering to purchase a CT- Scan machine. Presently the hospital is outsourcing the CT- Scan Machine and is earning commission of 15,000 per month (net of tax). The following details are given regarding the machine:

Cost of CT-Scan machine	₹15,00,000
Operating cost per annum (excluding depreciation)	₹2,25,000
Expected revenue per annum	₹7,90,000
Salvage value of machine (after 5 years)	₹3,00,000
Expected life of machine	5 years

Assuming tax rate @ 30%, whether it would be profitable for the hospital to purchase the machine?

Give your recommendation under:

- (i) Net Present Value Method, and
(ii) Profitability Index Method.

PV factors at 12% are given below:

Year	1	2	3	4	5
PV factor	0.893	0.797	0.712	0.636	0.567

[(8 Marks) May 2014]

Answer

(i) Net Present Value

Year	Particulars	₹	DF @ 12%	PV
0	Cost of CT-Scan machine	(15,00,000)	1.000	(15,00,000)
1 - 5	Cash Flow After Tax	2,87,500	3.605	10,36,438
5	Salvage at the end	3,00,000	0.567	1,70,100
NPV				(2,93,462)

Recommendation: CT-Scan machine should not be purchased having negative NPV.

(ii) Calculation of Profitability Index:

$$\text{Profitability Index} = \frac{\text{PV of Inflows}}{\text{PV of Outflows}} = \frac{12,06,538}{15,00,000} = 0.804$$

Recommendation: Since PI is less than 1, CT-Scan machine should not be purchased.

Working Notes:

Calculation of Incremental CFAT:

Particulars	₹
Expected revenue per annum	7,90,000
Less: Operating cost per annum (excluding depreciation)	(2,25,000)
Less: Depreciation (15,00,000 - 3,00,000) ÷ 5 years	(2,40,000)

	PBT	3,25,000
Less: Tax @ 30%		(97,500)
	PAT	2,27,500
Less: Loss of commission income per annum (15,000 × 12)		(1,80,000)
Add: Depreciation		2,40,000
	CFAT	2,87,500

PYQ 2

Given below are the data on a capital project 'M':

Annual cash inflow	₹60,000
Useful life	4 years
Salvage value	zero
Internal rate of return	15%
Profitability index	1.064

Table of discount factor:

Discount Factor	Years			
	1	2	3	4
15%	0.870	0.756	0.658	0.572
14%	0.877	0.769	0.675	0.592
13%	0.886	0.783	0.693	0.614
12%	0.893	0.797	0.712	0.636

You are required to calculate:

- (i) Cost of the project
- (ii) Payback period
- (iii) Cost of capital
- (iv) Net present value of cash inflow

[(8 Marks) May 2015]

Answer

(a) **Cost of the project:**

At IRR,

Present value of inflows	=	Present value of outflows
Present value of outflows	=	Annual cost of saving × Cumulative discount factor @ IRR for 4 years
	=	₹60,000 × 2.855
Cost of project	=	₹1,71,300

(b) **Payback Period:**

Payback period	=	$\frac{\text{Initial Outflow}}{\text{Equal Annual Cash Inflows}}$	=	$\frac{1,71,000}{60,000}$
	=	2.855 years		

(c) **Cost of Capital:**

Cum DF @ cost of capital for 4 years	=	$\frac{\text{Present Value of Inflows}}{\text{Annual Inflows}}$	=	$\frac{1,82,263.20}{60,000}$
	=	3.038		

From the discount factor table, at discount rate of 12%, the cumulative discount factor for four years is 3.038 (0.893 + 0.797 + 0.712 + 0.636)

Hence, Cost of capital = **12%**

(d) Net Present Value of cash inflows:

$$\begin{aligned}
 \text{PI} &= \frac{\text{PV of Inflows}}{\text{PV of Outflows}} \\
 1.064 &= \frac{\text{PV of Inflows}}{1,71,300} \\
 \text{PV of Inflows} &= 1,71,300 \times 1.064 = \mathbf{₹1,82,263.2} \\
 \text{NPV} &= \text{PV of inflows} - \text{PV of outflows} \\
 &= ₹1,82,263.20 - ₹1,71,300 = \mathbf{₹10,963.20}
 \end{aligned}$$

PYQ 3

Domestic services (P) Ltd. is in the business of providing cleaning sewerage line services at homes. There is a proposal before the company to purchase a mechanised sewerage cleaning system for a sum of ₹20 lakhs. The present system of the company is to use manual labour for the job.

You are provided with the following information:

Proposed Mechanised System:

Cost of machine	₹20 lakhs
Life of machine	10 years
Depreciation (on straight line basis)	10%
Cash Operating cost of mechanised system	₹5 lakhs per annum

Present System (manual):

Manual labour	200 persons
Cost of manual labour	₹10,000 per person per annum

The company has after tax cost of fund at 10% per annum. The applicable tax rate is 30%.

PV factor for 10 years at 10% are as given below:

Years	1	2	3	4	5	6	7	8	9	10
PV factor	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386

You are required to find out whether it is advisable to purchase he machine. Give your recommendation with workings.

[(8 Marks) June 2015]

Answer

Net Present Value

Year	Particulars	₹	DF @ 10%	PV
0	Cost of Machine	(20,00,000)	1.000	(20,00,000)
1 - 10	Incremental CFAT	11,10,000	6.144	68,19,840
NPV				48,19,840



Recommendation: Company should purchase the machine having positive NPV.

Working Notes:

Calculation of Incremental CFAT:

<i>Particulars</i>	<i>₹</i>
Saving in labour cost (200 persons @ ₹10,000 p.a.)	20,00,000
Less: Cash Operating cost of mechanized system p.a.	(5,00,000)
Less: Depareciation	(2,00,000)
PBT	13,00,000
Less: Tax @ 30%	(3,90,000)
PAT	9,10,000
Add: Depreciation (20,00,000 ÷ 10 years)	2,00,000
CFAT	11,10,000

PYQ 4

Given below are the data on a capital project 'C':

Cost of the project	₹2,28,400
Useful life	4 years
Salvage value	zero
Internal rate of return	15%
Profitability index	1.0417

You are required to calculate:

- (a) Annual cash flow
- (b) Cost of capital
- (c) Net present value (NPV)
- (d) Discounted Payback period

Table of discount factor:

<i>Discount Factor</i>	<i>Years</i>			
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
15%	0.869	0.756	0.658	0.572
14%	0.877	0.769	0.675	0.592
13%	0.885	0.783	0.693	0.613
12%	0.893	0.797	0.712	0.636

[(8 Marks) May 2016]

Answer

(a) Annual cash flow:

At IRR,
 Present value of inflows = Present value of outflows
 Present value of outflows = Annual cash inflow × Cumulative discount factor @ IRR for 4 years
 2,28,400 = Annual cash inflow × 2.855
 Annual cash Inflow = **₹80,000**

(b) Cost of Capital:

$$\begin{aligned}
 \text{Present value of inflows} &= \text{Annual cash inflow} \times \text{Cumulative discount factor @ Cost of Capital for 4 years} \\
 \text{Cost of project + NPV} &= 80,000 \times \text{Cumulative discount factor @ Cost of Capital for 4 years} \\
 2,28,400 + 9,524 &= 80,000 \times \text{PVIFA}_4 \\
 \text{PVIFA 4 years} &= 2.974 \\
 \text{Cost of capital} &= \mathbf{13\%}
 \end{aligned}$$

Alternatively

$$\begin{aligned}
 \text{Cum DF @ cost of capital}_{4 \text{ years}} &= \frac{\text{Present Value of Inflows}}{\text{Annual Inflows}} = \frac{2,37,924}{80,000} \\
 &= 2.974 \\
 \text{Cost of capital} &= \mathbf{13\%}
 \end{aligned}$$

From the discount factor table, at discount rate of 13%, the cumulative discount factor for four years is 2.974 (0.885 + 0.783 + 0.693 + 0.613)

(c) Net Present Value (NPV):

$$\text{NPV} = \text{Cost of project} \times (\text{PI} - 1) = 2,28,400 \times (1.0417 - 1) = \mathbf{₹9,524}$$

(d) Discounted Payback Period:

$$\begin{aligned}
 \text{Discounted Payback Period} &= \text{LLY} + \frac{\text{Initial Outflows} - \text{Cumulative PV upto LLY}}{\text{PV of inflows of ULY}} \\
 &= 3 \text{ years} + \frac{2,28,400 - 1,88,880}{49,040} = \mathbf{3.806 \text{ years}}
 \end{aligned}$$

Working notes:

Calculation of PV of cash inflow cumulative PV of cash inflow:

Years	PV of cash inflow	Cumulative PV of cash inflow
1	80,000 × 0.885 = 70,800	70,800
2	80,000 × 0.783 = 62,640	1,33,440
3	80,000 × 0.693 = 55,440	1,88,880
4	80,000 × 0.613 = 49,040	2,37,920

PYQ 5

X Limited is considering to purchase of new plant worth ₹80,00,000. The rate of cost of capital is 10%. You are required to calculate:

- (a) Pay-back period
- (b) Net present value at 10 discount factor
- (c) Profitability index at 10 discount factor
- (d) Internal rate of return with the help of 10% and 15% discount factor.

The expected net cash flows after taxes and before depreciation and present value table are as follows:

<i>Year</i>	<i>Net Cash Flow (₹)</i>	<i>Present value of 1 at 10% discount rate</i>	<i>Present value of 1 at 15% discount rate</i>
1	14,00,000	.909	.870
2	14,00,000	.826	.756
3	14,00,000	.751	.658
4	14,00,000	.683	.572
5	14,00,000	.621	.497
6	16,00,000	.564	.432
7	20,00,000	.513	.376
8	30,00,000	.467	.327
9	20,00,000	.424	.284
10	8,00,000	.386	.247

[(8 Marks) May 2017]

Answer

(a) Payback period:

$$\text{Payback period} = \frac{14,00,000 + 14,00,000 + 14,00,000 + 14,00,000 + 14,00,000 + 10,00,000}{16,00,000} = 5.625 \text{ Years}$$

(b) Calculation of NPV

<i>Years</i>	<i>Cash Inflow</i>	<i>PVIF @ 10%</i>	<i>Present value</i>
0	80,00,000	1.000	(80,00,000)
1	14,00,000	.909	12,72,600
2	14,00,000	.826	11,56,400
3	14,00,000	.751	10,51,400
4	14,00,000	.683	9,56,200
5	14,00,000	.621	8,69,400
6	16,00,000	.564	9,02,400
7	20,00,000	.513	10,26,000
8	30,00,000	.467	14,01,000
9	20,00,000	.424	8,48,000
10	8,00,000	.386	3,08,800
NPV			17,92,200

(c) Calculation of PI:

$$\text{Profitability index} = \frac{\text{PV of Inflow}}{\text{PV of Outflow}} = \frac{97,92,200}{80,00,000} = 1.224$$

(d) Calculation of IRR:

$$\text{NPV at 10\%} = 17,92,200$$

$$\begin{aligned} \text{NPV at 15\%} &= 14,00,000 \times 3.353 + 16,00,000 \times .432 + 20,00,000 \times .376 + \\ & 30,00,000 \times .327 + 20,00,000 \times .284 + 8,00,000 \times .247 - 80,00,000 \\ &= -1,16,000 \end{aligned}$$

$$\begin{aligned} \text{IRR} &= L + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times H - L = 10\% + \frac{17,92,200}{17,92,200 - (-1,16,000)} \times 5\% \\ &= 14.70\% \end{aligned}$$

PYQ 6

A firm can make investment in either of the following projects. The firm anticipates its cost of capital to be 10%. Pre-tax cash flows of the projects for five years are as follows:

<i>Year</i>	<i>0</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
Project A (₹)	(2,00,000)	35,000	80,000	90,000	75,000	20,000
Project B (₹)	(2,00,000)	2,18,000	10,000	10,000	4,000	3,000

Ignore taxation. An amount of ₹35,000 will be spent on account of sales promotion in year 3 in case of project A. this has not been taken into account in pre-tax cash inflows.

The discount factors are as under:

<i>Year</i>	<i>0</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
PVF at 10%	1	0.91	0.83	0.75	0.68	0.62

You are required to calculate for each project:

- (a)** The payback period
- (b)** The discounted payback period
- (c)** Desirability factor
- (d)** Net present value

[(8 Marks) Nov 2017]

Answer

(a) Payback period:

$$\text{Payback period A} = 35,000 + 80,000 + 55,000 + 30,000 / 75,000 = \mathbf{3.4 \text{ Years}}$$

$$\text{Payback period B} = 2,00,000 / 2,18,000 = \mathbf{0.92 \text{ Years}}$$

Calculation of Present Value of pre-tax cash inflows:

<i>Years</i>	<i>Cash Inflow A</i>	<i>Cash Inflow B</i>	<i>PVIF @ 10%</i>	<i>Present value A</i>	<i>Present value B</i>
1	35,000	2,18,000	.91	31,850	1,98,380
2	80,000	10,000	.83	66,400	8,300
3	55,000	10,000	.75	41,250	7,500
4	75,000	4,000	.68	51,000	2,720
5	20,000	3,000	.62	12,400	1,860
Total				2,02,900	2,18,760

(b) Discounted payback period:

$$\text{Discounted payback A} = 31,850 + 66,400 + 41,250 + 51,000 + 9,500 / 12,400 = \mathbf{4.77 \text{ Years}}$$

$$\text{Discounted payback B} = 1,98,380 + 1,620 / 8,300 = \mathbf{1.2 \text{ Years}}$$

(c) Desirability factor:

$$\text{Desirability factor} = \text{PV of Inflow} \div \text{PV of Outflow}$$

$$\text{Project A} = 2,02,900 \div 2,00,000 = \mathbf{1.0145}$$

$$\text{Project B} = 2,18,760 \div 2,00,000 = \mathbf{1.0938}$$



(d) NPV:

NPV	=	PV of Inflow - PV of Outflow		
Project A	=	2,02,900 - 2,00,000	=	2,900
Project B	=	2,18,760 - 2,00,000	=	18,760

PYQ 7

A proposal to invest in a project, which has a useful life of 5 years and no salvage value at the end of useful life, is under consideration of a firm. It is anticipated that the project will generate a steady cash inflow of ₹70,000 per annum. After analyzing other facts of the project, the following information were revealed:

Internal rate of return	13%
Profitability index	1.07762

Table of discount factor:

Discount Factor	Years					Total
	1	2	3	4	5	
10%	0.909	0.826	0.751	0.683	0.621	3.790
11%	0.901	0.812	0.731	0.659	0.593	3.696
12%	0.893	0.797	0.712	0.636	0.567	3.605
13%	0.885	0.783	0.693	0.613	0.543	3.517

You are required to calculate:

- (1)** Cost of the project
- (2)** Payback period
- (3)** Net present value
- (4)** Cost of capital

[(8 Marks) May 2018]

Answer

(1) Cost of the project:

At IRR,

Present value of inflows	=	Present value of outflows		
Present value of outflows	=	Annual cash inflows × Cumulative discount factor @ IRR for 5 years	=	
	=	₹70,000 × 3.517	=	
Cost of the project	=	₹2,46,190	=	

(2) Payback Period:

Payback period	=	$\frac{\text{Initial Outflow}}{\text{Annual Cash Inflow}}$	=	$\frac{2,46,190}{70,000}$
	=	3.517 years	=	

(3) Net Present Value:

PI	=	$\frac{\text{PV of Inflows}}{\text{PV of Outflows}}$	=	$\frac{\text{PV of Inflow}}{2,46,190}$
PV of Inflows	=	2,46,190 × 1.07762	=	₹2,65,299
NPV	=	PV of inflows – PV of outflows	=	

$$= ₹2,65,299 - ₹2,46,190 = ₹19,109$$

(4) Cost of Capital:

$$\begin{aligned} \text{Cum DF @ cost of capital for 5 years} &= \frac{\text{Present Value of Inflows}}{\text{Annual Inflows}} = \frac{2,65,299}{70,000} \\ &= 3.790 \\ \text{Cost of capital} &= 10\% \text{ (Given in table)} \end{aligned}$$

PYQ 8

PD Ltd. an existing company is planning to introduce a new product with projected life of 8 years. Project cost will be ₹2,40,00,000. At the end of 8 years no residual value will be realized. Working capital of ₹30,00,000 will be needed. The 100% capacity of the project is 2,00,000 units p.a. but the production and sales volume are expected as under:

<i>Year</i>	<i>Units</i>
1	60,000
2	80,000
3-5	1,40,000
6-8	1,20,000

Other information:

1. Selling price per unit ₹200.
2. Variable cost is 40% of sales.
3. Fixed cost p.a. ₹30,00,000.
4. In addition to these advertisement expenditure will have to be incurred as under:

<i>Year</i>	<i>(₹ in lacs)</i>
1	50
2	25
3-5	10
6-8	5

5. Income tax is 25%.
6. Straight line method of depreciation is permissible for tax purpose.
7. Cost of capital is 10%.
8. Assume that loss cannot be carried forward.

Present value table

<i>Year</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
PVF@10%	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467

Advise about the project acceptability.

[(10 Marks) Nov 2018]

Answer

Net Present Value

<i>Year</i>	<i>Particulars</i>	<i>₹</i>	<i>DF @ 10%</i>	<i>PV</i>
0	Initial outflows (2,40,00,000 + 30,00,000)	(2,70,00,000)	1.000	(2,70,00,000)
1	CFAT	(8,00,000)	0.909	(7,27,200)
2	CFAT	38,25,000	0.826	31,59,450
3 - 5	CFAT	1,03,50,000	2.055	2,12,69,250
6 - 8	CFAT	89,25,000	1.544	1,37,80,200

8	Working Capital	30,00,000	0.467	14,01,000
NPV				1,18,82,700

Company should accept the proposal having positive NPV of the project.

Working Notes:

1. Depreciation: = $\frac{\text{Original Cost less Salvage}}{\text{Life of Equipment}}$ = $\frac{2,40,00,000}{8 \text{ Years}}$ = **30,00,000**

2. Statement showing CFAT:

Particulars	1	2	3 - 5	6 - 8
Units sold	60,000	80,000	1,40,000	1,20,000
Sales @ ₹200 p.u.	1,20,00,000	1,60,00,000	2,80,00,000	2,40,00,000
Less: VC @ 40%	48,00,000	64,00,000	1,12,00,000	96,00,000
Contribution	72,00,000	96,00,000	1,68,00,000	1,44,00,000
Less: Advertisement expenses	(50,00,000)	(25,00,000)	(10,00,000)	(5,00,000)
Less: Cash fixed cost	(30,00,000)	(30,00,000)	(30,00,000)	(30,00,000)
Less: Depreciation	(30,00,000)	(30,00,000)	(30,00,000)	(30,00,000)
PBT	(38,00,000)	11,00,000	98,00,000	79,00,000
Less: Tax @ 25%	-	(2,75,000)	(24,50,000)	(19,75,000)
PAT	(38,00,000)	8,25,000	73,50,000	59,25,000
Add: Depreciation	30,00,000	30,00,000	30,00,000	30,00,000
CFAT	(8,00,000)	38,25,000	1,03,50,000	89,25,000

PYQ 9

AT Limited is considering three projects A, B and C. the cash flows associated with the projects are given below:

Projects	C₀	C₁	C₂	C₃	C₄
A	(10,000)	2,000	2,000	6,000	0
B	(2,000)	0	2,000	4,000	6,000
C	(10,000)	2,000	2,000	6,000	10,000

You are required to:

- (a) Calculate the payback period of each of the three projects.
- (b) If the cut-off period is two years, then which projects should be accepted?
- (c) Projects with positive NPV's if the opportunity cost of capital is 10 percent.
- (d) "Payback gives too much weight to cash flows that occur after the cut-off date". True or false?
- (e) "If a firm used a single cut-off period for all projects, it is likely to accept too many short lived projects." True or false?

Present value table

Year	0	1	2	3	4	5
PVF@10%	1.000	0.909	0.826	0.751	0.683	0.621

[(10 Marks) May 2019]

Answer

(a) Calculation of Cumulative Cash Flows:

Years	Project A		Project B		Projects C	
	Cash Flow	Cum. CF	Cash Flow	Cum. CF	Cash Flow	Cum. CF
1	2,000	2,000	0	0	2,000	2,000

2	2,000	4,000	2,000	2,000	2,000	4,000
3	6,000	10,000	4,000	6,000	6,000	10,000
4	-	-	6,000	12,000	10,000	20,000

Payback Period:

Project A = **3 Years**
 Project B = **2 Years**
 Project C = **3 Years**

(b) If cut-off period is two years then company should accept **projects B**.

(c) NPV:

NPV = Present value of Inflow – Present value of outflow

Project A = $2,000 \times 0.909 + 2,000 \times 0.826 + 6,000 \times 0.751 - 10,000 = \mathbf{(2,024)}$

Project B = $0 \times 0.909 + 2,000 \times 0.826 + 4,000 \times 0.751 + 6,000 \times 0.683 - 2,000$
 = **6,754**

Project C = $2,000 \times 0.909 + 2,000 \times 0.826 + 6,000 \times 0.751 + 10,000 \times 0.683 - 10,000$
 = **4,806**

Project B and C have positive NPV.

(d) **False:** Payback only considers cash flows from the initiation of the project till it's payback period is being reached, and ignores cash flows after the payback period.

(e) **True:** When a firm use a single cut-off period for all projects, it is likely to accept too many short lived projects having payback period within such cut-off date. Long term projects take time to reach at payback, in case of single cut-off date these long term projects are ignored. Thus, payback is biased towards short-term projects.

PYQ 10

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

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

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

- (a) The projects are independent of each other and are divisible.
- (b) The projects are not divisible.

[(5 Marks) Nov 2019]

Answer

(a) Statement of Rank and Selection of Projects (Divisible Situation)

Projects	PI (1+ NPV/Investment)	Rank	Project Cost	Project (%)	Investment
C	$1 + 20,000/40,000 = 1.50$	1	₹40,000	100%	₹40,000
D	$1 + 35,000/1,00,000 = 1.35$	3	₹1,00,000	10%	₹10,000

E	$1 + 24,000/50,000 = 1.48$	2	₹50,000	100%	₹50,000
F	$1 + 18,000/60,000 = 1.30$	4	₹60,000	-	-
Total Investment					₹1,00,000

Optimum investment: 100% of C, E and 1/10 of D.

(b) Statement of Possible Combinations and Combined NPV (Indivisible Situation)

Possible Combinations	Combined Investment	Combined NPV
C + E	₹90,000	₹44,000
C + F	₹1,00,000	₹38,000
D	₹1,00,000	₹35,000

Invest in combination of C and E having highest combined NPV and invest remaining ₹10,000 elsewhere.

PYQ 11

CK Ltd. is planning to buy a new machine. Details of which are as follows:

Cost of the machine at the commencement	₹2,50,000
Economic life of the machine	8 years
Residual value	Nil
Annual production capacity of the machine	1,00,000 units
Estimated selling price per unit	₹6
Estimated variable cost per unit	₹3
Estimated annual fixed cost (Excluding depreciation)	₹1,00,000
Advertisement expenses in 1 st year in addition of fixed cost	₹20,000
Maintenance expenses in 5 th year in addition of fixed cost	₹30,000
Cost of capital	12%
Ignore tax.	

Analyse the above mentioned proposal using the Net Present Value method and advice.

The PV factors at 12% are:

Year	1	2	3	4	5	6	7	8
PV Factor	.893	.797	.712	.636	.567	.507	.452	.404

[(5 Marks) Nov 2020]

Answer

Statement of NPV

Year	Particulars	₹	DF @ 12%	PV
0	Initial outflows	(2,50,000)	1.000	(2,50,000)
1	Cash inflow	1,80,000	0.893	1,60,740
2 - 4	Cash inflow	2,00,000	2.145	4,29,000
5	Cash inflow	1,70,000	0.567	96,390
6 - 8	Cash inflow	2,00,000	1.363	2,72,600
NPV				7,08,730

Working Note:

(a) Calculation of Annual Cash Inflow

Particulars	1	2 - 4	5	6 - 8
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Sales value @ ₹6 per unit of 1,00,000 units	6,00,000	6,00,000	6,00,000	6,00,000
Less: Variable costs @ ₹3 per unit	3,00,000	3,00,000	3,00,000	3,00,000
Less: Annual cash fixed cost				
Less: Advertisement expenses	1,00,000	1,00,000	1,00,000	1,00,000
Less: Maintenance expenses	20,000	-	-	-
Cash Inflow	-	-	30,000	-
	1,80,000	2,00,000	1,70,000	2,00,000

Advise: CK limited should buy machine having positive NPV.

PYQ 12

A company wants to buy a machine, and two different models namely A and B are available. Following further particulars are available:

Particulars	Machine A	Machine B
Original Cost (₹)	8,00,000	6,00,000
Estimated life in years	4	4
Salvage value (₹)	0	0

The company provides depreciation under straight line method. Income tax rate applicable is 30%. The present value of ₹1 at 12% discounting factor and net profit before depreciation and tax are as under:

Year	Net Profit before Depreciation and Tax		PV Factor
	Machine A	Machine B	
1	2,30,000	1,75,000	0.893
2	2,40,000	2,60,000	0.797
3	2,20,000	3,20,000	0.712
4	5,60,000	1,50,000	0.636

Calculate:

- (1) NPV (Net Present Value)
- (2) Discounted Pay- back Period
- (3) PI (Profitability Index)

[(10 Marks) Jan 2021]

Answer

(1) **NPV** = PV of Inflows – PV of Outflows

Machine A = 8,18,909 – 8,00,000 = **18,909**

Machine B = 6,17,425 – 6,00,000 = **17,425**

(2) **Discounted pay-back Period**

Machine A = 3 years + (8,00,000 – 5,31,437)/2,87,472 = **3.93 years**

Machine B = 3 years + (6,00,000 – 5,22,025)/95,400 = **3.82 years**

(3) **PI** = PV of Inflows ÷ PV of Outflows

Machine A = 8,18,909 ÷ 8,00,000 = **1.023**

Machine B = 6,17,425 ÷ 6,00,000 = **1.029**



Suggestion: As per NPV method Machine A is more beneficial and as per Discounted pay-back period method and PI method Machine B is more beneficial.

Working Notes:

1. Statement showing Present Value of CFAT and cumulative PV of CFAT of Machine A:

<i>Particulars</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Net Profit before Depreciation and Tax	2,30,000	2,40,000	2,20,000	5,60,000
Less: Depreciation (8,00,000 ÷ 4 years)	(2,00,000)	(2,00,000)	(2,00,000)	(2,00,000)
PBT	30,000	40,000	20,000	3,60,000
Less: Tax @ 30%	(9,000)	(12,000)	(6,000)	(1,08,000)
PAT	21,000	28,000	14,000	2,52,000
Add: Depreciation	2,00,000	2,00,000	2,00,000	2,00,000
CFAT	2,21,000	2,28,000	2,14,000	4,52,000
× PV Factor	0.893	0.797	0.712	0.636
Present Value of CFAT	1,97,353	1,81,716	1,52,368	2,87,472
Cumulative PV of CFAT	1,97,353	3,79,069	5,31,437	8,18,909

2. Statement showing Present Value of CFAT and cumulative PV of CFAT of Machine B:

<i>Particulars</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Net Profit before Depreciation and Tax	1,75,000	2,60,000	3,20,000	1,50,000
Less: Depreciation (6,00,000 ÷ 4 years)	(1,50,000)	(1,50,000)	(1,50,000)	(1,50,000)
PBT	25,000	1,10,000	1,70,000	-
Less: Tax @ 30%	(7,500)	(33,000)	(51,000)	-
PAT	17,500	77,000	1,19,000	-
Add: Depreciation	1,50,000	1,50,000	1,50,000	1,50,000
CFAT	1,67,500	2,27,000	2,69,000	1,50,000
× PV Factor	0.893	0.797	0.712	0.636
Present Value of CFAT	1,49,578	1,80,919	1,91,528	95,400
Cumulative PV of CFAT	1,49,578	3,30,497	5,22,025	6,17,425

PYQ 13

An existing company has a machine in operation for two years, its estimated life is 4 years with no residual value in the end. Its current market value is ₹3 lakhs. The management is considering a proposal to purchase an improved model of a machine which gives increase output. The details are as under:

<i>Particulars</i>	<i>Existing Machine</i>	<i>New Machine</i>
Purchase price	₹6,00,000	₹10,00,000
Estimated life	6 years	4 years
Residual value	0	0
Annual operating days	300	300
Operating hour per day	6	6
Selling price per unit	₹10	₹10
Material cost per unit	₹2	₹2
Output per hour in units	20	40
Labour cost per hour	₹20	₹30
Fixed overhead per annum excluding depreciation	₹1,00,000	₹60,000
Working capital	₹1,00,000	₹2,00,000
Income tax rate	30%	30%

Assuming that cost of capital is 10% and the company uses written down value of depreciation @ 20% and it has several machines in 20% block.

Advise the management on the replacement of machine as per NPV method.

The discounting factor table given below:

<i>Discounting Factors</i>	<i>Year 1</i>	<i>Year 2</i>	<i>Year 3</i>	<i>Year 4</i>
10%	0.909	0.826	0.751	0.683

[(10 Marks) July 2021]

Answer

Statement of NPV

<i>Year</i>	<i>Particulars</i>	<i>₹</i>	<i>DF @ 10%</i>	<i>PV</i>
0	Initial outflows	(8,00,000)	1.000	(8,00,000)
1	Incremental CFAT	2,59,000	0.909	2,35,431
2	Incremental CFAT	2,50,600	0.826	2,06,996
3	Incremental CFAT	2,43,880	0.751	1,83,154
4	Incremental CFAT + Working Capital (2,38,504 + 1,00,000)	3,38,504	0.683	2,31,198
NPV				56,779

Advise: The company should go ahead with replacement of machine, since it has positive NPV.

Working Notes:

1. Calculation of initial outflow:

Cost of new machine	₹10,00,000
Less: Sales value of old machine	(₹3,00,000)
Add: Increase in Working Capital	₹1,00,000
Initial outflow	₹8,00,000

2. Total operating hours = 300 days × 6 hours = 1,800 hours

3. Increase in output = 1,800 hours × (40 - 20) = 36,000 units

4. Base for incremental Depreciation:

<i>Particulars</i>	<i>₹</i>
(A) WDV of Existing Machine:	
Purchase price of existing machine	6,00,000
Less: Depreciation year 1 (6,00,000 × 20%)	(1,20,000)
Less: Depreciation year 2 (4,80,000 × 20%)	(96,000)
WDV of Existing Machine (A)	3,84,000
(B) Depreciation Base of New Machine:	
Purchase price of new machine	10,00,000
Add: WDV of existing Machine	3,84,000
Less: Sale value of existing machine	(3,00,000)
Depreciation Base of New Machine (B)	10,84,000
(C) Base for incremental Depreciation (B - A)	7,00,000

5. Calculation of incremental CFAT:



<i>Particulars</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Increase in Sales (36,000 units × ₹10)	3,60,000	3,60,000	3,60,000	3,60,000
+ Decrease in Cash Fixed cost (1,00,000 – 60,000)				
- Increase in Material cost (36,000 units × ₹2)	40,000	40,000	40,000	40,000
- Increase in Labour cost {1,800 hours × (30-20)}	(72,000)	(72,000)	(72,000)	(72,000)
Less: Increase in Depreciation (Base: 7,00,000)	(18,000)	(18,000)	(18,000)	(18,000)
Incremental PBT	(1,40,000)	(1,12,000)	(89,600)	(71,680)
Less: Tax @ 30%	1,70,000	1,98,000	2,20,400	2,38,320
Incremental PAT	(51,000)	(59,400)	(66,120)	(71,496)
Add: Incremental Depreciation	1,19,000	1,38,600	1,54,280	1,66,824
Incremental CFAT	1,40,000	1,12,000	89,600	71,680
	2,59,000	2,50,600	2,43,880	2,38,504

Notes: Since company has several machines in 20% block of assets, there is no tax benefit on loss on sale of machine because block will remain in existence.

PYQ 14

Stand Ltd is contemplating replacement of one of its machine which has become outdated and inefficient. Its financial manager has prepared a report outlining two possible replacement machines. The details of each machine are as follows:

	<i>Machine 1</i>	<i>Machine 2</i>
Initial investment	₹12,00,000	₹16,00,000
Estimated useful life	3 Years	5 Years
Residual value	₹1,20,000	₹1,00,000
Contribution per annum	₹11,60,000	₹12,00,000
Fixed maintenance costs per annum	₹40,000	₹80,000
Other fixed operating costs per annum	₹7,20,000	₹6,10,000

The maintenance costs are payable annually in advance. All other cash flows apart from the initial investment assumed to occur at the end of each year. Depreciation has been calculated by straight line method and has been included in other fixed operating costs. The expected cost of capital for this project is assumed as 12% p.a.

Which machine is more beneficial, using Annualized Equivalent Approach? Ignore tax.

<i>Year</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>
PVIF _{0.12,t}	0.893	0.797	0.712	0.636	0.567	0.507
PVIFA _{0.12,t}	0.893	1.690	2.402	3.038	3.605	4.112

[(10 Marks) Dec 2021]

Answer

(i) Statement Showing Evaluation of Two Machines

<i>Particulars</i>	<i>Machine 1</i>	<i>Machine 2</i>
(A) Initial investment	12,00,000	16,00,000
(B) PV of Contribution	27,86,320	43,26,000
	(11,60,000 × 2.402)	(12,00,000 × 3.605)
(C) PV of Cash fixed operating costs	8,64,720	11,17,550
	(3,60,000 × 2.402)	(3,10,000 × 3.605)
(D) PV of Fixed maintenance costs	1,07,600	3,23,040
	{40,000 × (1.690+1)}	{80,000 × (3.038+1)}
(E) PV of residual value	85,440	56,700

Net present value (B + E - A - C - D)	(1,20,000 × 0.712)	(1,00,000 × 0.567)
÷ PVIFA	6,99,440	13,42,110
Annualized Equivalent NPV	÷ 2.402	÷ 3.605
	2,91,191	3,72,291

Select the Machine 2 having higher annualized equivalent NPV

Working Notes:

1. **Depreciation:** = (Initial investment – Residual value) ÷ Useful life

Machine 1	=	(₹12,00,000 – ₹1,20,000) ÷ 3 years	=	₹3,60,000
Machine 2	=	(₹16,00,000 – ₹1,00,000) ÷ 5 years	=	₹3,00,000

2. **Cash fixed operating costs** = Fixed operating costs – Depreciation

Machine 1	=	₹7,20,000 – ₹3,60,000	=	₹3,60,000
Machine 2	=	₹6,10,000 – ₹3,00,000	=	₹3,10,000

PYQ 15

Alpha Limited is a manufacturer of computers. It wants to introduce artificial intelligence while making computers. The estimated annual saving from introduction of the artificial intelligence (AI) is as follows:

- Reduction of five employees with annual salaries of ₹3,00,000 each
- Reduction of ₹3,00,000 in production delays caused by inventory problem.
- Reduction in lost sales ₹2,50,000 and
- Gain due to timely billing ₹2,00,000

The purchase price of the system for installation of artificial intelligence is ₹20,00,000 and installation cost is ₹1,00,000. 80% of the purchase price will be paid in the year of purchase and remaining will be paid in next year.

The estimated life of the system is 5 years and it will be depreciated on a straight-line basis. However, the operation of the new system requires two computer specialists with annual salaries of ₹5,00,000 per person.

In addition to above, annual maintenance and operating cost for five years are as below:

	(Amount in ₹)				
Year	1	2	3	4	5
Maintenance & Operating Cost	2,00,000	1,80,000	1,60,000	1,40,000	1,20,000

Maintenance and operating cost are payable in advance. The company's tax rate is 30% and its required rate of return is 15%.

Year	1	2	3	4	5
PVIF _{0.10,t}	0.909	0.826	0.751	0.683	0.621
PVIF _{0.12,t}	0.893	0.797	0.712	0.636	0.567
PVIF _{0.15,t}	0.870	0.756	0.658	0.572	0.497

Evaluate the project by using Net Present Value and Profitability Index.

[(10 Marks) May 2022]



Answer

(1) Net Present value (NPV)

Year	Particulars	₹	PVIF @ 15%	PV
0	Initial Outflows:			
	80% of Purchase price (20,00,000 × 80%)	(16,00,000)	1.000	(16,00,000)
	Installation cost	(1,00,000)	1.000	(1,00,000)
1	20% of Purchase Cost	(4,00,000)	0.870	(3,48,000)
PV of Outflows				20,48,000
0	Maintenance & Operating cost for year 1	(2,00,000)	1.000	(2,00,000)
1	CFAT	8,81,000	0.870	7,66,470
2	CFAT	8,95,000	0.756	6,76,620
3	CFAT	9,09,000	0.658	5,98,122
4	CFAT	9,23,000	0.572	5,27,956
5	CFAT	10,37,000	0.497	5,15,389
PV of Inflows				28,84,557
NPV				8,36,557

Advice: Accept the proposal having positive NPV.

(2) Profitability Index = PV of Inflows ÷ PV of Outflows
 = 28,84,557 ÷ 20,48,000 = 1.41

Advice: Accept the proposal having PI higher than 1.

Working Note:

Statement of CFAT

Particulars	1	2	3	4	5
Saving in employees salaries (₹3,00,000 × 5)	15,00,000	15,00,000	15,00,000	15,00,000	15,00,000
+ Reduction in prod. delays	3,00,000	3,00,000	3,00,000	3,00,000	3,00,000
+ Reduction in lost sales	2,50,000	2,50,000	2,50,000	2,50,000	2,50,000
+ Gain due to timely billing	2,00,000	2,00,000	2,00,000	2,00,000	2,00,000
- Salaries computer specialist (₹5,00,000 × 2)	(10,00,000)	(10,00,000)	(10,00,000)	(10,00,000)	(10,00,000)
- Maintenance & Op. cost	(2,00,000)	(1,80,000)	(1,60,000)	(1,40,000)	(1,20,000)
- Depreciation (21,00,000 ÷ 5 years)	(4,20,000)	(4,20,000)	(4,20,000)	(4,20,000)	(4,20,000)
PBT	6,30,000	6,50,000	6,70,000	6,90,000	7,10,000
- Tax @ 30%	(1,89,000)	(1,95,000)	(2,01,000)	(2,07,000)	(2,13,000)
PAT	4,41,000	4,55,000	4,69,000	4,83,000	4,97,000
+ Depreciation	4,20,000	4,20,000	4,20,000	4,20,000	4,20,000
+ Maint. & Op. cost (accrual)	2,00,000	1,80,000	1,60,000	1,40,000	1,20,000
- Maint. & Op. cost (Cash)	(1,80,000)	(1,60,000)	(1,40,000)	(1,20,000)	-
CFAT	8,81,000	8,95,000	9,09,000	9,23,000	10,37,000

PYQ 16

A firm is in need of a small vehicle to make deliveries. It is intending to choose between two options. One option is to buy a new three wheeler that would cost ₹1,50,000 and will remain in service for 10 years.

The other alternative is to buy a second hand vehicle for ₹80,000 that could remain in service for 5 years. Thereafter the firm, can buy another second hand vehicle for ₹60,000 that will last for another 5 years.

The scrap value of the discarded vehicle will be equal to its written down value (WDV). The firm pays 30% tax and is allowed to claim depreciation on vehicles @ 25% on WDV basis. The cost of capital of the firm is 12%.

You are required to advise the best option.

Given:

<i>t</i>	1	2	3	4	5	6	7	8	9	10
PVIF (t, 12%)	0.892	0.797	0.711	0.635	0.567	0.506	0.452	0.403	0.360	0.322

[(10 Marks) Nov 22]

Answer

Statement of PV of outflow under Option 1

Year	Particulars	₹	DF @ 12%	PV
1	Tax Shield on depreciation (37,500 × 0.3)	11,250	0.892	10,035
2	Tax Shield on depreciation (28,125 × 0.3)	8,438	0.797	6,725
3	Tax Shield on depreciation (21,094 × 0.3)	6,328	0.711	4,499
4	Tax Shield on depreciation (15,820 × 0.3)	4,746	0.635	3,014
5	Tax Shield on depreciation (11,865 × 0.3)	3,560	0.567	2,019
6	Tax Shield on depreciation (8,899 × 0.3)	2,670	0.506	1,351
7	Tax Shield on depreciation (6,674 × 0.3)	2,002	0.452	905
8	Tax Shield on depreciation (5,006 × 0.3)	1,502	0.403	605
9	Tax Shield on depreciation (3,754 × 0.3)	1,126	0.360	405
10	Tax Shield on depreciation (2,816 × 0.3)	845	0.322	272
10	Scrap value new three wheeler	8,447	0.322	2,720
PV of Inflows				32,550
PV of Outflows (Initial Cost of new three wheeler)				1,50,000
Net PV of Outflows (1,50,000 - 32,550)				1,17,450

Statement of PV of outflow under Option 2

Year	Particulars	₹	DF @ 12%	PV
1	Tax Shield on depreciation (20,000 × 0.3)	6,000	0.892	5,352
2	Tax Shield on depreciation (15,000 × 0.3)	4,500	0.797	3,587
3	Tax Shield on depreciation (11,250 × 0.3)	3,375	0.711	2,400
4	Tax Shield on depreciation (8,438 × 0.3)	2,531	0.635	1,607
5	Tax Shield on depreciation (6,328 × 0.3)	1,898	0.567	1,076
5	Scrap value of second hand vehicle 1	18,984	0.567	10,764
6	Tax Shield on depreciation (15,000 × 0.3)	4,500	0.506	2,277
7	Tax Shield on depreciation (11,250 × 0.3)	3,375	0.452	1,526
8	Tax Shield on depreciation (8,438 × 0.3)	2,531	0.403	1,020
9	Tax Shield on depreciation (6,328 × 0.3)	1,898	0.360	683
10	Tax Shield on depreciation (4,746 × 0.3)	1,424	0.322	459
10	Scrap value of second hand vehicle 2	14,238	0.322	4,585
PV of Inflows				35,336
PV of Outflows (80,000 + 60,000 × 0.567)				1,14,020
Net PV of Outflows (1,14,020 - 35,336)				78,684

Advise: Select option 2 having lower Net PV of Outflows.



PYQ 17

A hospital is considering to purchase a diagnostic machine costing ₹80,000. The projected life of the machine is 8 years and has an expected salvage value of ₹6,000 at the end of 8 years. The annual operating cost of the machine is ₹7,500. It is expected to generate revenues of ₹40,000 per year for eight years. Presently, the hospital is outsourcing the diagnostic work and is earning commission income of ₹12,000 per annum. Consider tax rate of 30% Discounting Rate as 10%.

Advise: Whether it would be profitable for the hospital to purchase the machine?

Give your recommendation as per Net Present Value method and Present Value Index method under below mentioned two situations:

- (i) If Commission income of ₹12,000 p.a. is before taxes.
- (ii) If Commission income of ₹12,000 p.a. is net of taxes.

<i>t</i>	1	2	3	4	5	6	7	8
PVIF (t, 10%)	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467

[(10 Marks) Nov 2022]

Answer

(i) Net Present Value and Present Value Index when commission income is before tax:

Net Present Value

Year	Particulars	₹	DF @ 10%	DCF
0	Initial Outflows	(80,000)	1.000	(80,000)
1 – 8	Cash Flow After Tax	17,125	5.334	91,345
8	Salvage	6,000	0.467	2,802
NPV				14,147

$$\text{Profitability Index} = \frac{\text{PV of Inflows}}{\text{PV of Outflows}} = \frac{94,147}{80,000} = 1.18$$

Advise: Since the net present value (NPV) is positive and profitability index is also greater than 1, it is profitable for the hospital to purchase the machine.

(ii) Net Present Value and Present Value Index when commission income is before tax:

Net Present Value

Year	Particulars	₹	DF @ 10%	DCF
0	Initial Outflows	(80,000)	1.000	(80,000)
1 – 8	Cash Flow After Tax	13,525	5.334	72,142
8	Salvage	6,000	0.467	2,802
NPV				(5,056)

$$\text{Profitability Index} = \frac{\text{PV of Inflows}}{\text{PV of Outflows}} = \frac{74,944}{80,000} = 0.94$$

Advise: Since the net present value (NPV) is negative and profitability index is also lower than 1, it is not profitable for the hospital to purchase the machine.

Working Notes:

Calculation of CFAT:

<i>Particulars</i>	<i>Case (i)</i>	<i>Case (ii)</i>
Sales	40,000	40,000
Less: Operating cost	7,500	7,500
Less: Depreciation $(80,000 - 6,000) \div 8$ years	9,250	9,250
Less: Loss of commission income before tax	(12,000)	-
Net Income	11,250	23,250
Less: Tax @ 30%	(3,375)	(6,975)
PAT	7,875	16,275
Add: Depreciation	9,250	9,250
Cash inflows after tax per annum	17,125	25,525
Less: Loss of commission income after tax	-	(12,000)
Net CFAT	17,125	13,525

PYQ 18

Four years ago, Z Ltd. had purchased a machine of ₹4,80,000 having estimated useful life of 8 years with zero salvage value. Depreciation charged using SLM method over the useful life. The company want to replace this machine with a new machine. Details of new machine are as below:

- Cost of new machine is ₹12,00,000 Vendor of this machine is agreed to take old machine at a value of ₹2,40,000. Cost of dismantling and removal of old machine will be ₹40,000. 80% of net purchase price will be paid on spot and remaining will be paid at the end of one year.
- Depreciation will be charged @ 20% p.a. under WDV method.
- Estimated useful life of new machine is four years and it has salvage value of ₹1,00,000 at the end of year four.
- Incremental annual sales revenue is ₹12,25,000.
- Contribution margin is 50%.
- Incremental indirect cost (excluding depreciation) is ₹1,18,750 per year.
- Additional working capital of ₹2,50,000 is required at the beginning of the year one and ₹3,00,000 at the beginning of the year three. Working capital at the end of the year four will be nil.
- Tax rate is 30%
- Ignore tax on capital gain.
- Z Ltd. will not make any additional investment, if it yields less than 12%.

Advise, whether existing machine should be replaced or not.

<i>Year</i>	1	2	3	4	5
PVIF _{0,12,t}	0.893	0.797	0.712	0.636	0.567

[(10 Marks) May 23]

Answer

Statement of NPV

<i>Year</i>	<i>Particulars</i>	₹	DF @12%	PV
0	Initial outflows	(10,50,000)	1.000	(10,50,000)
1	Incremental CFAT - 20% of Net purchase price (3,99,625 - 20% of 10,00,000)	1,99,625	0.893	1,78,265
2	Incremental CFAT - Additional Working Capital	85,225	0.797	67,924

3	(3,85,225 – 3,00,000)	3,73,705	0.712	2,66,078
4	Incremental CFAT	10,14,489	0.636	6,45,215
	Incremental CFAT + Incremental Salvage + WC (3,64,489 + 1,00,000 + 5,50,000)			
NPV				1,07,482

Advise: The company should replace existing machine with new machine having positive NPV

Working Notes:

1. Calculation of initial outflow:

Cost of new machine	12,00,000
Less: Sales value of old machine net of disposal (2,40,000 – 40,000)	(2,00,000)
Net Purchase Price	10,00,000
Initial Outflow:	
80% of Net purchase price (80% of 10,00,000)	8,00,000
Add: Additional Working Capital	2,50,000
	10,50,000

2. Calculation of incremental CFAT:

Particulars	1	2	3	4
Incremental Contribution (12,25,000 × 50%)	6,12,500	6,12,500	6,12,500	6,12,500
Less: Incremental indirect cost	(1,18,750)	(1,18,750)	(1,18,750)	(1,18,750)
Less: Incremental depreciation	(1,80,000)	(1,32,000)	(93,600)	(62,880)
Incremental PBT	3,13,750	3,61,750	4,00,150	4,30,870
Less: Tax @ 30%	(94,125)	(1,08,525)	(1,20,045)	(1,29,261)
Incremental PAT	2,19,625	2,53,225	2,80,105	3,01,609
Add: Incremental Depreciation	1,80,000	1,32,000	93,600	62,880
Incremental CFAT	3,99,625	3,85,225	3,73,705	3,64,489

3. Incremental Depreciation:

Year 1	=	12,00,000 × 20% - (4,80,000 ÷ 8 years)	=	₹1,80,000
Year 2	=	9,60,000 × 20% - 60,000	=	₹1,32,000
Year 3	=	7,68,000 × 20% - 60,000	=	₹93,600
Year 4	=	6,14,400 × 20% - 60,000	=	₹62,880

PYQ 19

ABC Ltd. is considering to purchase a machine which is priced at ₹5,00,000. The estimated life of machine is 5 years and has an expected salvage value of ₹45,000 at the end of 5 years. It is expected to generate revenue of ₹1,50,000 per annum for five years. The annual operating cost of the machine is ₹28,125, Corporate Tax Rate is 20% and the cost of capital is 10%.

You are required to analyse whether it would be profitable for the company to purchase the machine by using;

- (a) Payback period Method
- (b) Net Present value method
- (c) Profitability Index Method

[[10 Marks) Nov 23]

Answer

(a) Payback period = $5,00,000 \div 1,15,700 = 4.32 \text{ years}$

Project should be accepted having payback period less than life of project.

(b) Statement of NPV

<i>Years</i>	<i>Particulars</i>	<i>₹</i>	<i>DF @ 10%</i>	<i>PV</i>
0	Investment (outflow)	(5,00,000)	1.000	(5,00,000)
1 – 5	CFAT	1,15,700	3.791	4,38,619
5	Salvage	45,000	0.621	27,945
NPV				(33,436)

Project should be rejected having negative NPV.

(c) Profitability Index = $4,66,564 \div 5,00,000 = 0.93$

Project should be rejected having PI less than 1.

Working Note:

Calculation of CFAT

<i>Particulars</i>	<i>₹</i>
Sales value	1,50,000
Less: Operating cost (50,000 gallon × ₹5)	(28,125)
Less: Depreciation (5,00,000 – 45,0000 ÷ 5 years)	(91,000)
PBT	30,875
Less: Tax @ 20%	(6,175)
PAT	24,700
Add: Depreciation	91,000
Annual CFAT	1,15,700

SUGGESTED REVISION FOR EXAM:

BQ: 2, 12, 14, 15, 16, 18, 21, 22, 23, 24, 25, 28, 30, 31, 34, 35, 36, 37

PYQ: 6, 9, 13, 14, 15

COST OF DEBT (K_d)**BQ 1**

Vishnu steels Ltd. has issued 30,000 irredeemable 14% debentures of ₹150 each. The cost of flotation of debentures is 5% of the total issued amount. The company's taxation rate is 40%.

Calculate the cost of debt.

[K_d 8.84%]

BQ 2

Five years ago, Sona Limited issued 12 per cent irredeemable debentures at ₹103, at ₹3 premium to their par value of ₹100. The current market price of these debentures is ₹94. If the company pays corporate tax at a rate of 35 per cent *What is its current cost of debenture capital?*

[K_d 8.30%]

BQ 3

Surya Industries Ltd. has raised funds through issue of 10,000 debentures of ₹150 each at a discount of ₹10 per debenture with 10 years maturity. The coupon rate is 16%. The flotation cost is ₹5 per debenture. The debentures are redeemable with a 10% premium. The corporate taxation rate is 40%.

Calculate the cost of debenture.

[K_d 11.60%]

BQ 4

Business machines Ltd. has issued redeemable debentures of ₹100 each repayable at the end of 8 year period on a coupon rate of 14%. The flotation expenses are 10% of issue amount.

Calculate the cost of debt.

[K_d 16.05%]

BQ 5

A company issued 10,000, 10% debentures of ₹100 each at a premium of 10% on 1.4.2020 to be matured on 1.4.2025. The debentures will be redeemed on maturity. *Compute the cost of debentures assuming 35% as tax rate.*

[K_d 4.28%]

BQ 6

A company issued 10,000, 10% debentures of ₹100 each on 1.4.2020 to be matured on 1.4.2025. The company wants to know the current cost of its existing debt and the market price of the debentures is ₹80. Compute the cost of existing debentures assuming 35% tax rate.

[K_d 11.67%]

BQ 7

Express cargo Ltd has issued 4 years Zero Coupon Bonds of ₹1,000 each at a price of ₹636.

Calculate the cost of debt.

[K_d 11.98%]

BQ 8

Institutional Development Bank (IDB) issued Zero interest deep discount bonds of face value of ₹1,00,000 each issued at ₹2,500 & repayable after 25 years.

Compute the cost of debt if there is no corporate tax.

Answer

Here,

Redemption Value (RV)	=	₹1,00,000
Net Proceeds (NP)	=	₹2,500
Interest	=	0
Life of bond	=	25 years

There is huge difference between RV and NP therefore in place of approximation method we should use trial & error method.

$$\begin{aligned}
 FV &= PV \times (1 + r)^n \\
 1,00,000 &= 2,500 \times (1 + r)^{25} \\
 40 &= (1 + r)^{25}
 \end{aligned}$$

Trial 1:	r	=	15%,	(1.15) ²⁵	=	32.919
Trial 2:	r	=	16%,	(1.16) ²⁵	=	40.874

Here:

L	=	15%	
H	=	16%	
NPV _L	=	32.919 - 40	= - 7.081
NPV _H	=	40.874 - 40	= + 0.874
IRR/K _d	=	$LR + \frac{NPV_L}{NPV_L - NPV_H} \times (H - L)$	
	=	$15\% + \frac{-7.081}{-7.081 - 0.874} \times (16\% - 15\%) = 15.89\%$	

BQ 9

A company issued 10,000, 10% debentures of ₹100 each on 1.4.2020 to be matured on 1.4.2025. The company wants to know the current cost of its existing debt and the market price of the debentures is ₹80.

Compute the cost of existing debentures by using Present value method/Yield to maturity approach (YTM) assuming 35% tax rate.

Answer

(a) *Identification of relevant cash flows:*

Year	Cash Flows
0	Current market price (P ₀) = ₹80
1 to 5	Interest net of tax [I (1 - t)] = 10% of ₹100 (1 - 0.35) = ₹6.5
5	Redemption value (RV) = Face value i.e. ₹100

(b) *Calculation of NPV at two discount rates:*

Year	Cash Flow	Present Value		Present Value	
		10%	DCF	15%	DCF

0	80	1.000	(80)	1.000	(80)
1 - 5	6.5	3.791	24.64	3.352	21.79
5	100	0.621	62.10	0.497	49.70
NPV			+6.74		-8.51

(c) Calculation of IRR/K_d

$$\begin{aligned} \text{IRR}/K_d &= \text{LR} + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times (\text{H} - \text{L}) = 10\% + \frac{6.74}{6.74 - (-8.51)} \times (15\% - 10\%) \\ &= \mathbf{12.21\%} \end{aligned}$$

YTM or present value method is a superior method of determining cost of debt of a company to approximation method and it is also preferred in the field of finance.

BQ 10

A company issued 10,000, 15% Convertible debentures of ₹100 each with a maturity period of 5 years. At maturity the debenture holders will have the option to convert the debentures into equity shares of the company in the ratio of 1:10 (10 shares for each debenture). The current market price of the equity shares is ₹12 each and historically the growth rate of the shares are 5% per annum.

Compute the cost of debentures assuming 35% tax rate.

Answer

Determination of Redemption value:

Higher of

- (i) The cash value of debentures = ₹100
- (ii) Value of equity shares = 10 shares × ₹12(1 + 0.05)⁵
= 10 shares × ₹12 × 1.276 = ₹153.12

₹153.12 will be taken as redemption value as it is higher than the cash option and attractive to the investors.

Calculation of Cost of Convertible debenture:

Alternative 1: Using approximation method:

$$K_d = \frac{I(1-t) + \frac{RV-NP}{n}}{\frac{RV+NP}{2}} \times 100 = \frac{15(1-0.35) + \frac{153.12-100}{5}}{\frac{153.12+100}{2}} \times 100 = \mathbf{16.09\%}$$

Alternative 2: Using present value method:

Calculation of NPV at two discount rates:

Year	Cash Flow	Present Value		Present Value	
		15%	DCF	20%	DCF
0	100	1.000	(100)	1.000	(100)
1 - 5	9.75	3.352	32.68	2.991	29.16
5	153.12	0.497	76.10	0.402	61.55
NPV			+8.78		-9.29

$$\text{IRR}/K_d = \text{LR} + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times (\text{H} - \text{L}) = 15\% + \frac{8.78}{8.78 - (-9.29)} \times (20\% - 15\%) = \mathbf{17.43\%}$$

BQ 11

RBML is proposing to sell a 5-year bond of ₹ 5,000 at 8 per cent rate of interest per annum. The bond amount will be amortised equally over its life.

What is the bond's present value for an investor if he expects a minimum rate of return of 6 per cent?

Answer

The amount of interest will go on declining as the outstanding amount of bond will be reducing due to amortisation. The amount of interest for five years will be:

First year	:	₹5,000 × 0.08	=	₹400
Second year	:	(₹5,000 – ₹1,000) × 0.08	=	₹320
Third year	:	(₹4,000 – ₹1,000) × 0.08	=	₹240
Fourth year	:	(₹3,000 – ₹1,000) × 0.08	=	₹160; and
Fifth year	:	(₹2,000 – ₹1,000) × 0.08	=	₹80.

The outstanding amount of bond will be zero at the end of fifth year. Since RBML will have to return ₹1,000 every year, the outflows every year will consist of interest payment and repayment of principal:

First year	:	₹1,000 + ₹400	=	₹1,400
Second year	:	₹1,000 + ₹320	=	₹1,320
Third year	:	₹1,000 + ₹240	=	₹1,240
Fourth year	:	₹1,000 + ₹160	=	₹1,160; and
Fifth year	:	₹1,000 + ₹80	=	₹1,080.

The above cash flows of all five years will be discounted with the cost of capital. Here the expected rate i.e. 6% will be used. Value of the bond is calculated as follows:

$$\begin{aligned}
 V_B &= \frac{1,400}{(1.06)^1} + \frac{1,320}{(1.06)^2} + \frac{1,240}{(1.06)^3} + \frac{1,160}{(1.06)^4} + \frac{1,080}{(1.06)^5} \\
 &= ₹1,320.75 + ₹1,174.80 + ₹1,041.14 + ₹918.88 + ₹807.05 = \mathbf{₹5,262.62}
 \end{aligned}$$

COST OF PREFERENCE SHARE CAPITAL (K_p)

BQ 12

XYZ Ltd. issues 2,000 10% preference shares of ₹100 each at ₹95 each. The company proposes to redeem the preference shares at the end of 10th year from the date of issue.

Calculate the cost of preference share capital.

Answer

$$K_p = \frac{PD + \left(\frac{RV - NP}{n} \right)}{\frac{RV + NP}{2}} \times 100 = \frac{10 + \left(\frac{100 - 95}{10} \right)}{\frac{100 + 95}{2}} \times 100 = \mathbf{10.77\%}$$

BQ 13

XYZ & Co. issues 2,000 10% preference shares of ₹100 each at ₹95 each.

Calculate the cost of preference share capital.



Answer

$$K_p = \frac{PD}{NP} \times 100 = \frac{10}{95} \times 100 = 10.53\%$$

BQ 14

If R Energy is issuing preferred stock at ₹100 per share, with a stated dividend of ₹12, and a floatation cost of 3% then,

What is the cost of preference share?

Answer

$$K_p = \frac{PD}{IP(1 - \text{Floatation Cost})} \times 100 = \frac{12}{100(1 - .03)} \times 100 = 12.37\%$$

COST OF EQUITY SHARE CAPITAL (K_e)

BQ 15

Radiant Ltd. has disbursed a dividend of ₹30 on each Equity share of ₹10. The current market price of share is ₹80.

Calculate the cost of equity as per dividend yield method.

[K_e 37.50%]

BQ 16

Prabhat Ltd. has 50,000 equity shares of ₹10 each and its current market value is ₹45 each. The after tax profit of the company for the year is ₹9,60,000.

Calculate the cost of equity based on price earnings/yield method.

Answer

$$K_e = \frac{EPS}{MPS} \times 100 = \frac{19.20}{45.00} \times 100 = 42.67\%$$

$$EPS = \frac{\text{Earnings}}{\text{No. of Equity shares}} = \frac{9,60,000}{50,000} = ₹19.20$$

BQ 17

Fox Ltd. issued new 10,000 equity shares of ₹10 each at a premium of ₹2 each. The company has incurred issue expenses of ₹5,000. The equity shareholder's expects the rate of dividend to 18% p.a.

Calculate the cost of equity share capital. Will your answer be different if these shares are existing shares and the current market price of share is ₹21?

Answer

(a) Since the Equity shares are newly issued, the cost of equity of it can be calculated as follows:

$$K_e (\text{New share}) = \frac{\text{Expected dividend}}{\text{Net proceeds}} \times 100 = \frac{1.80}{11.50} \times 100 = 15.65\%$$

$$\text{Net proceeds per share} = \frac{(10,000 \text{ Equity shares} \times 12.00) - 5,000}{10,000 \text{ Shares}} = \text{₹}11.50$$

(b) In case of existing equity shares, market price is to be taken as basis for calculation of cost of equity capital as follows:

$$K_e = \frac{\text{Expected dividend}}{\text{Current market price}} \times 100 = \frac{1.80}{21.00} \times 100 = 8.57\%$$

BQ 18

A company has paid dividend of ₹1 per share (of face value of ₹10 each) last year and it is expected to grow @10% next year. Calculate the cost of equity if the market price of share is ₹55.

Calculate the cost of equity.

Answer

$$K_e = \frac{D_1 + g}{P_0} = \frac{1(1+0.10)}{55} + .10 = 12\%$$

BQ 19

The equity of Mercury Ltd. are traded in the market at ₹90 each. The current year expected dividend per share is ₹18. The subsequent growth in dividends is expected at the rate of 6%.

Calculate the cost of equity capital.

[K_e 26%]

BQ 20

Bright Star Ltd. has its equity shares of ₹10 each quoted in a stock exchange has market price of ₹56. A constant expected annual growth rate of 6% and a dividend of ₹3.60 per share has been paid for the current year.

Calculate the cost of capital.

[K_e 12.81%]

BQ 21

(a) A Company's shares are quoted at ₹250. The dividend just paid was ₹50. Face value per share ₹100. No growth in dividend is expected. Compute K_e.

(b) Presume in the above part the anticipated growth rate in dividend is 10% p.a. Compute K_e.

(c) Presume in part (a), investors in the company have a required rate of return of 15%. Current dividends of ₹30 per share have just been paid. No increase is anticipated. Estimate the share price today.

(d) Presume in part (c), dividends are expected to grow @ 5% p.a. Estimate share price today.

[(a) K_e 20%, (b) K_e 32%, (c) P₀ ₹200, (d) P₀ ₹315]

BQ 22

Sun Ltd. has its shares of ₹10 each quoted on the stock exchange; the current price per share is ₹24. During the previous 3 years, dividends have steadily increased from ₹1.20 to ₹1.60 per share.

Calculate the cost of equity shares.

[g 10%; K_e 17.33%]



BQ 23

Calculate the cost of equity capital of H Ltd., whose risk free rate of return equals 10%. The firm's beta equals 1.75 and the return on the market portfolio equals to 15%.

Answer

$$K_e = R_f + \beta (R_m - R_f) = 10\% + 1.75 \times (15\% - 10\%) = 18.75\%$$

BQ 24

The risk free return is 10% and the risk premium is 5% with beta of a company is 1.6. During the previous 5 years, dividends have steadily increased from ₹2.115 to ₹2.966 per share. The company's earnings and the dividend experienced constant growth.

Find out the intrinsic value (Market value of share) of the shares.

Answer

$$P_0 = \frac{D_1}{K_e - g} = \frac{3(1+.07)}{18\% - 7\%} = ₹29.18$$

$$K_e = R_f + \beta (R_m - R_f) = 10\% + 1.6 \times (5\%) = 18\%$$

$$\text{Growth rate} = \sqrt[5]{\frac{\text{Latest Dividend}}{\text{First Dividend}}} - 1 = \sqrt[5]{\frac{2.966}{2.115}} - 1 = 7\%$$

BQ 25

Mr. Mehra had purchased a share of Alpha Limited for ₹1,000. He received dividend for a period of five years at the rate of 10 percent. At the end of the fifth year, he sold the share of Alpha Limited for ₹1,128.

You are required to compute the cost of equity as per realised yield approach.

Answer

Calculation of NPV at two discount rates:

Year	Cash Flow	Present Value		Present Value	
		11%	DCF	13%	DCF
0	1,000	1.000	(1,000)	1.000	(1,000)
1 - 5	100	3.696	369.60	3.517	351.70
5	1,128	0.593	668.90	0.543	612.50
NPV			+38.50		-35.80

Calculation of IRR/ K_e :

$$K_e = LR + \frac{NPV_L}{NPV_L - NPV_H} \times (H - L) = 11\% + \frac{38.50}{38.50 - (-35.80)} \times (13\% - 11\%) = 12.04\%$$

BQ 26

Calculate the cost of equity from the following data using realized yield approach:

Year	1	2	3	4	5
Dividend per share	1.00	1.00	1.20	1.25	1.15
Price per share (at the beginning)	9.00	9.75	11.50	11.00	10.60

Answer

In this questions we will first calculate yield for last 4 years and then calculate it geometric mean as follows:

$$\begin{aligned}
 1 + Y_1 &= \frac{D_1 + P_1}{P_0} = \frac{1 + 9.75}{9} = 1.1944 \\
 1 + Y_2 &= \frac{D_2 + P_2}{P_1} = \frac{1 + 11.50}{9.75} = 1.2821 \\
 1 + Y_3 &= \frac{D_3 + P_3}{P_2} = \frac{1.2 + 11}{11.50} = 1.0609 \\
 1 + Y_4 &= \frac{D_4 + P_4}{P_3} = \frac{1.25 + 10.60}{11} = 1.0772
 \end{aligned}$$

Geometric mean:

$$\begin{aligned}
 K_e &= [(1 + Y_1) \times (1 + Y_2) \times \dots \times (1 + Y_n)]^{1/n} - 1 \\
 K_e &= [1.1944 \times 1.2821 \times 1.0609 \times 1.0772]^{1/4} - 1 = \mathbf{0.15 \text{ or } 15\%}
 \end{aligned}$$

BQ 27

ABC Company’s equity share is quoted in the market at ₹25 per share currently. The company pays a dividend of ₹2 per share and the investor’s market expects a growth rate of 6% per year.

You are required to:

- (i) Calculate the company’s cost of equity capital.
- (ii) If the company issues 10% debentures of face value of ₹100 each and realises ₹96 per debenture while the debentures are redeemable after 12 years at a premium of 12%, calculate cost of debenture using YTM?

Assume Tax Rate to be 50%.

Answer

(i) Cost of Equity Capital (K_e):

$$K_e = \frac{D_1}{P_0} + g = \frac{2(1 + 0.06)}{25} + .06 = \mathbf{14.48\%}$$

Note: Dividend ₹2 is treated as D₀, student may treat it as D₁ and answer will change accordingly.

(ii) Cost of Debenture (K_d):

Identification of relevant cash flows:

Year	Cash Flows
0	Current market price (P ₀) = ₹96
1 to 12	Interest net of tax [I (1 - t)] = 10% of ₹100 (1 - 0.50) = ₹5
12	Redemption value (RV) = ₹112

Calculation of NPV at two discount rates

Year	Cash Flow	Present Value		Present Value	
		5%	DCF	10%	DCF

0	96	1.000	(96)	1.000	(96)
1 - 12	5	8.863	44.32	6.814	34.07
12	112	0.557	62.38	0.319	35.73
NPV			+10.70		-26.20

Calculation of IRR/K_d

$$\text{IRR}/K_d = \text{LR} + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times (\text{H} - \text{L}) = 5\% + \frac{10.70}{10.70 - (-26.20)} (10\% - 5\%) = \mathbf{6.45\%}$$

COST OF RETAINED EARNINGS (K_r)

BQ 28

ABC Company provides the following details:

$$D_0 = ₹4.19 \quad P_0 = ₹50 \quad g = 5\%$$

Calculate the cost of retained earnings.

Answer

$$K_r = \frac{D_1}{P_0} + g = \frac{4.19(1+0.05)}{50} + 0.05 = \mathbf{13.80\%}$$

BQ 29

ABC Company provides the following details:

$$R_f = 7\% \quad \beta = 1.20 \quad R_m - R_f = 6\%$$

Calculate the cost of retained earnings based on CAPM method.

Answer

$$K_r = R_f + \beta (R_m - R_f) = 7\% + 1.2 \times (6\%) = \mathbf{14.20\%}$$

BQ 30

Face value of equity shares of a company is ₹10, while current market price is ₹200 per share. Company is going to start a new project, and is planning to finance it partially by new issue and partially by retained earnings.

You are required to calculate cost of equity shares as well as cost of retained earnings if issue price will be ₹190 per share and floatation cost will be ₹5 per share. Dividend at the end of first year is expected to be ₹10 and growth rate will be 5%.

Answer

$$K_r = \frac{D_1}{P_0} + g = \frac{10}{200} + 0.05 = \mathbf{10\%}$$

$$K_e (\text{New Shares}) = \frac{D_1}{NP} + 0.05 = \frac{10}{185} + 0.05 = \mathbf{10.41\%}$$

WEIGHTED AVERAGE COST OF CAPITAL (K_0)

BQ 31

The Capital structure of Vikas Ltd. is as follows:

Sources of Fund	Book Value	Market Value
Equity Share Capital	₹10,00,000	₹20,00,000
Retained Earnings	₹5,00,000	Nil
14% Preference Share Capital	₹7,00,000	₹7,00,000
12% Debentures	₹6,00,000	₹6,00,000

After tax, cost of capital of these different sources is Equity share capital 18%, Retained earnings 15%, Preference share capital 14%, and Debentures 8%. Calculate the weighted average cost of capital of the company on the basis of (a) Book Value Weights and (b) Market Value Weights.

Answer

(a) Statement of WACC (Book Value Weights)

Capital Structure	Amount	Weight	Specific Cost	Cost of Capital
Equity Share Capital	10,00,000	0.357	0.18	0.0643
Retained Earnings	5,00,000	0.179	0.15	0.0268
14% Preference Share Capital	7,00,000	0.250	0.14	0.0350
12% Debentures	6,00,000	0.214	0.08	0.0171
Total	28,00,000	1.000	WACC	0.1432

(b) Statement of WACC (Market Value Weights)

Capital Structure	Amount	Weight	Specific Cost	Cost of Capital
Equity Share Capital	*13,33,333	0.404	0.18	0.0727
Retained Earnings	*6,66,667	0.202	0.15	0.0303
14% Preference Share Capital	7,00,000	0.212	0.14	0.0297
12% Debentures	6,00,000	0.182	0.08	0.0146
Total	33,00,000	1.000	WACC	0.1473

*Market Value of equity has been apportioned in the ratio of Book Value of equity and retained earnings.

BQ 32

Cost of equity of a company is 10.41% while cost of retained earnings is 10%. There are 50,000 equity shares of ₹10 each and retained earnings of ₹15,00,000. Market price per equity share is ₹50.

Calculate WACC using market value weights if there is no other sources of finance.

Answer

Book value of paid up equity capital	=	₹5,00,000	
Book value of retained earnings	=	₹15,00,000	
Ratio Paid up equity capital & retained earnings	=	500000 : 1500000	= 1 : 3
Market value of paid equity capital & retained earnings	=	₹50,000 × ₹50	= ₹25,00,000
Market value of paid up equity capital	=	₹25,00,000 × ¼	= ₹6,25,000
Market value of retained earnings	=	₹25,00,000 × ¾	= ₹18,75,000



Statement of WACC (Market Value Weights)

<i>Capital Structure</i>	<i>Amount</i>	<i>Weight</i>	<i>Specific Cost</i>	<i>Cost of Capital</i>
Equity Shares	*6,25,000	0.25	0.1041	0.0260
Retained Earnings	*18,75,000	0.75	0.1000	0.0750
Total	25,00,000	1.00	WACC	0.1010

*Market Value of equity has been apportioned in the ratio of Book Value of equity and retained earnings.

BQ 33

The capital structure of Bombay Traders Ltd. as on 31.03.2022 is as follows:

	<i>(₹ Crores)</i>
Equity Share Capital (100 lakhs equity shares of ₹10 each)	10
Reserves	2
14% Debentures of ₹100 each	3

For the year ended 31.03.2023 the company is likely to pay equity dividend at 20%. As the company is a market leader with good future, dividend is likely to grow by 5% every year. The equity shares are now traded at ₹80 per share in the stock exchange. Income-tax rate applicable to the company is 50%.

Required:

- (a) The current weighted cost of capital.
- (b) The company has plans to raise a further ₹5 crores by way of long term loan at 16% interest. When this take place the market value of the equity shares is expected to fall to ₹50 per share. What will be the new weighted average cost of capital of the company?

[(a) K_e 7.50%, K_r 7.50%, K_d 7%, K_o 7.40%; (b) K_e 9%, K_r 9%, K_d 7%, K_{TL} 8%, K_o 8.45%]

BQ 34

Gamma limited has in issue 5,00,000; ₹1 ordinary shares whose current ex-dividend market price is ₹1.50 per share. The company has just paid a dividend of 27 paise per share, and dividends are expected to continue at this level for some time.

If the company has no debt capital, compute the weighted average cost of capital?

Answer

$$K_e = \frac{D_1}{P_0} = \frac{0.27}{1.50} = 18\%$$

Since, there is no debt capital, WACC = $K_e = 18\%$

BQ 35

Determine cost of capital using market value weights as well as book value weights using following data:

Book value of capital structure:

Debenture (₹1,000 each)	₹16,00,000
Preference Shares (₹10 each)	₹4,00,000
Equity share Capital (Shares of ₹100 each)	₹20,00,000
	₹40,00,000

Market price:

Debentures	₹1,100 each
Preference Shares	₹12 each
Equity Shares	₹200 each

Debentures carry 8 percent interest, issued at par, redeemable at par, maturity period 20 years. Flotation cost 4 percent. Preference shares carry 10 percent dividend rate, issue and redemption at par. Maturity period 15 years. Flotation cost 5 percent. Equity dividend expected at the end of the year, i.e. ₹20 per share. Anticipated growth rate in dividends is 5 percent. Corporate tax rate 55 percent.

Answer

$$K_d = \frac{I(1-t) + \left(\frac{RV - NP}{n}\right) \times 100}{\frac{RV + NP}{2}} = \frac{80(1-0.55) + \left(\frac{1,000 - 960}{20}\right) \times 100}{\frac{1,000 + 960}{2}} = 3.88\%$$

$$K_p = \frac{PD + \left(\frac{RV - NP}{n}\right) \times 100}{\frac{RV + NP}{2}} = \frac{1.00 + \left(\frac{10 - 9.50}{15}\right) \times 100}{\frac{10 + 9.50}{2}} = 10.60\%$$

$$K_e = \frac{D_1}{P_0} + g = \frac{20}{200} + 0.05 = 15\%$$

Statement of WACC (Book Value Weights)

<i>Capital Structure</i>	<i>Amount</i>	<i>Weight</i>	<i>Specific Cost</i>	<i>Cost of Capital</i>
Debentures	16,00,000	0.40	3.88%	1.552%
Preference Share Capital	4,00,000	0.10	10.60%	1.06%
Equity Share Capital	20,00,000	.050	15%	7.50%
Total	40,00,000	1.00	WACC	10.112%

Statement of WACC (Market Value Weights)

<i>Capital Structure</i>	<i>Amount</i>	<i>Weight</i>	<i>Specific Cost</i>	<i>Cost of Capital</i>
Debentures	17,60,000	0.2821	3.88%	1.095%
Preference Share Capital	4,80,000	0.0769	10.60%	0.815%
Equity Share Capital	40,00,000	0.6410	15%	9.615%
Total	62,40,000	1.00	WACC	11.525%

BQ 36

Masco Limited wishes to raise additional finance of ₹10 lakhs for meeting its investment plans. It has ₹2,10,000 in the form of retained earnings available for investment purposes. The following are further details:

Debt-equity mix	3:7
Cost of debt:	
Upto ₹1,80,000	10% (before tax)
beyond ₹1,80,000	16% (before tax)
Current Earning per share	₹4
Dividend payout	50% of earnings



Expected growth rate in dividend	10%
Current market price per share	₹44
Tax rate	50%

You are required:

- (a) To determine the pattern for raising the additional finance.
- (b) To determine the post-tax average cost of additional debt.
- (c) To determine the cost of retained earnings and cost of equity, and
- (d) Compute the overall weighted average after tax cost of additional finance.

[(a) 3,00,000 Debt (1,80,000 @ 10% and balance 1,20,000 @ 16%) and 7,00,000 Equity (2,10,000 through retained earnings and 4,90,000 through fresh issue); (b) K_d 6.2%; (c) K_e 15%, K_r 15%; (d) K_o 12.36%]

Assumption: DPS is treated at D_0 .

BQ 37

As a financial analyst of a large electronics company, you are required to determine the weighted average cost of capital of the company using (a) book value weights and (b) market value weights. The following information is available for your perusal.

The company's present book value capital structure is:

Debentures (₹100 per debenture)	₹8,00,000
Preference shares (₹100 per share)	₹2,00,000
Equity shares (₹10 per share)	₹10,00,000

All these securities are traded in capital markets. Recent price are:

Debentures	₹110 per debenture
Preference shares	₹120 per share
Equity shares	₹22 each

Anticipated external financing opportunities are:

- (i) ₹100 per debenture redeemable at par, 11% coupon rate, 4% flotation cost, 10 years of maturity, sale price, ₹100.
- (ii) ₹100 per preference share redeemable at par, 12% dividend rate, 5% flotation cost, 10 years of maturity, sale price, ₹100.
- (iii) Equity share has ₹2 flotation cost and sale price per share of ₹22.

In addition, the dividend expected on the equity share at the end of the year is ₹2 per share with annual growth of 7%. The firm has a practice of paying all earnings in the form of dividends. Corporate Income-tax rate is 35%.

Answer

(a) Calculation of Weighted Average Cost of Capital by Using Book Value Weight

Particular	Book Value	Weight	Cost (K)	Weighted cost
11% Debenture	8,00,000	0.40	7.70%	3.080%
12% Preference share	2,00,000	0.10	12.82%	1.282%
Equity Share Capital	10,00,000	0.50	17.00%	8.500%
Total	20,00,000	1.00	WACC	12.862%

(b) Calculation of Weighted Average Cost of Capital by Using Market Value Weight

<i>Particular</i>	<i>Market value</i>	<i>Weight</i>	<i>Cost (K)</i>	<i>Weighted cost</i>
11% Debenture	8,80,000	0.265	7.70%	2.041%
12% Preference share	2,40,000	0.072	12.82%	0.923%
Equity Share Capital	22,00,000	0.663	17.00%	11.271%
Total	33,20,000	1.000	WACC	14.235%

Working notes:

$$K_e = \frac{D_1}{P_0 - F} + g = \frac{2}{22 - 2} + 0.07 = 17\%$$

$$K_d = \frac{I(1-t) + \left(\frac{RV - NP}{n}\right)}{\frac{RV + NP}{2}} \times 100 = \frac{11(1 - 0.35) + \left(\frac{100 - 96}{10}\right)}{\frac{100 + 96}{2}} \times 100 = 7.70\%$$

$$K_p = \frac{PD + \left(\frac{RV - NP}{n}\right)}{\frac{RV + NP}{2}} \times 100 = \frac{12 + \left(\frac{100 - 95}{10}\right)}{\frac{100 + 95}{2}} \times 100 = 12.82\%$$

BQ 38

Calculate the WACC using the following data by using:

- (a) Book value weights
- (b) Market value weights

The capital structure of the company is as under:

Debentures (₹100 per debenture)	₹5,00,000
Preference shares (₹100 per share)	₹5,00,000
Equity shares (₹10 per share)	₹10,00,000

The market prices of these securities are:

Debentures	₹105 per debenture
Preference shares	₹110 per share
Equity shares	₹24 each

Additional information:

- (i) ₹100 per debenture redeemable at par, 10% coupon rate, 4% flotation cost, 10 years of maturity. The market price per debenture is ₹105.
- (ii) ₹100 per preference share redeemable at par, 5% coupon rate, 2% flotation cost, 10 years of maturity.
- (iii) Equity share has ₹4 flotation cost and market price per share of ₹24.

The next year expected dividend is ₹1 per share with annual growth of 5%. The firm has a practice of paying all earnings in the form of dividends. Corporate tax rate is 30%. Use YTM method to calculate cost of debentures and preference shares.



Answer

(a) Calculation of Weighted Average Cost of Capital by Using Book Value Weight

Particular	Book Value	Weight	Cost (K)	Weighted cost
10% Debenture	5,00,000	0.25	6.89%	1.72%
5% Preference share	5,00,000	0.25	4.09%	1.02%
Equity Share Capital	10,00,000	0.50	10.00%	5.00%
Total	20,00,000	1.00	WACC	7.74%

(b) Calculation of Weighted Average Cost of Capital by Using Market Value Weight

Particular	Market value	Weight	Cost	Weighted cost
10% Debenture	5,25,000	0.151	6.89%	1.04%
5% Preference share	5,50,000	0.158	4.09%	0.65%
Equity Share Capital	24,00,000	0.691	10.00%	6.90%
Total	34,75,000	1.000	WACC	8.59%

Working notes:

$$(a) \quad K_e = \frac{D_1}{P_0 - F} + g = \frac{1}{24 - 4} + 0.05 = 10\%$$

(b) Cost of Debt (K_d):

Calculation of IRR/ K_d

$$\begin{aligned} \text{IRR}/K_d &= \text{LR} + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times (\text{H} - \text{L}) = 5\% + \frac{14.65}{14.65 - (-0.83)} \times (7\% - 5\%) \\ &= 6.89\% \end{aligned}$$

Calculation of NPV at discount rate of 5% and 7%

Year	Cash Flow	Present Value		Present Value	
		5%	DCF	7%	DCF
0	105 - 4% of 105	1.000	(100.80)	1.000	(100.80)
1 - 10	10 (1 - 0.30)	7.722	54.05	7.024	49.17
10	100	0.614	61.40	0.508	50.80
NPV			+14.65		-0.83

(c) Cost of Preference shares (K_p):

Calculation of IRR/ K_d

$$\begin{aligned} \text{IRR}/K_d &= \text{LR} + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times (\text{H} - \text{L}) = 3\% + \frac{9.25}{9.25 - (-7.79)} \times (5\% - 3\%) \\ &= 4.09\% \end{aligned}$$

Calculation of NPV at discount rate of 3% and 5%

Year	Cash Flow	Present Value		Present Value	
		3%	DCF	5%	DCF
0	110 - 2% of 110	1.000	(107.80)	1.000	(107.80)
1 - 10	5	8.530	42.65	7.722	38.61
10	100	0.744	74.40	0.614	61.40
NPV			+9.25		-7.79

BQ 39

Determine the cost of capital of Best Luck Limited using the book value (BV) and market value (MV) weights from the following information:

<i>Sources of Fund</i>	<i>Book Value</i>	<i>Market Value</i>
Equity Shares	₹1,20,00,000	₹2,00,00,000
Retained Earnings	₹30,00,000	Nil
Preference Shares	₹36,00,000	₹33,75,000
Debentures	₹9,00,000	₹10,40,000

Additional Information:

- Equity:** Equity shares are quoted at ₹130 per share and a new issue priced at ₹125 per share will be fully subscribed; flotation costs will be ₹5 per share.
- Dividend:** During the previous 5 years, dividends have steadily increased from ₹10.60 to ₹14.19 per share. Dividend at the end of the current year is expected to be ₹15 per share.
- Preference Shares:** 15% Preference shares with face value of ₹100 would realise ₹105 per share.
- Debentures:** The company proposes to issue 11 year 15% debentures but the yield on debentures of similar maturity and risk class is 16%; flotation cost is 2%.
- Tax:** Corporate tax rate is 35%. Ignore dividend tax.

Floatation cost would be calculated on face value.

Answer

(a) Calculation of Weighted Average Cost of Capital by Using Book Value Weight

<i>Particulars</i>	<i>Book Value</i>	<i>Weight (W)</i>	<i>Cost (K)</i>	<i>Weighted cost</i>
Equity Shares	₹1,20,00,000	0.615	0.1850	0.1138
Retained Earnings	₹30,00,000	0.154	0.1800	0.0277
Preference Shares	₹36,00,000	0.185	0.1429	0.0264
Debentures	₹9,00,000	0.046	0.1095	0.0050
Total	₹1,95,00,000	1.000	WACC	0.1729

(b) Calculation of Weighted Average Cost of Capital by Using Market Value Weight

<i>Particulars</i>	<i>Market Value</i>	<i>Weight (W)</i>	<i>Cost (K)</i>	<i>Weighted cost</i>
*Equity Shares	₹1,60,00,000	0.655	0.1850	0.1212
*Retained Earnings	₹40,00,000	0.164	0.1800	0.0295
Preference Shares	₹33,75,000	0.138	0.1429	0.0197
Debentures	₹10,40,000	0.043	0.1095	0.0047
Total	₹2,44,15,000	1.000	WACC	0.1751

Working notes:

$$K_e = \frac{D_1}{P_0 - F} + g = \frac{15}{125 - 5} + 6\% = 18.50\%$$

$$g = \sqrt[5]{\frac{14.19}{10.60}} = 6\%$$



$$K_r = \frac{D_1}{P_0} + g = \frac{15}{125} + 6\% = 18\%$$

$$K_d = \frac{I(1-t) + \left(\frac{RV-NP}{n}\right)}{\frac{RV+NP}{2}} \times 100 = \frac{15(1-0.35) + \left(\frac{100-91.75}{11}\right)}{\frac{100+91.75}{2}} \times 100 = 10.95\%$$

$$K_p = \frac{PD}{NP} \times 100 = \frac{15}{105} \times 100 = 14.29\%$$

$$\text{MV of Debenture} = \frac{\text{Interest}}{\text{Market rate of Interest}} = \frac{15\% \text{ of } 100}{16\%} \times 100 = ₹93.75$$

$$\begin{aligned} \text{NP of Debenture} &= \text{MV of Debenture} - \text{Floatation Cost} \\ &= ₹93.75 - ₹2 (2\% \text{ of } ₹100) = ₹91.75 \end{aligned}$$

*Since yield on similar type of debentures is 16 per cent, the company would be required to offer debentures at discount.

$$\begin{aligned} \text{Market value of Equity Shares} &= ₹2,00,00,000 \times 120/150 = ₹1,60,00,000 \\ \text{Market value of Retained Earnings} &= ₹2,00,00,000 \times 30/150 = ₹40,00,000 \end{aligned}$$

*Market Value of equity has been apportioned in the ratio of Book Value of equity and retained earnings.

BQ 40

Kalyanam Ltd. has an operating profit of ₹34,50,000 and has employed Debt which gives total Interest Charge of ₹7,50,000. The firm has an existing Cost of Equity and Cost of Debt as 16% and 8% respectively. The firm has a new proposal before it, which requires funds of ₹75 Lakhs and is expected to bring an additional profit of ₹14,25,000. To finance the proposal, the firm is expecting to issue an additional debt at 8% and will not be issuing any new equity shares in the market. Assume no tax culture.

You are required to calculate the Weighted Average Cost of Capital (WACC) of Kalyanam Ltd.:

- (a) Before the new Proposal
- (b) After the new Proposal.

Answer

$$\begin{aligned} (1) \quad \text{Value of Debt} &= \frac{\text{Interest}}{\text{Cost of debt } (K_d)} = \frac{7,50,000}{8\%} \\ &= ₹93,50,000 \end{aligned}$$

$$\begin{aligned} (2) \quad \text{Value of Equity Capital} &= \frac{\text{Operating Profit} - \text{Interest}}{\text{Cost of equity } (K_e)} = \frac{34,50,000 - 7,50,000}{16\%} \\ &= ₹1,68,75,000 \end{aligned}$$

$$\begin{aligned} (3) \quad \text{New cost of Equity after proposal:} &= \frac{\text{Operating Profit} - \text{Interest}}{\text{Equity Capital}} \\ &= \frac{34,50,000 + 14,25,000 - 7,50,000 - 8\% \text{ of } 75,00,000}{1,68,75,000} = 20.90\% \end{aligned}$$

(a) Calculation of WACC Before the New Proposal

<i>Particulars</i>	<i>Book Value</i>	<i>Weight (W)</i>	<i>Cost (K)</i>	<i>Weighted cost</i>
Equity Shares	₹1,68,75,000	0.6429	0.16	0.1029
Debt	₹93,75,000	0.3571	0.08	0.0286
Total	₹2,62,50,000	1.000	WACC	0.1315

(b) Calculation of WACC After the New Proposal

<i>Particulars</i>	<i>Book Value</i>	<i>Weight (W)</i>	<i>Cost (K)</i>	<i>Weighted cost</i>
Equity Shares	₹1,68,75,000	0.5	0.209	0.1045
Debt (₹93,75,000 + ₹75,00,000)	₹1,68,75,000	0.5	0.080	0.0400
Total	₹3,37,50,000	1.0	WACC	0.1445

MARGINAL WEIGHTED AVERAGE COST OF CAPITAL (MACC)

BQ 41

Bulldog Ltd. has a debt of 14% in the past. It can raise a fresh debt at 12.5%. The company is in a tax bracket of 35%. Bulldog Ltd. plans to follow dividend discount model to estimate the cost of equity. The company plans to pay ₹4 per share as dividends in the next year. The DPS of the company is expected to grow at the rate of 8% p.a. The current MPS of the company's equity shares is ₹40.

You are required to compute the marginal weighted average cost of capital if the target debt to value ratio of the company is 20%.

Answer

$$\text{Marginal WACC} = K_e W_e + K_d W_d = 18\% \times 0.80 + 8.125\% \times 0.20 = \mathbf{16.025\%}$$

Calculation of Marginal K_e and K_d

$$K_e = \frac{D_1}{P_0} + g = \frac{4}{40} + .08 = 18\%$$

$$K_d = I(1 - t) = 12.50\% (1 - 0.35) = 8.125\%$$

BQ 42

ABC Ltd. has the following capital structure, which is considered to be optimum at on 31st March, 2022:

14% debenture	₹30,000
11% preference share capital	₹10,000
Equity share capital (10,000 shares)	₹1,60,000

The company's share has a current market price of ₹23.60 per share. The expected dividend per share in next year is 50 percent of the 2021 EPS. The EPS of last 10 years is as follows. The past trends are expected to continue:

<i>Year</i>	<i>2012</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>	<i>2016</i>	<i>2017</i>	<i>2018</i>	<i>2019</i>	<i>2020</i>	<i>2021</i>
EPS (₹)	1.00	1.10	1.21	1.33	1.46	1.61	1.77	1.95	2.15	2.36

The company issued new debentures carrying 16% rate of interest and the current market price of debenture is ₹96. Preference shares ₹9.20 (with dividend of ₹1.1 per share) were also issued. The company is in 50% tax bracket.



- (i) Calculate the after tax (a) Cost of New Debts, (b) Cost of New Preference Share, and (c) Cost of New Equity Share (assuming new equity from retained earnings).
- (ii) Calculate the marginal cost of capital when no new share was issued.
- (iii) Determine the amount that can be spent for capital investment before new ordinary shares must be sold. Assuming that retained earnings for next year's investment are 50% of 2021.
- (iv) Compute marginal cost of capital when the fund exceeds the amount calculated in (iii), assuming new equity is issued at ₹20 per share?

Answer

(i) (a) After tax cost of new debt

$$K_d = \frac{I(1-t)}{NP} \times 100 = \frac{16(1-.50)}{96} \times 100 = 8.33\%$$

(b) After tax cost of new preference shares

$$K_p = \frac{PD}{NP} \times 100 = \frac{1.10}{9.20} \times 100 = 11.96\%$$

(c) Cost of new equity or cost of retained earnings

$$K_r = \frac{D_1}{P_0(\text{old})} + g = \frac{2.36 \times 50\%}{23.60} + 0.10 = 15\%$$

(ii) MCC (K_o) when no new equity share was issued:

$$K_d W_d + K_p W_p + K_r W_r = 8.33\% \times .15 + 11.96\% \times .05 + 15\% \times .80 = 13.85\%$$

(iii) The company can pay the following amount before issue of new shares:

$$\text{Equity (retained earnings in this case)} = 80\% \text{ of the total capital}$$

$$\text{Therefore, investment before new issue} = \frac{11,800}{80\%} = ₹14,750$$

$$\text{Retained earnings} = ₹2.36 \times 50\% \times 10,000 = ₹11,800$$

(iv) MCC (K_o) when funds exceeds ₹14,750

$$K_d W_d + K_p W_p + K_e W_e = 8.33\% \times .15 + 11.96\% \times .05 + 15.90\% \times .80 = 14.57\%$$

If the company pay more than ₹14,750, it will have to issue new shares. The cost of new issue of ordinary share is:

$$K_e = \frac{D_1}{P_0(\text{new})} + g = \frac{1.18}{20} + 0.10 = 15.90\%$$

WN: Calculation of growth:

$$\text{Growth from year 2012 to 2013} = (1.10 - 1.00) \div 1.00 = 10\%$$

[Same rate of growth is found in future years]

BQ 43

M/s Navya Corporation has a capital structure of 40% debt and 60% equity. The company is presently considering several alternative investment proposals costing less than ₹20,00,000. The corporation always raises the required funds without disturbing its present debt equity ratio. The cost of raising the debt and equity are as under:

<i>Project cost</i>	<i>Cost of debt</i>	<i>Cost of equity</i>
Upto ₹2,00,000	10%	12%
Above ₹2,00,000 & upto ₹5,00,000	11%	13%
Above ₹5,00,000 & upto ₹10,00,000	12%	14%
Above ₹10,00,000 & upto ₹20,00,000	13%	14.5%

Assuming tax rate at 50%, calculate:

- (a) Cost of capital of two projects X and Y whose funds requirements are ₹6,50,000 and ₹14,00,000 respectively.
- (b) If a project is expected to give after tax return of 10%, determine under what conditions it would be acceptable?

Answer

(a) Statement Showing Weighted Average Cost of Capital

<i>Project cost</i>	<i>Financing</i>	<i>Weight (W)</i>	<i>Cost (K)</i>	<i>Weighted cost</i>
Upto ₹2,00,000	Debt	0.4	10% (1 - 0.50) = 5%	2.00%
	Equity	0.6	12%	7.20%
				9.20%
Above ₹2,00,000 & upto ₹5,00,000	Debt	0.4	11% (1 - 0.50) = 5.5%	2.20%
	Equity	0.6	13%	7.80%
				10.00%
Above ₹5,00,000 & upto ₹10,00,000	Debt	0.4	12% (1 - 0.50) = 6%	2.40%
	Equity	0.6	14%	8.40%
				10.80%
Above ₹10,00,000 & upto ₹20,00,000	Debt	0.4	13% (1 - 0.50) = 6.5%	2.60%
	Equity	0.6	14.50%	8.70%
				11.30%

<i>Project</i>	<i>Fund requirement</i>	<i>Cost of capital</i>
Project X	₹6,50,000	10.80%
Project Y	₹14,50,000	11.30%

- (b) If a project is expected to give after tax return of 10%, it would be acceptable provided its cost does not exceeds 5,00,000 or, after tax return should be more than or at least equal to the weighted average cost of capital.



PAST YEAR QUESTIONS

PYQ 1

The following details are provided by GPS Limited:

Equity Share capital	₹65,00,000
12% Preference Share Capital	₹12,00,000
15% Redeemable Debentures	₹20,00,000
10% Convertible Debentures	₹8,00,000

The cost of equity capital for the company is 16.30% and Income Tax rate for the company is 30%.

You are required to calculate the Weighted Average Cost of Capital (WACC) of the company.

[(5 Marks) May 2014]

Answer

$$\begin{aligned} \text{WACC} &= K_e W_e + K_p W_p + K_{rd} W_{rd} + K_{cd} W_{cd} \\ &= 16.30\% \times \frac{65}{105} + 12\% \times \frac{12}{105} + 10.50\% \times \frac{20}{105} + 7\% \times \frac{8}{105} = \mathbf{13.9952\%} \end{aligned}$$

Working Notes:

(i) Calculation of cost of Preference Share Capital (K_p):

$$K_p = \text{Rate of Preference Dividend} = \mathbf{12\%}$$

(ii) Calculation of cost of Redeemable Debentures (K_{rd}):

$$K_{rd} = I(1 - t) = 15\%(1 - 0.30) = \mathbf{10.50\%}$$

(iii) Calculation of cost Convertible Debentures (K_{cd}):

$$K_{cd} = I(1 - t) = 10\%(1 - 0.30) = \mathbf{7\%}$$

PYQ 2

A Ltd. wishes to raise additional finance of ₹30 lakhs for meeting its investment plans. The company has ₹6,00,000 in the form of retained earnings available for investment purposes. The following are the further details:

Debt equity ratio	:	30 : 70
Cost of debt:		
Upto ₹3,00,000	:	11% (before tax) and
Beyond ₹3,00,000	:	14% (before tax)
Earning per share	:	₹15 per share
Dividend payout	:	70% of earnings
Expected growth rate	:	10%
Current market price	:	₹90 per share
Company's tax rate	:	30%
Shareholder's personal tax rate	:	20%.

You are required to:

1. Calculate the post tax average cost of additional debt.
2. Calculate the cost of retained earnings and cost of equity.
3. Calculate the overall weighted average (after tax) cost of additional finance.

[(8 Marks) May 2015]

Answer

Total capital required is ₹30 lakhs. With a debt - equity ratio of 30 : 70. It means ₹9 lakhs is to be raised through debt and ₹21 lakhs through equity. Out of ₹21 lakhs, ₹6 lakhs are available in the form of retained earnings hence ₹15 lakhs will have to raise by issuing equity shares.

1. Post tax average cost of additional debt:

$$\begin{aligned}
 K_{d1} &= I(1-t) = 11\%(1-0.30) = 7.70\% \\
 K_{d2} &= I(1-t) = 14\%(1-0.30) = 9.80\% \\
 \text{Average } K_d &= K_{d1}W_{d1} + K_{d2}W_{d2} = 7.7\% \times \frac{3}{9} + 9.8\% \times \frac{6}{9} = 9.10\%
 \end{aligned}$$

2. Cost of retained earning & cost of equity:

$$\begin{aligned}
 K_e &= \frac{D_1}{P_0} + g = \frac{10.50 + 10\%}{90} + 0.10 = 22.83\% \\
 K_r &= K_e(1-PT) = 22.83\%(1-.20) = 18.27\% \\
 D_0 &= ₹15 \times 70\% = ₹10.50
 \end{aligned}$$

3. Overall cost of additional finance:

$$\begin{aligned}
 K_o &= K_eW_e + K_rW_r + K_dW_d \\
 &= 22.83\% \times \frac{15}{30} + 18.27\% \times \frac{6}{30} + 9.10\% \times \frac{9}{30} = 17.80\%
 \end{aligned}$$

Assumption: DPS ₹10.50 is treated as D_0 .

PYQ 3

A company issues 25,000, 14% debentures of ₹1,000 each. The debentures are redeemable after the expiry period 5 years. Tax rate applicable to the company is 35%.

Calculate the cost of debt after tax if debentures are issued at 5% discount with 2% flotation cost. [(5 Marks) Nov 2015]

Answer

$$\begin{aligned}
 K_d &= \frac{I(1-t) + \left(\frac{RV - NP}{n}\right)}{\frac{RV + NP}{2}} \times 100 = \frac{140(1-0.35) + \left(\frac{1000 - 930}{5}\right)}{\frac{1000 + 930}{2}} \times 100 \\
 &= 10.88\%
 \end{aligned}$$

$$\text{Net Proceeds} = 1,000 - 5\% \text{ Discount} - 2\% \text{ Flotation cost} = 930$$

Note: Flotation cost has been calculated on the basis of face value (i.e. 2% of ₹1,000 or ₹950 whichever is higher).



PYQ 4

The X Company has following capital structure at 31st March, 2015, which is considered to be optimum:

14% debenture	₹3,00,000
11% preference share capital	₹1,00,000
Equity share capital (1,00,000 shares)	₹16,00,000

The company's share has a current market price of ₹23.60 per share. The expected dividend per share in next year is 50 percent of the 2015 EPS. The EPS of last 10 years is as follows. The past trends are expected to continue:

Year	2006	2007	2008	2009	2010	2011	2012	2013	2015	2015
EPS (₹)	1.00	1.10	1.21	1.33	1.46	1.61	1.77	1.95	2.15	2.36

The company issued new debentures carrying 16% rate of interest and the current market price of debenture is ₹96. Preference shares ₹9.20 (with dividend of ₹1.1 per share) were also issued. The company is in 50% tax bracket.

- (i) Calculate the after tax cost of (a) New Debts, (b) New Preference Share, and (c) New Equity Share (assuming new equity from retained earnings).
- (ii) Calculate the marginal cost of capital when no new share was issued.
- (iii) How much can be spent for capital investment before new ordinary shares must be sold? Assuming that retained earnings for next year's investment are 50% of 2015.
- (iv) What will be marginal cost of capital when the fund exceeds the amount calculated in (iii), assuming new equity is issued at ₹20 per share?

[(8 Marks) May 2016]

Answer

(i) (a) After tax cost of new debt

$$K_d = \frac{I(1-t)}{NP} \times 100 = \frac{16(1-.50)}{96} \times 100 = 8.33\%$$

(b) After tax cost of new preference shares

$$K_p = \frac{PD}{NP} \times 100 = \frac{1.10}{9.20} \times 100 = 11.96\%$$

(a) Cost of new equity or cost of retained earnings

$$K_r = \frac{D_1}{P_0(\text{old})} + g = \frac{2.36 \times 50\%}{23.60} + 0.10 = 15\%$$

(ii) MCC (K_o) when no new equity share was issued:

$$K_d W_d + K_p W_p + K_r W_r = 8.33\% \times .15 + 11.96\% \times .05 + 15\% \times .80 = 13.85\%$$

(iii) The company can pay the following amount before issue of new shares:

$$\text{Equity (retained earnings in this case)} = 80\% \text{ of the total capital}$$

$$\text{Therefore, investment before new issue} = \frac{1,18,000}{80\%} = \text{₹1,47,500}$$

$$\text{Retained earnings} = ₹2.36 \times 50\% \times 1,00,000 = \text{₹1,18,000}$$

(iv) MCC (K_o) when funds exceeds ₹1,47,500

$$K_d W_d + K_p W_p + K_e W_e = 8.33\% \times .15 + 11.96\% \times .05 + 15.90\% \times .80 = 14.57\%$$

If the company pay more than ₹1,47,500, it will have to issue new shares. The cost of new issue of ordinary share is:

$$K_e = \frac{D_1}{P_0(\text{new})} + g = \frac{1.18}{20} + 0.10 = 15.90\%$$

WN: Calculation of growth:

$$\text{Growth from year 2006 to 2007} = (1.10 - 1.00) \div 1.00 = 10\%$$

[Same rate of growth is found in future years]

PYQ 5

ABC Company's equity share is quoted in the market at ₹25 per share currently. The company pays a dividend of ₹2 per share and the investor's market expects a growth rate of 6% per year.

You are required to:

- (i)** Calculate the company's cost of equity capital.
- (ii)** If the anticipated growth rate is 8% per annum, calculate the indicated market price per share.
- (iii)** If the company issues 10% debentures of face value of ₹100 each and realises ₹96 per debenture while the debentures are redeemable after 12 years at a premium of 12%, what will be the cost of debenture? Assume Tax Rate to be 50%.

[[5 Marks] Nov 2016]

Answer

$$\text{(i) } K_e = \frac{D_1}{P_0} + g = \frac{2}{25} + 0.06 = 14\%$$

Note: The cost of equity can be calculated with taking the effect of growth on dividend (i.e. D₁ = 2.12).

$$\text{(ii) } P_0 = \frac{D_1}{K_e - g} = \frac{2}{14\% - 8\%} = \text{₹33.33}$$

$$\begin{aligned} \text{(iii) } K_d &= \frac{I(1-t) + \left(\frac{RV - NP}{n}\right)}{\frac{RV + NP}{2}} \times 100 = \frac{10(1-0.50) + \left(\frac{112 - 96}{12}\right)}{\frac{112 + 96}{2}} \times 100 \\ &= 6.089\% \end{aligned}$$

PYQ 6

Following is the capital structure of RBT Ltd. As on 31st March 2016:

<i>Sources of Fund</i>	<i>Book Value</i>	<i>Market Value</i>
------------------------	-------------------	---------------------



Equity Share of ₹10 each	₹50,00,000	₹1,05,00,000
Retained Earnings	₹13,00,000	Nil
11% Preference Share of ₹100 each	₹7,00,000	₹9,00,000
14% Debentures of ₹100 each	₹30,00,000	₹36,00,000

Market price of equity shares is ₹40 per share and it is expected that a dividend of ₹4 per share would be declared. The dividend per share is expected to grow at the rate of 8% every year. Income tax rate applicable to the company is 40% and shareholder's personal income tax rate is 20%.

You are required to calculate:

- (i) Cost of capital for each source of capital,
- (ii) Weighted average cost of capital on the basis of book value weights,
- (iii) Weighted average cost of capital on the basis of market value weights.

[[8 Marks] Nov 2016]

Answer

(i) Calculation of cost of capital for each source of capital:

$$\begin{aligned}
 K_e &= \frac{D_1}{P_0} + g = \frac{4}{40} + 0.08 = 18\% \\
 K_r &= K_e (1 - PT) = 18\% (1 - 0.20) = 14.40\% \\
 K_d &= I (1 - t) = 14\% (1 - 0.40) = 8.40\% \\
 K_p &= \text{Rate of PD} = 11\%
 \end{aligned}$$

(ii) Calculation of WACC (K_o) using book value proportions

Name of Source	Amount	Proportion	K	K _o
Equity Share Capital	50,00,000	0.50	18%	9.00%
Retained Earnings	13,00,000	0.13	14.40%	1.87%
Preference Share Capital	7,00,000	0.07	11%	0.77%
Debentures	30,00,000	0.30	8.40%	2.52%
Total	1,00,00,000	1.00	WACC	14.16%

(iii) Calculation of WACC (K_o) using market value proportions

Name of Source	Amount	Proportion	K	K _o
Equity Share Capital	83,33,333	0.555	18%	9.99%
Retained Earnings	21,66,667	0.145	14.40%	2.09%
Preference Share Capital	9,00,000	0.060	11%	0.66%
Debentures	36,00,000	0.240	8.40%	2.02%
Total	1,50,00,000	1.000	WACC	14.76%

Market value of Equity Share Capital = ₹1,05,00,000 × 50/63 = ₹83,33,333

Market value of Retained Earnings = ₹1,05,00,000 × 13/63 = ₹21,66,667

*Market Value of equity has been apportioned in the ratio of Book Value of equity and retained earnings.

PYQ 7

JC Ltd. is planning an equity issue in current year. It has an earning per share (EPS) of ₹20 and proposes to pay 60% dividend at the current year end with a P/E ratio 6.25, it wants to offer the issue at market price. The flotation cost is expected to be 4% of the issue price.

You are required to determine rate of return for equity share (cost of equity) before the issue and after the issue.

[(5 Marks) May 2018]

Answer

Market price of share (P ₀)	=	EPS × PE	=	₹20 × 6.25	=	₹125
Net proceeds	=	125 - 4%	=		=	₹120
Return on Equity (ROE)	=	1/PE	=	1/6.25	=	16%
Growth rate	=	r × b	=	16% × 40%	=	6.40%
K _e (before issue)	=	$\frac{D_1}{P_0} + g$	=	$\frac{60\% \text{ of } 20}{125} + 6.40\%$	=	16%
K _e (after issue)	=	$\frac{D_1}{NP} + g$	=	$\frac{60\% \text{ of } 20}{120} + 6.40\%$	=	16.40%

PYQ 8

Alpha Ltd. has furnished the following information:

Earning per share (EPS)	:	₹4.00
Dividend payout ratio	:	25%
Market price per share	:	₹50
Rate of tax	:	30%
Growth rate of dividend	:	10%

The company wants to raise additional capital of ₹10 lakhs including debt of ₹4 lakhs. The cost of debt (before tax) is 10% upto ₹2 lakhs and 15% beyond that.

Compute the after tax cost equity and debt and the weighted average cost of capital.

[(5 Marks) May 2019]

Answer

K _e	=	$\frac{D_1}{P_0} + g$	=	$\frac{4.00 \times 25\% \times 110\%}{50} + 0.10$	=	12.20%
K _{d1}	=	I (1 - t)	=	10% (1 - 0.30)	=	7%
K _{d2}	=	I (1 - t)	=	15% (1 - 0.30)	=	10.50%
K _o	=	K _e W _e + K _{d1} W _{d1} + K _{d2} W _{d2}				
	=	$12.20\% \times \frac{6}{10} + 7\% \times \frac{2}{10} + 10.50\% \times \frac{2}{10}$			=	10.82%

PYQ 9

A company wants to raise additional finance of ₹5 crore in next year. The company expected to retain



₹1 crore in next year. Further details are as follows:

- (i) The amount will be raised by equity and debt in the ratio of 3 : 1.
- (ii) The additional issue of equity shares will result in price per share being fixed at ₹25.
- (iii) The debt capital raised by way of term loan will cost 10% for the first ₹75 lakh and 12% for the next ₹50 lakh.
- (iv) The net expected dividend on equity shares is ₹2.00 per share. The dividend is expected to grow at the rate of 5%.
- (v) Income tax rate of 25%.

You are required:

- (a) To determine the amount of equity and debt for raising additional finance.
- (b) To determine the post tax average cost of additional debt.
- (c) To determine the cost of retained earning and cost of equity.
- (d) To compute the overall weighted average cost of additional finance after tax.

[[10 Marks] Nov 2019]

Answer

(a) Total capital required is ₹5 crore. With a debt-equity ratio of 1:3. It means ₹1.25 crore is to be raised through debt and ₹3.75 crores through equity. Out of ₹3.75 crore, ₹1 crore are available in the form of retained earnings hence ₹2.75 crore will have to raise by issuing equity shares.

(b) **Post tax average cost of additional debt:**

$$\begin{aligned}
 K_{d1} &= I(1-t) = 10\%(1-0.25) = 7.5\% \\
 K_{d2} &= I(1-t) = 12\%(1-0.25) = 9\% \\
 \text{Average } K_d &= K_{d1}W_{d1} + K_{d2}W_{d2} = 7.5\% \times \frac{75}{125} + 9\% \times \frac{50}{125} = 8.10\%
 \end{aligned}$$

(c) **Cost of retained earning & cost of equity:**

$$\begin{aligned}
 K_e &= \frac{D_1}{P_0} + g = \frac{2}{25} + 0.05 = 13\% \\
 K_r &= K_e = 13\%
 \end{aligned}$$

(d) **Overall cost of additional finance:**

$$\begin{aligned}
 K_o &= K_eW_e + K_rW_r + K_dW_d \\
 &= 13\% \times \frac{275}{500} + 13\% \times \frac{100}{500} + 8.10\% \times \frac{125}{500} = 11.78\%
 \end{aligned}$$

PYQ 10

TT Ltd. issued 20,000, 10% Convertible debentures of ₹100 each with a maturity period of 5 years. At maturity the debenture holders will have the option to convert the debentures into equity shares of the company in the ratio of 1:5 (5 shares for each debenture). The current market price of the equity shares is ₹20 each and historically the growth rate of the shares are 4% per annum. Assuming tax rate is 25%.

Compute the cost of 10% debentures using Approximation Method and Internal Rate of Return Method.

PV Factor are as under:

<i>Year</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
<i>PV Factor @ 10%</i>	0.909	0.826	0.751	0.683	0.621
<i>PV Factor @ 15%</i>	0.870	0.756	0.658	0.572	0.497

[(5 Marks) Nov 2020]

Answer

(a) Calculation of Cost of Convertible debenture using Approximation Method:

$$K_d = \frac{1(1-t) + \frac{CV-NP}{n}}{\frac{CV+NP}{2}} \times 100 = \frac{10(1-0.25) + \frac{121.67-100}{5}}{\frac{121.67+100}{2}} \times 100 = 10.68\%$$

(b) Calculation of Cost of Convertible debenture using IRR Method

Calculation of NPV at two discount rates:

<i>Year</i>	<i>Cash Flow</i>	<i>Present Value</i>		<i>Present Value</i>	
		<i>10%</i>	<i>DCF</i>	<i>15%</i>	<i>DCF</i>
0	(100)	1.000	(100)	1.000	(100)
1 - 5	7.50	3.790	28.43	3.353	25.15
5	121.67	0.621	75.56	0.497	60.47
<i>NPV</i>			<i>+3.99</i>		<i>-14.38</i>

$$\begin{aligned} IRR/K_d &= LR + \frac{NPV_L}{NPV_L - NPV_H} \times (H - L) = 10\% + \frac{3.99}{3.99 - (-14.38)} \times (15\% - 10\%) \\ &= 11.09\% \end{aligned}$$

Determination of Convertible value:

Higher of:

- (i)* The cash value of debentures = ₹100
- (ii)* Value of equity shares = 5 shares × ₹20 (1 + 0.04)⁵
= 5 shares × ₹24.333 = ₹121.67

₹121.67 will be taken as redemption value as it is higher than the cash option and attractive to the investors.

PYQ 11

The capital structure of PQR Ltd. is as follows:

10% Debentures	₹3,00,000
12% Preference shares	₹2,50,000
Equity shares (face value ₹10 per share)	₹5,00,000

Additional information:

- (i)* ₹100 per debenture redeemable at par has 2% floatation cost & 10 years of maturity. The market price per debenture is ₹110.



- (ii) ₹100 per preference share redeemable at par has 3% floatation cost & 10 years of maturity. The market price per preference share is ₹108.
- (iii) Equity share has ₹4 floatation cost and market price per share of ₹25. The next year expected dividend is ₹2 per share with annual growth of 5%. The firm has a practice of paying all earnings in the form of dividends.
- (iv) Corporate Income tax rate is 30%.

Calculate Weighted Average Cost of Capital (WACC) using market value weights.
[(10 Marks) Jan 2021]

Answer

Calculation of Weighted Average Cost of Capital by Using Market Value Weight

Particular	Market value	Weight	Cost	Weighted cost
10% Debenture	3,30,000	0.178	7.27%	1.294%
12% Preference share	2,70,000	0.146	12.49%	1.823%
Equity Share Capital	12,50,000	0.676	14.52%	9.816%
Total	18,50,000	1.000	WACC	12.933%

Working notes:

1. Calculation of specific cost of various sources of funds:

$$K_e = \frac{D_1}{P_0 - F} + g = \frac{2}{25 - 4} + .05 = 14.52\%$$

$$K_d = \frac{I(1 - t) + \left(\frac{RV - NP}{n}\right)}{\frac{RV + NP}{2}} \times 100 = \frac{10(1 - 0.30) + \left(\frac{100 - 98}{10}\right)}{\frac{100 + 98}{2}} \times 100 = 7.27\%$$

$$K_p = \frac{PD + \left(\frac{RV - NP}{n}\right)}{\frac{RV + NP}{2}} \times 100 = \frac{12 + \left(\frac{100 - 97}{10}\right)}{\frac{100 + 97}{2}} \times 100 = 12.49\%$$

2. Calculation of market value of various sources of funds:

Debentures = 3,00,000 × 110/100 = 3,30,000

Preference shares = 2,50,000 × 108/100 = 2,70,000

Equity shares = 5,00,000 × 25/10 = 12,50,000

PYQ 12

Following are the information of TT Ltd.:

Particulars	
Earnings per share	₹10
Dividend per share	₹6
Expected growth rate in dividend	6%
Current market price per share	₹120
Tax rate	30%
Requirement of additional finance	₹30,00,000

Debt Equity ratio (for additional finance)	2 : 1
Cost of Debt:	
0 – 5,00,000	10%
5,00,001 – 10,00,000	9%
Above 10,00,000	8%

Assuming that there is no Reserve and Surplus available in TT Ltd.

You are required to:

- (a)** Find the pattern of finance for additional requirement.
- (b)** Calculate post tax average cost of additional debt.
- (c)** Calculate cost of equity.
- (d)** Calculate overall weighted average after tax cost of additional finance.

[[10 Marks) July 2021]

Answer

(a) Pattern for additional requirement: Total requirement of additional fund is ₹30,00,000. With a Debt Equity ratio of 2 : 1. It means ₹20,00,000 is to be raised through debt and ₹10,00,000 through equity. Out of ₹20,00,000 debt, first ₹5,00,000 @10%, next ₹5,00,000 @9% and remaining ₹10,00,000 @8%. Entire equity finance of ₹10,00,000 through issuing equity shares.

(b) Post tax average cost of additional debt:

$$\begin{aligned}
 K_{d1} &= I(1-t) = 10\%(1-0.30) = 7\% \\
 K_{d2} &= I(1-t) = 9\%(1-0.30) = 6.30\% \\
 K_{d3} &= I(1-t) = 8\%(1-0.30) = 5.60\% \\
 \\
 \text{Average } K_d &= K_{d1}W_{d1} + K_{d2}W_{d2} + K_{d3}W_{d3} \\
 &= 7\% \times 5/20 + 6.30\% \times 5/20 + 5.60\% \times 10/20 = 6.125\%
 \end{aligned}$$

(c) Cost of Equity:

$$K_e = \frac{D_1}{P_0} + g = \frac{6(1+0.06)}{120} + 0.06 = 11.30\%$$

(d) Overall WACC after tax of additional finance:

$$\begin{aligned}
 K_o &= K_eW_e + K_dW_d = 11.30\% \times \frac{10}{30} + 6.125\% \times \frac{20}{30} \\
 &= 7.85\%
 \end{aligned}$$

Assumption: DPS is treated at D_0 .

PYQ 13

Book value of capital structure of B Ltd. is as follows:

Sources	Amount
12% 6,000 Debentures @ ₹100 each	₹6,00,000
Retained earnings	₹4,50,000
4,500 Equity shares @ ₹100 each	₹4,50,000
	₹15,00,000



Currently the market value of debenture is ₹110 per debenture and equity share is ₹180 per share. The expected rate of return to equity shareholder is 24% p.a. Company is paying tax @30%.

Calculate WACC on the basis of market value weights.

[(5 Marks) Dec 2021]

Answer

Statement of WACC (Market Value Weights)

Capital Structure	Amount	Weight	Specific Cost	Cost of Capital
12% Debentures	6,60,000	0.449	0.0764	0.0343
Equity Fund including Retained earning	8,10,000	0.551	0.1333	0.0734
Total	14,70,000	1.000	WACC	0.1077

WACC (K_o) = 0.1077 or 10.77%

Working Notes:

(1) Calculation of Market Value:

Market value of debenture = $(\text{₹}6,00,000 \div \text{₹}100) \times \text{₹}110 = \text{₹}6,60,000$

Market value of Equity and Retained earnings:
= $(\text{₹}4,50,000 \div \text{₹}100) \times \text{₹}180 = \text{₹}8,10,000$

(2) Calculation of K_e :

$K_e = \frac{D_1}{P_0} \times 100 = \frac{24\% \text{ of } 100}{180} = 13.33\%$

(3) Calculation of K_d :

$K_d = \frac{I(1-t)}{NP} \times 100 = \frac{12\% \text{ of } 100(1-0.3)}{110} \times 100 = 7.64\%$

PYQ 14

A company issues:

- 15% convertible debentures of ₹100 each at par with a maturity period of 6 years. On maturity, each debenture will be converted into 2 equity shares of the company. The risk-free rate of return is 10%, market risk premium is 18% and beta of the company is 1.25. The company has paid dividend of ₹12.76 per share. Five year ago, it paid dividend of ₹10 per share. Flotation cost is 5% of issue amount.
- 5% preference shares of ₹100 each at premium of 10%. These shares are redeemable after 10 years at par. Flotation cost is 6% of issue amount.

Assuming corporate tax rate is 40%.

- (a)** Calculate the cost of convertible debentures using the approximation method.
- (b)** Use YTM method to calculate cost of preference shares.

<i>Year</i>	1	2	3	4	5	6	7	8	9	10
PVIF _{0.03,t}	0.971	0.943	0.915	0.888	0.863	0.837	0.813	0.789	0.766	0.744
PVIF _{0.05,t}	0.952	0.907	0.864	0.823	0.784	0.746	0.711	0.677	0.645	0.614
PVIFA _{0.03,t}	0.971	1.913	2.829	3.717	4.580	5.417	6.230	7.020	7.786	8.530
PVIFA _{0.05,t}	0.952	1.859	2.723	3.546	4.329	5.076	5.786	6.463	7.108	7.722

<i>Interest rate</i>	1%	2%	3%	4%	5%	6%	7%	8%	9%
FVIF _{i,5}	1.051	1.104	1.159	1.217	1.276	1.338	1.403	1.469	1.539
FVIF _{i,6}	1.062	1.126	1.194	1.265	1.340	1.419	1.501	1.587	1.677
FVIF _{i,7}	1.072	1.149	1.230	1.316	1.407	1.504	1.606	1.714	1.828

[(10 Marks) May 2022]

Answer

(a) Calculation of cost of Convertible Debentures using Approximation method:

$$K_d = \frac{I(1-t) + \frac{RV-NP}{n}}{\frac{RV+NP}{2}} \times 100 = \frac{15(1-0.40) + \frac{130.58-95}{6}}{\frac{130.58+95}{2}} \times 100 = \mathbf{13.24\%}$$

Working Notes:

Determination of Redemption value:

Higher of:

(i) The cash value of debentures = ₹100

(ii) Value of equity shares = 2 shares × ₹48.72 (1 + 0.05)⁶ = ₹130.58

₹130 will be taken as redemption value as it is higher than the cash option and attractive to the investors.

Calculation of Value of Share today:

$$P_0 = \frac{D_1}{K_e - g} = \frac{12.76(1+0.05)}{32.50\% - 5\%} = ₹48.72$$

$$K_e = R_f + \beta (R_m - R_f) = 10\% + 1.25 \times 18\% = 32.50\%$$

$$g = \sqrt[5]{\frac{12.76}{10.00}} = 5\% \text{ or}$$

$$g = 12.76 \div 10.00 = 1.276 \text{ (5\% for 5 year; given in interest rate table)}$$

(b) Calculation of Cost of Preference shares using YTM method::

Calculation of NPV at two discount rates:

<i>Year</i>	<i>Cash Flow</i>	<i>Present Value</i>		<i>Present Value</i>	
		3%	<i>DCF</i>	5%	<i>DCF</i>
0	103.40	1.000	(103.40)	1.000	(103.40)
1 - 10	5	8.530	42.65	7.722	38.61
10	100	0.744	74.40	0.614	61.40
NPV			+13.65		-3.39



$$\begin{aligned} \text{IRR}/K_d &= \text{LR} + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times (\text{H} - \text{L}) = 3\% + \frac{13.65}{13.65 - (-3.39)} \times (5\% - 3\%) \\ &= \mathbf{4.60\%} \end{aligned}$$

Working Note:

$$\begin{aligned} \text{Net Proceeds} &= \text{Issue Price} - \text{Flotation Cost} \\ &= (100 + 10\% \text{ Premium}) - 6\% = \mathbf{₹103.40} \end{aligned}$$

PYQ 15

The following is the extract of the Balance Sheet of M/s KD Ltd.:

<i>Particulars</i>	<i>Amount (₹)</i>
Ordinary shares (Face Value ₹10 per share)	5,00,000
Share Premium	1,00,000
Retained Profits	6,00,000
8% Preference Shares (Face Value ₹25 per share)	4,00,000
12% Debentures (Face value ₹100 each)	6,00,000
	22,00,000

The ordinary shares are currently priced at ₹39 ex-dividend and preference share is priced at ₹18 Cum-dividend. The debentures are selling at 120 percent ex-interest. The applicable tax rate to D Ltd. is 30 percent. KD Ltd.'s cost of equity has been estimated at 19 percent. Calculate the WACC (weighted average cost of capital) of KD Ltd. on the basis of market value.

[(5 Marks) Nov 2022]

Answer

Statement of WACC (Market Value Weights)

<i>Capital Structure</i>	<i>Amount</i>	<i>Weight</i>	<i>Specific Cost</i>	<i>Cost of Capital</i>
Ordinary Shares	8,12,500	0.278	0.190	0.0528
Share Prem & Retained Profits	11,37,500	0.389	0.190	0.0739
8% Preference Shares	2,56,000	0.087	0.125	0.0109
12% Debentures	7,20,000	0.246	0.070	0.0172
Total	29,26,000	1.000	WACC	0.1548

$$\text{WACC } (K_o) = \mathbf{0.1548 \text{ or } 15.48\%}$$

Working Notes:

(1) Calculation of Market Value:

Total Market value of Equity and Retained earnings:	=	(₹5,00,000 ÷ ₹10) × ₹39	=	₹19,50,000
Market Value of Equity	=	₹19,50,000 × 5/12	=	₹8,12,500
Market Value of Retained earnings	=	₹19,50,000 × 7/12	=	₹11,37,500
Market Value of Debentures	=	(₹6,00,000 ÷ ₹100) × ₹120	=	₹7,20,000
Market Value of Preference Shares	=	(₹4,00,000 ÷ ₹25) × ₹16*	=	₹2,56,000

*Market value of 1 Preference Share ex-dividend is used i.e. ₹16 (₹18 - 8% of ₹25).

(2) Calculation of K_r :

$$K_r = K_e = 19\%$$

(3) Calculation of K_d :

$$K_d = \frac{I(1-t)}{NP} \times 100 = \frac{12\% \text{ of } 100(1-0.3)}{120} \times 100 = 7\%$$

(4) Calculation of K_p :

$$K_p = \frac{PD}{NP} \times 100 = \frac{8\% \text{ of } 25}{16} \times 100 = 12.5\%$$

PYQ 16

MR Ltd. is having the following capital structure, which is considered to be optimum as on 31.03.2022.

Equity share capital (50,000 shares)	₹8,00,000
12% Pref. share capital	₹50,000
15% Debentures	₹1,50,000
	₹10,00,000

The earnings per share (EPS) of the company were ₹2.50 in 2021 and the expected growth in equity dividend is 10% per year. The next year's dividend per share (DPS) is 50% EPS of the year 2021. The current market price per share (MPS) is ₹25.00. The 15% new debentures can be issued by the company. The company's debentures are currently selling at ₹96 per debenture. The new 12% Pref. Share can be sold at a net price of ₹91.50 (face value ₹100 each). The applicable tax rate is 30%.

You are required to calculate:

- (i) After tax cost of
 - (a) New debt,
 - (b) New pref. share capital and
 - (c) Equity shares assuming that new equity shares come from retained earnings.
- (ii) Marginal cost of capital.
- (iii) How much can be spent for capital investment before sale of new equity shares assuming that retained earnings for next year investment is 50% of 2021?

[(6 Marks) Nov 2022]

Answer

(i) (a) After tax cost of new debt

$$K_d = \frac{I(1-t)}{NP} \times 100 = \frac{15(1-0.30)}{96} \times 100 = 10.94\%$$

(b) After tax cost of new preference shares

$$K_p = \frac{PD}{NP} \times 100 = \frac{12}{91.50} \times 100 = 13.11\%$$



(c) Cost of new equity or cost of retained earnings

$$K_r = \frac{D_1}{P_0} + g = \frac{2.50 \times 50\%}{25} + 0.10 = 15\%$$

(ii) Marginal cost of capital:

$$K_d W_d + K_p W_p + K_r W_r = 10.94\% \times .15 + 13.11\% \times .05 + 15\% \times .80 = 14.30\%$$

(iii) The company can pay the following amount before issue of new shares:

$$\text{Equity (retained earnings in this case)} = 80\% \text{ of the total capital}$$

$$\text{Therefore, investment before new issue} = \frac{62,500}{80\%} = ₹78,125$$

$$\text{Retained earnings} = ₹2.50 \times 50\% \times 50,000 \text{ shares} = ₹62,500$$

PYQ 17

Capital structure of D Ltd. as on 31st March, 2023 is given below.

<i>Particular</i>	<i>₹</i>
Equity share capital (₹10 each)	30,00,000
8% Preference share capital (₹100 each)	10,00,000
12% Debentures (₹100 each)	10,00,000

- Current market price of equity share is ₹80 per share. The company has paid dividend of ₹14.07 per share. Seven years ago, it paid dividend of ₹10 per share. Expected dividend is ₹16 per share.
- 8% Preference shares are redeemable at 6% premium after five years. Current market price per preference share is ₹104.
- 12% debentures are redeemable at 20% premium after 10 years, Flotation cost is ₹5 per debenture.
- The company is in 40% tax bracket.
- In order to finance an expansion plan, the company intends to borrow 15% Long-term loan of ₹30,00,000 from bank. This financial decision is expected to increase dividend on equity share from ₹16 per share to ₹18 per share. However, the market price of equity share is expected to decline from ₹80 to ₹72 per share, because investors' required rate of return is based on current market conditions.

Required:

- (a)** Determine the existing Weighted Average Cost of Capital (WACC) taking book value weights.
(b) Compute Weighted Average Cost of Capital (WACC) after the expansion plan taking book value weights.

<i>Interest Rate</i>	<i>1%</i>	<i>2%</i>	<i>3%</i>	<i>4%</i>	<i>5%</i>	<i>6%</i>	<i>7%</i>
FVIF _{i,5}	1.051	1.104	1.159	1.217	1.276	1.338	1.403
FVIF _{i,6}	1.062	1.126	1.194	1.265	1.340	1.419	1.501
FVIF _{i,7}	1.072	1.149	1.230	1.316	1.407	1.504	1.606

[(10 Marks) May 23]

Answer

(a) Calculation of Existing Weighted Average Cost of Capital by taking Book Value Weight

<i>Particulars</i>	<i>Book Value</i>	<i>Weight (W)</i>	<i>Cost (K)</i>	<i>Weighted cost</i>
Equity Shares	₹30,00,000	0.60	0.2500	0.1500
Preference Shares	₹10,00,000	0.20	0.0800	0.0160
Debentures	₹10,00,000	0.20	0.0902	0.0180
Total	₹50,00,000	1.00	WACC	0.1840

Existing WACC = **0.1840 or 18.40%**

(b) Calculation of Weighted Average Cost of Capital after expansion by taking Book Value Weight

<i>Particulars</i>	<i>Book Value</i>	<i>Weight (W)</i>	<i>Cost (K)</i>	<i>Weighted cost</i>
Equity Shares	₹30,00,000	0.375	0.3000	0.1125
Preference Shares	₹10,00,000	0.125	0.0800	0.0100
Debentures	₹10,00,000	0.125	0.0902	0.0113
Long Term Loan	₹30,00,000	0.375	0.9000	0.0338
Total	₹80,00,000	1.000	WACC	0.1676

Revised WACC = **0.1676 or 16.76%**

Working notes:

$$K_e = \frac{D_1}{P_0} + g = \frac{16}{80} + 5\% = 25\%$$

$$g = \sqrt[7]{\frac{14.07}{10}} - 1 = 5\%$$

or

$$g \text{ (FVIF}_{i,7}\text{)} = 14.07 \div 10 = 1.407 \text{ (} g = 5\% \text{ in table)}$$

$$K_p = \frac{PD + \left(\frac{RV-NP}{n}\right)}{\frac{RV+NP}{2}} \times 100 = \frac{8 + \left(\frac{106-104}{5}\right)}{\frac{106+104}{2}} \times 100 = 8\%$$

$$K_d = \frac{I(1-t) + \left(\frac{RV-NP}{n}\right)}{\frac{RV+NP}{2}} \times 100 = \frac{12(1-0.40) + \left(\frac{120-95}{10}\right)}{\frac{120+95}{2}} \times 100 = 9.02\%$$

$$K_e \text{ (Revised)} = \frac{D_1}{P_0} + g = \frac{18}{72} + 5\% = 30\%$$

$$K_{TL} = I(1-t) = 15\%(1-0.4) = 9\%$$

PYQ 18

Z Ltd. wishes to raise additional fund of ₹25,00,000 for meeting its investment plan. It has ₹5,25,000 in the form of retained earnings available for investment purposes. Further details are as following:

Combination of debt and equity	2:3
Cost of debt	
Upto ₹2,50,000	8% (before tax)
Above ₹2,50,000 and to upto ₹5,00,000	10% (before tax)
Beyond ₹5,00,000	12% (after tax)



Earning of company	₹50,00,000
Retention Ratio	40%
Expected growth of dividend	15%
Market price per share	₹500
Number of outstanding equity shares	1,00,000
Tax Rate	30%

You are required to calculate:

- (a) Cost of debt
- (b) Cost of retained earnings and cost of equity
- (c) Weighted average cost of capital

[[10 Marks) Nov 23]

Answer

Total capital required is ₹25 lakhs. With a debt-equity ratio of 2:3. It means ₹10 lakhs is to be raised through debt (₹2,50,000 @8% next ₹2,50,000 @10% and ₹5,00,000 @12%) and ₹15 lakhs through equity. Out of ₹15 lakhs, ₹5,25,000 are available in the form of retained earnings hence ₹9,75,000 lakhs will have to raise by issuing equity shares.

(a) Cost of debt:

$$K_{d1} = I(1 - t) = 8\% (1 - 0.30) = 5.60\%$$

$$K_{d2} = I(1 - t) = 10\% (1 - 0.30) = 7.00\%$$

$$K_{d3} = 12.00\% \text{ (after tax given)}$$

$$\text{Average } K_d = 5.6\% \times \frac{2.5}{10} + 7\% \times \frac{2.5}{10} + 12\% \times \frac{5}{10} = 9.15\%$$

(b) Cost of retained earning & cost of equity:

$$K_e = \frac{D_1}{P_0} + g = \frac{30 + 15\%}{500} + 0.15 = 21.90\%$$

$$K_r = K_e = 21.90\%$$

$$\text{EPS} = \frac{\text{₹}50,00,000}{1,00,000 \text{ Shares}} = \text{₹}50$$

$$D_0 = \text{₹}50 \times 60\% = \text{₹}30$$

(c) Overall cost of additional finance:

$$K_o = K_e W_e + K_r W_r + K_d W_d = 21.90\% \times \frac{9.75}{25} + 21.90\% \times \frac{5.25}{25} + 9.15\% \times \frac{10}{25} = 16.80\%$$

Assumption: DPS is treated at D_0 .

SUGGESTED REVISION FOR EXAM:

BQ: 8, 10, 11, 21, 24, 25, 26, 27, 30, 33, 37, 38, 39, 42

PYQ: 7, 9, 12, 14, 15, 17

NET INCOME & NET OPERATING INCOME APPROACHES

BQ 1

Rupa Ltd.'s EBIT is ₹5,00,000. The company has 10%, ₹20 lakh debentures. The equity capitalization rate i.e. K_e is 16%.

You are required to calculate:

- (1) Market value of equity and value of firm
- (2) Overall cost of capital.

Answer

(1) Statement Showing Market Value of Equity and Value of Firm

<i>Particulars</i>	<i>₹</i>
Net Operating income	5,00,000
Less: Interest on Debt	2,00,000
Earnings for Equity Investors	3,00,000
Equity Capitalization rate	16%
Market Value of Equity (3,00,000 ÷ 0.16)	18,75,000
Value of debt	20,00,000
Total Value of the Firm	38,75,000

(2) Overall cost of capital:

$$K_o = \frac{\text{EBIT}}{V} \times 100 = \frac{5,00,000}{38,75,000} \times 100 = 12.90\%$$

BQ 2

Indra Ltd. has EBIT of ₹1,00,000. The company makes use of debt and equity capital. The firm has 10% debentures of ₹5,00,000 and the firm's equity capitalization rate is 15%.

You are required to calculate:

- (1) Market value of equity and value of firm
- (2) Overall cost of capital.

Answer

(1) Statement Showing Market Value of Equity and Value of Firm

<i>Particulars</i>	<i>₹</i>
Net Operating income	1,00,000
Less: Interest on Debt	50,000
Earnings for Equity Investors	50,000
Equity Capitalization rate	15%
Market Value of Equity (50,000 ÷ 0.15)	3,33,333
Value of debt	5,00,000
Total Value of the Firm	8,33,333

(2) Overall cost of capital:

$$K_o = \frac{\text{EBIT}}{V} \times 100 = \frac{1,00,000}{8,33,333} \times 100 = 12\%$$

BQ 3

Amita Ltd's operating income (EBIT) is ₹5,00,000. The firm's cost of debt is 10% and currently the firm employs ₹15,00,000 of debt. The overall cost of capital of the firm is 15%.

You are required to calculate:

- (1) Market value of firm.
- (2) Cost of Equity.

Answer

$$(1) \text{ Market Value of Firm} = \frac{\text{EBIT}}{K_o} = \frac{5,00,000}{15\%} = \text{₹}33,33,333$$

$$(2) \text{ Cost of Equity} = \frac{\text{EBIT} - I}{\text{Market value of Equity}} \times 100 = \frac{5,00,000 - 1,50,000}{18,33,333} \times 100 = 19.09\%$$

Working note:

$$\begin{aligned} \text{Market value of Equity} &= \text{Market value of Firm} - \text{Market value of Debt} \\ &= 33,33,333 - 15,00,000 = 18,33,333 \end{aligned}$$

BQ 4

X Ltd. and Y Ltd. are identical except that the former uses debt while the latter does not. Thus levered firm has issued 10% Debentures of ₹9,00,000. Both the firms earn EBIT of 20% on total assets of ₹15,00,000. Assuming tax rate is 50% and capitalization rate is 15% for an all equity firm.

- (i) Compute the value of the two firms using NI approach.
- (ii) Compute the value of the two firms using NOI approach.
- (iii) Calculate the overall cost of capital, K_o for both the firms using NOI approach.

Answer**(i) Calculation of Value of firms by NI Approach:**

Particulars	X Ltd (₹)	Y Ltd (₹)
EBIT (20% of ₹15,00,000)	3,00,000	3,00,000
Less: Interest on Debt	90,000	-
Profit Before Tax	2,10,000	3,00,000
Less: Tax @ 50%	1,05,000	1,50,000
Profit After Tax	1,05,000	1,50,000
Equity Capitalization rate	15%	15%
Market Value of Equity (PAT ÷ K_e)	7,00,000	10,00,000
Value of debt	9,00,000	-
Total Value of the Firm	16,00,000	10,00,000

(ii) Values of the firm as per NOI Approach:

$$\text{Value of unlevered firm (Y Ltd)} = \frac{\text{EBIT}(1-t)}{K_o} = \frac{3,00,000 (1-0.30)}{0.15}$$



$$= ₹10,00,000$$

$$\begin{aligned} \text{Value of levered firm (X Ltd)} &= \text{Value of unlevered firm} + \text{Debt} \times \text{tax} \\ &= ₹10,00,000 + 9,00,000 \times 50\% = 14,50,000 \end{aligned}$$

This value of ₹14,50,000 can be bifurcated into Debt of ₹9,00,000 and Equity of ₹5,50,000.

(iii) Calculation of K_o under NOI Approach:

$$Y \text{ Ltd } (K_o) = K_e = 15\%$$

$$\begin{aligned} X \text{ Ltd } (K_o) &= K_e W_e + K_d W_d \\ &= 19.1\% \times \frac{5,50,000}{14,50,000} + 5\% \times \frac{9,00,000}{14,50,000} = 10.34\% \end{aligned}$$

Or

$$\begin{aligned} X \text{ Ltd } (K_o) &= \frac{\text{EBIT}(1 - t)}{V} \times 100 = \frac{3,00,000(1 - 0.50)}{14,50,000} \times 100 \\ &= 10.34\% \end{aligned}$$

Working Notes:

Calculation of K_e of X Ltd:

$$\begin{aligned} K_e &= \frac{\text{Earning for Equity}}{\text{Market value of Equity}} \times 100 = \frac{(3,00,000 - 90,000)(1 - 0.50)}{5,50,000} \times 100 \\ &= 19.10\% \end{aligned}$$

BQ 5

Companies P and Q are identical in all respects including risk factors except for debt - equity, P has issued 10% debentures of ₹18 lakhs while Q has issued only equity. Both the companies earn 20% before interest and taxes on their total assets of ₹30 lakhs. Assuming a tax rate of 50% and capitalisation rate of 15% for an all - equity company.

Compute the value of companies P and Q using:

- (a) Net income approach and
- (b) Net operating income approach.

Answer

(a) Calculation of Value of firms by NI Approach:

Particulars	P Ltd (₹)	Q Ltd (₹)
EBIT (20% of ₹30,00,000)	6,00,000	6,00,000
Less: Interest on Debt	1,80,000	-
Profit Before Tax	4,20,000	6,00,000
Less: Tax @ 50%	2,10,000	3,00,000
Profit After Tax	2,10,000	3,00,000
Equity Capitalization rate	15%	15%
Market Value of Equity (PAT ÷ K_e)	14,00,000	20,00,000
Value of debt	18,00,000	-
Total Value of the Firm	32,00,000	20,00,000

(b) Values of the firm as per NOI Approach:

$$\begin{aligned} \text{Value of unlevered firm (Q Ltd)} &= \frac{\text{EBIT}(1-t)}{K_o} = ₹20,00,000 \\ \text{Value of levered firm (P Ltd)} &= \text{Value of unlevered firm} + \text{Debt} \times \text{tax} \\ &= ₹20,00,000 + 18,00,000 \times 50\% = ₹29,00,000 \end{aligned}$$

MODIGLIANI & MILLER HYPOTHESIS

BQ 6

One third of the total market value of Sanghmani Limited consists of loan stock, which has a cost of 10 per cent. Another company, Samsui Limited, is identical in every respect to Sanghmani Limited, except that its capital structure is all equity, and its cost of equity is 16 per cent. According to Modigliani and Miller, if we ignored taxation and tax relief on debt capital.

Compute the cost of equity of Sanghmani Limited?

Answer

$$\begin{aligned} K_o \text{ Sanghmani Limited} &= K_o \text{ Samsui Limited} = 16\% \\ K_o \text{ Sanghmani Limited} &= K_e W_e + K_d W_d \\ 16\% &= K_e \times 2/3 + 10\% \times 1/3 \\ K_e \text{ Sanghmani Limited} &= 19\% \end{aligned}$$

BQ 7

Companies U and L are identical in every respect except that the former does not use debt in its capital structure, while the latter employs ₹6,00,000 of 15% debt. Assuming that (a) all the MM assumptions are met (b) the corporate tax rate is 50%, (c) the EBIT is ₹2,00,000 and (d) the equity capitalization of the unlevered company is 20%.

What will be the value of the firms U and L? Also determine the weighted average cost of capital for both the firms.

Answer

$$\begin{aligned} \text{Value of unlevered firm} &= \frac{\text{EBIT} (1-t)}{K_o} = \frac{2,00,000 (1-0.50)}{0.20} = ₹5,00,000 \\ \text{Value of levered firm} &= \text{Value of unlevered firm} + \text{Debt} \times \text{tax} \\ &= ₹5,00,000 + 6,00,000 \times 50\% = ₹8,00,000 \\ K_o \text{ of unlevered firm} &= K_e = 20\% \\ K_o \text{ of levered firm} &= \frac{\text{EBIT}(1-t)}{V} = \frac{2,00,000 (1-0.50)}{8,00,000} = ₹12.50\% \end{aligned}$$

BQ 8

Blue Ltd., an all equity financed company is considering the repurchase of ₹275 lakhs equity shares and



to replace it with 15% debentures of the same amount. Current market value of the company is ₹1,750 lakhs with its cost of capital of 20%. The company's Earnings before Interest and Taxes (EBIT) are expected to remain constant in future years. The company also has a policy of distributing its entire earnings as dividend. Assuming the corporate tax rate as 30%.

You are required to calculate the impact on the following on account of the change in the capital structure as per Modigliani and Miller (MM) Approach:

- (1) Market value of the company,
- (2) Overall cost of capital, and
- (3) Cost of equity.

Answer

(1) Market Value (MV) of Blue Ltd:

$$\begin{aligned}
 \text{MV before repurchase (V}_{UL}) &= 1,750 \text{ Lakhs} \\
 \text{MV after repurchase (V}_L) &= V_{UL} + \text{Debt} \times \text{Tax} \\
 &= 1,750 \text{ L} + 275 \text{ L} \times 30\% = 1,832.5 \text{ Lakhs} \\
 \text{Impact on MV of firm} &= 1,832.50 \text{ L} - 1,750 \text{ L} \\
 &= \text{Increase by } 82.50 \text{ Lakhs}
 \end{aligned}$$

(2) Overall cost of capital:

$$\begin{aligned}
 \text{WACC before repurchase} &= 20\% \\
 \text{WACC after repurchase} &= \frac{\text{EBIT} (1-t)}{\text{Value of firm}} \times 100 = \frac{500 \text{ L} (1-0.30)}{1,832.50 \text{ L}} \times 100 \\
 &= 19.10\% \\
 \text{Impact on Cost of capital} &= 20\% - 19.10\% = \text{Decrease by } 0.90\%
 \end{aligned}$$

(3) Cost of Equity:

$$\begin{aligned}
 K_e \text{ before repurchase} &= 20\% \\
 K_e \text{ after repurchase} &= \frac{(\text{EBIT} - I) (1-t)}{\text{MV of Equity}} \times 100 = \frac{(500 \text{ L} - 15\% \text{ of } 275 \text{ L}) (1-0.30)}{1,557.50 \text{ L}} \times 100 \\
 &= 20.62\% \\
 \text{Impact on } K_e &= 20.62\% - 20\% = \text{Increase by } 0.62\%
 \end{aligned}$$

Workings notes:

$$\begin{aligned}
 \text{MV of Equity (before repurchase)} &= \frac{\text{EAT}}{K_e} \\
 1,750 \text{ Lakhs} &= \frac{\text{EAT}}{0.20} \\
 \text{EAT} &= 1,750 \text{ Lakhs} \times 20\% = 350 \text{ L} \\
 \text{EBIT} &= \frac{\text{EAT}}{(1-t)} \\
 &= \frac{350 \text{ L}}{(1-0.3)} = 500 \text{ L}
 \end{aligned}$$

$$\begin{aligned} \text{MV of Equity (after repurchase)} &= \text{Value of firm} - \text{Value of Debt} \\ &= 1,832.50 \text{ L} - 275 \text{ L} = 1,557.5 \text{ L} \end{aligned}$$

TRADITIONAL APPROACH & MISCELLANEOUS

BQ 9

Determine the optimal capital structure of a company from the following information:

Options	Cost of Debt (K_d) in %	Cost of Equity (K_e) in %	% of Debt on Total Value (Debt + Equity)
1	11	13	0.00
2	11	13	0.10
3	11.6	14	0.20
4	12	15	0.30
5	13	16	0.40
6	15	18	0.50
7	18	20	0.60

Answer

Calculation of Optimal Debt - Equity Mix

% of Debt in capital employed	K_d in %	% of Equity in capital employed	K_e in %	WACC $K_o = K_e W_e + K_d W_d$
0.00	11	1.00	13	13.00%
0.10	11	0.90	13	12.80%
0.20	11.6	0.80	14	13.52%
0.30	12	0.70	15	14.10%
0.40	13	0.60	16	14.80%
0.50	15	0.50	18	16.50%
0.60	18	0.40	20	18.80%

Decision: 2nd option is the best because it has lowest WACC.

BQ 10

ABC Ltd. with EBIT of ₹3,00,000 is evaluating a number of possible capitals below. Which of the capital structure will you recommend, and why?

Capital Structure	Debt	K_d	K_e
I	₹3,00,000	10%	12.00%
II	₹4,00,000	10%	12.50%
III	₹5,00,000	11%	13.50%
IV	₹6,00,000	12%	15.00%
V	₹7,00,000	14%	18.00%

Answer

Statement of K_o and Value of Firm

Particulars	Plan I	Plan II	Plan III	Plan IV	Plan V
EBIT	3,00,000	3,00,000	3,00,000	3,00,000	3,00,000
Less: Interest	30,000	40,000	55,000	72,000	98,000
Net profit	2,70,000	2,60,000	2,45,000	2,28,000	2,02,000
÷ K_e	0.12	0.125	0.135	0.15	0.18

Market value of Equity (E)	22,50,000	20,80,000	18,14,815	15,20,000	11,22,222
Market value of Debt (D)	3,00,000	4,00,000	5,00,000	6,00,000	7,00,000
Market value of firm (V)	25,50,000	24,80,000	23,14,815	21,20,000	18,22,222
K_o (EBIT ÷ V)	11.76%	12.10%	12.95%	14.15%	16.46%

The capital structure (Plan I) having ₹3,00,000 of debt has the lowest cost of capital consequently the highest market value, should be accepted.

BQ 11

Alpha Limited and Beta Limited are identical except for capital structures. Alpha Ltd. has 50 per cent debt and 50 per cent equity, whereas Beta Ltd. has 20 per cent debt and 80 per cent equity. (All percentages are in market value terms). The borrowing rate for both companies is 8 per cent in a no-tax world, and capital markets are assumed to be perfect.

(a) (i) If you own 2 per cent of the shares of Alpha Ltd., determine your return if the company has net operating income of ₹3,60,000 and the overall capitalisation rate of the company, K_o is 18 per cent?

(ii) Calculate the implied required rate of return on equity?

(b) Beta Ltd. has the same net operating income as Alpha Ltd. (i) Determine the implied required equity return of Beta Ltd.? (ii) Analyse why does it differ from that of Alpha Ltd.?

Answer

(a) Value of the Alpha Ltd. = $\frac{NOI}{K_o} = \frac{3,60,000}{18\%} = ₹20,00,000$

Value of Shares of Alpha Ltd. = 50% of ₹20,00,000 = ₹10,00,000

(i) Return on Shares on Alpha Ltd

Particulars	₹
Net Operating income	3,60,000
Less: Interest on Debt@ 8% on ₹10,00,000 (50% of ₹20,00,000)	80,000
Earnings for Equity Investors	2,80,000
Return on 2% Shares (2% of ₹2,80,000)	5,600

(ii) Implied required rate of return on Equity = $\frac{2,80,000}{10,00,000} \times 100 = 28\%$

(b) (i) Return on Shares on Beta Ltd

Particulars	₹
Net Operating income	3,60,000
Less: Interest on Debt@ 8% on ₹4,00,000 (20% of ₹20,00,000)	32,000
Earnings for Equity Investors	3,28,000

Value of Shares of Beta Ltd. = 80% of ₹20,00,000 = ₹16,00,000

Implied required rate of return on Equity = $\frac{3,28,000}{16,00,000} \times 100 = 20.50\%$

(ii) It is lower than the Alpha Ltd. because Beta Ltd. uses less debt in its capital structure. As the equity capitalisation is a linear function of the debt-to-equity ratio when we use the net operating income approach, the decline in required equity return offsets exactly the disadvantage of not employing so much in the way of “cheaper” debt funds.

ARBITRAGE PROCESS ($V_L > V_{UL}$)**BQ 12**

There are two company N Ltd. and M Ltd., having same earnings before interest and taxes i.e. EBIT of ₹20,000. M Ltd. is a levered company having a debt of ₹1,00,000 @ 7% rate of interest. The cost of equity of N Ltd. is 10% and of M Ltd. is 11.50%.

Compute how arbitrage process will be carried on?

Answer

Value of Equity (S)	=	$\frac{\text{NOI}-\text{Interest}}{\text{Cost of Equity}}$	
S_N	=	$\frac{20,000}{10\%}$	= ₹2,00,000
S_M	=	$\frac{20,000-7,000}{11.50\%}$	= ₹1,13,043
V_N	=	₹2,00,000	
V_M	=	$S_M + D$	
	=	₹1,13,043 + ₹1,00,000	= ₹2,13,043

Arbitrage Process:

If you have 10% shares of M Ltd., your value of investment in equity shares is 10% of ₹1,13,043 i.e. ₹11,304.30 and return will be 10% of (₹20,000 – ₹7,000) = ₹1,300.

Strategy (Same return with lower investment):

Sell your 10% share of levered firm for ₹11,304.30 and borrow 10% of levered firms debt i.e. 10% of ₹1,00,000 and invest the money i.e. 10% in unlevered firms stock:

Total resources /Money we have	=	₹11,304.30 + ₹10,000	=	₹21,304.30
Invest in 10% shares of Unlevered firm	=	10% of ₹2,00,000	=	₹20,000
Surplus cash available with you	=	₹21,304.3 – ₹20,000	=	₹1,304.30
Your return	=	10% EBIT of unlevered firm – Interest		
	=	10% of ₹20,000 – 7% of ₹10,000		
	=	₹2,000 – ₹700	=	₹1,300

Conclusion:

Your return is same i.e. ₹1,300 which you are getting from N Ltd. before investing in M Ltd. but still you have ₹1,304.3 excess money available with you. Hence, you are better off by doing arbitrage.

BQ 13

Following data is available in respect of two companies having same business risk:

Capital employed	=	₹2,00,000
EBIT	=	₹30,000



$$K_e = 12.5\%$$

Sources	Levered Company (₹)	Unlevered Company (₹)
Debt (@ 10%)	1,00,000	-
Equity	1,00,000	2,00,000

Investor is holding 15% shares in levered company.

Calculate increase in annual earnings of investor if he switches his holding from levered to unlevered company.

Answer

1. Calculation of Value of firms:

Particulars	Levered (₹)	Unlevered (₹)
EBIT	30,000	30,000
Less: Interest @ 10%	10,000	-
Earning available to Equity Shareholders	20,000	30,000
Equity Capitalization rate	12.5%	12.5%
Market Value of Equity (Earning for Equity ÷ K_e)	1,60,000	2,40,000
Value of Debt	1,00,000	-
Value of the Firm	2,60,000	2,40,000

Value of Levered company is more than that of unlevered company therefore investor will sell his shares in levered company and buy shares in unlevered company. To maintain the level of risk he will borrow proportionate amount and invest that amount also in shares of unlevered company.

2. Investment & Borrowings:

Sell shares in Levered company (1,60,000 × 15%)	24,000
Borrow money (1,00,000 × 15%)	<u>15,000</u>
Buy shares in Unlevered company	39,000

3. Change in Return:

Income from shares in Unlevered company (39,000 × 12.5%)	4,875
Less: Interest on loan (15,000 × 10%)	<u>1,500</u>
Net Income from unlevered firm	3,375
Income from Levered firm (24000 × 12.5%)	<u>3,000</u>
Incremental Income due to arbitrage	375

ARBITRAGE PROCESS ($V_{UL} > V_L$)

BQ 14

There are two companies U Ltd. and L Ltd., having same NOI of ₹20,000 except that L Ltd. is a levered company having a debt of ₹1,00,000 @ 7% and cost of equity of U Ltd. & L Ltd. are 10% and 18% respectively.

Compute how arbitrage process will work.

Answer

Calculation of Value of firms:

<i>Particulars</i>	<i>U Ltd. (₹)</i>	<i>L Ltd. (₹)</i>
EBIT	20,000	20,000
Less: Interest @ 7% of ₹1,00,000	-	7,000
Earning available to Equity Shareholders	20,000	13,000
Equity Capitalization rate	10%	18%
Market Value of Equity (Earning for Equity ÷ K _e)	2,00,000	72,222
Value of Debt	-	1,00,000
<i>Value of the Firm</i>	<i>2,00,000</i>	<i>1,72,222</i>

Assume you have 10% shares of unlevered firm:

Investment	=	10% of ₹2,00,000	=	₹20,000
Return	=	10% on ₹20,000	=	₹2,000

Strategy (Same return with lower investment):

Sell your shares in unlevered firm for ₹20,000 and buy 10% shares of levered firm's equity plus debt:

Investment in shares of L Ltd.	=	10% of ₹72,222	=	₹7,222
Investment in debt of L Ltd.	=	10% of ₹1,00,000	=	₹10,000

Total investment = **₹17,222**

Surplus cash available = ₹20,000 – ₹17,222 = ₹2,778

Your return in L Ltd.
 = 10% of Earning available for Equity + Interest on Debt
 = 10% of ₹13,000 + 7% of ₹10,000
 = ₹1,300 + ₹700
 = ₹2,000

In both the cases the return received is ₹2,000 and still you have excess cash of ₹2,778. Hence, you are better off. In the above solution we have not invested entire amount received from "sale of shares of Unlevered company". Alternatively, we could have invested entire amount in Levered company. In that case annual earnings would have increased.

BQ 15

Following data is available in respect of two companies having same business risk:

Capital employed	=	₹2,00,000
EBIT	=	₹30,000

<i>Sources</i>	<i>Levered Company (₹)</i>	<i>Unlevered Company (₹)</i>
Debt (@ 10%)	1,00,000	-
Equity	1,00,000	2,00,000
K _e	20%	12.5%

Investor is holding 15% shares in Unlevered company.

Calculate increase in annual earnings of investor if he switches his holding from unlevered to levered company.



Answer

1. Calculation of Value of firms:

<i>Particulars</i>	<i>Levered (₹)</i>	<i>Unlevered (₹)</i>
EBIT	30,000	30,000
Less: Interest @ 10%	10,000	-
Earning available to Equity Shareholders	20,000	30,000
Equity Capitalization rate	20%	12.5%
Market Value of Equity (Earning for Equity ÷ K _e)	1,00,000	2,40,000
Value of Debt	1,00,000	-
<i>Value of the Firm</i>	<i>2,00,000</i>	<i>2,40,000</i>

Value of Unlevered company is more than that of Levered company therefore investor will sell his shares in unlevered company and buy shares in levered company. Market value of Debt and Equity of Levered company are in the ratio of ₹1,00,000 : ₹1,00,000, i.e., 1:1. To maintain the level of risk he will lend proportionate amount (50%) and invest balance amount (50%) in shares of Levered company.

2. Investment:

Sell shares in Unlevered company (2,40,000 × 15%)	<u>36,000</u>
Lend money (36,000 × 50%)	18,000
Buy shares in Levered company	<u>18,000</u>
Total investment	<u>36,000</u>

3. Change in Return:

Income from shares in Levered company (18,000 × 20%)	3,600
Add: Interest on money lent (18,000 × 10%)	<u>1,800</u>
Total income after switch over	5,400
Income from Unlevered firm (36,000 × 12.5%)	<u>4,500</u>
Incremental Income due to arbitrage	<u>900</u>

PAST YEAR QUESTIONS

PYQ 1

'A' Ltd. and 'B' Ltd. are identical in every respect except capital structure. 'A' Ltd. does not use any debt in its capital structure whereas 'B' Ltd. employs 12% debentures amounting to ₹10,00,000. Assuming that:

- (i) All assumptions of MM model are met;
- (ii) Income tax rate is 30%;
- (iii) EBIT is ₹2,50,000 and
- (iv) The equity capitalization rate of 'A' Ltd. is 20%.

Calculate the value of both the companies and also find out Weighted Average Cost of Capital for both the companies.

[(5 Marks) Nov 2014]

Answer**Calculation of value of 'A' Ltd and 'B' Ltd:**

$$\text{Value of 'A' Ltd. (Unlevered)} = \frac{\text{EBIT} (1 - t)}{K_e} = \frac{2,50,000 (1 - .30)}{.20} = \mathbf{8,75,000}$$

$$\begin{aligned} \text{Value of 'B' Ltd. (Levered)} &= \text{Market value of 'A' Ltd} + \text{Debt} \times \text{Tax} \\ &= 8,75,000 + 10,00,000 \times 30\% = \mathbf{11,75,000} \end{aligned}$$

Calculation of WACC of 'A' Ltd and 'B' Ltd:

$$K_0 \text{ of 'A' Ltd.} = K_e \text{ of 'A' Ltd} = \mathbf{20\%}$$

[In case of All equity company $K_0 = K_e$]

$$\begin{aligned} K_0 \text{ of 'B' Ltd.} &= \frac{\text{EBIT} (1 - t)}{V} \times 100 = \frac{2,50,000 (1 - .30)}{11,75,000} \times 100 \\ &= \mathbf{14.89\%} \end{aligned}$$

PYQ 2

RST Ltd. is expecting an EBIT of ₹4,00,000 for F.Y. 2015-16. Presently the company is financed by equity share capital ₹20,00,000 with equity capitalization rate of 16%. The company is contemplating to redeem part of the capital by introducing debt financing. The company has two options to raise debt to the extent of 30% or 50% of the total fund. It is expected that for debt financing upto 30%, the rate of interest will be 10% and equity capitalization rate will increase to 17%. If the company opts for 50% debt, then the interest rate will be 12% and equity capitalization rate will be 20%.

You are required to compute value of the company; its overall cost of capital under different options and also state which is the best option.

[(8 Marks) Nov 2015]

Answer**Statement of Value of Firm and Cost of Capital**

Particulars	All equity	30% Debt	50% Debt
-------------	------------	----------	----------

Earnings before interest and tax	4,00,000	4,00,000	4,00,000
Less: Interest @ 10% of ₹6,00,000 or @ 12% of ₹10,00,000	-	60,000	-
Earning available for Equity			1,20,000
÷ K_e	4,00,000	3,40,000	2,80,000
Value of Equity (E) [PBT ÷ K_e]	16%	17%	20%
Value of Debt (D)	25,00,000	20,00,000	14,00,000
Value of Firm (V)	-	6,00,000	10,00,000
K_o (EBIT ÷ V)	25,00,000	26,00,000	24,00,000
	16%	15.38%	16.67%

Decision: Company should opt for 30% debt finance having higher Value of firm and lower K_o .

PYQ 3

PNR Limited and PXR Limited are identical in every respect except capital structure. PNR limited does not employ debts in its capital structure whereas PXR Limited employs 12% Debentures amounting to ₹20,00,000.

The following additional information are given to you:

- (i) Income tax rate is 30%
- (ii) EBIT is ₹5,00,000
- (iii) The equity capitalization rate of PNR Limited is 20% and
- (iv) All assumptions of Modigliani - Miller Approach are met.

Calculate:

- (i) Value of both the companies,
- (ii) Weighted average cost of capital for both the companies.

[(8 Marks) May 2017]

Answer

Calculation of value of 'PNR' Ltd and 'PXR' Ltd:

$$\begin{aligned} \text{Value of 'PNR' Ltd. (Unlevered)} &= \frac{\text{EBIT} (1 - t)}{K_e} = \frac{5,00,000 (1 - .30)}{.20} \\ &= \mathbf{17,50,000} \end{aligned}$$

$$\begin{aligned} \text{Value of 'PXR' Ltd. (Levered)} &= \text{Market value of 'PNR' Ltd} + \text{Debt} \times \text{Tax} \\ &= 17,50,000 + 20,00,000 \times 30\% \\ &= \mathbf{23,50,000} \end{aligned}$$

Calculation of WACC of 'PNR' Ltd and 'PXR' Ltd:

$$K_o \text{ of 'PNR' Ltd.} = K_e \text{ of 'PNR' Ltd} = \mathbf{20\%}$$

[In case of All equity company $K_o = K_e$]

$$\begin{aligned} K_o \text{ of 'PXR' Ltd.} &= \frac{\text{EBIT} (1 - t)}{V} \times 100 = \frac{5,00,000 (1 - .30)}{23,50,000} \times 100 \\ &= \mathbf{14.89\%} \end{aligned}$$

PYQ 4

Stopgo Ltd. an all equity financed company is considering the repurchase of ₹200 Lakhs equity and to replace it with 15% debentures of the same amount. Current market value of the company is ₹1140

Lakhs and its cost of capital is 20%. Its earning before interest and tax (EBIT) are expected to remain constant in future. Its entire earnings are distributed as dividend. Applicable tax rate is 30%.

You are required to calculate the impact on the following on account of the change in the capital structure as per MM Hypothesis:

- (1) The market value of the company.
- (2) Its cost of capital, and
- (3) Its cost of equity.

[(5 Marks) May 2018]

Answer

(1) Market Value (MV) of Stopgo Ltd:

MV before repurchase (V_{UL})	=	1,140 Lakhs	
MV after repurchase (V_L)	=	$V_{UL} + \text{Debt} \times \text{Tax}$	
	=	$1,140 \text{ L} + 200 \text{ L} \times 30\%$	= 1,200 Lakhs
Impact on MV of firm	=	$1,200 \text{ L} - 1,140 \text{ L}$	= Increase by 60 Lakhs

(2) Weighted average cost of capital:

WACC before repurchase	=	20%	
WACC after repurchase	=	$\frac{\text{EBIT} (1-t)}{\text{Value of firm}} \times 100 = \frac{325.71 \text{ L} (1-0.30)}{1,200 \text{ L}} \times 100$	
	=	19%	
Impact on Cost of capital	=	$20\% - 19\%$	= Decrease by 1%

(3) Cost of Equity:

K_e before repurchase	=	20%	
K_e after repurchase	=	$\frac{(\text{EBIT} - I)(1-t)}{\text{MV of Equity}} \times 100$	
	=	$\frac{(325.71 \text{ L} - 15\% \text{ of } 200 \text{ L})(1-0.30)}{1,000 \text{ L}} \times 100$	
	=	20.70%	
Impact on K_e	=	$20.70\% - 20\%$	= Increase by 0.70%

Workings notes:

MV of Equity (before repurchase)	=	$\frac{\text{EAT}}{K_e}$	
1,140 Lakhs	=	$\frac{\text{EAT}}{0.20}$	
EAT	=	$1,140 \text{ Lakhs} \times 20\%$	= 228 L
EBIT	=	$\text{EAT} \div (1-t)$	



$$= 228 \text{ L} \div (1 - 0.3) = 325.71 \text{ L}$$

$$\text{MV of Equity (after repurchase)} = \text{Value of firm} - \text{Value of Debt}$$

$$= 1,200 \text{ L} - 200 \text{ L} = 1,000 \text{ L}$$

PYQ 5

The following data relate to two companies belonging to the same risk class:

	<i>A Ltd.</i>	<i>B Ltd.</i>
Expected Net operating Income	₹18,00,000	₹18,00,000
12% Debt	₹54,00,000	-
Equity Capitalization Rate	-	18

Required:

- (a) Determine the total market value, Equity capitalization rate and weighted average cost of capital for each company assuming no taxes as per M.M. Approach.
- (b) Determine the total market value, Equity capitalization rate and weighted average cost of capital for each company assuming 40% taxes as per M.M. Approach.

[(10 Marks) Nov 2018]

Answer

(a) Various calculation without tax:

Market Value of firms:

$$\text{Market Value of B Ltd. (V}_{UL}) = \text{EBIT} \div K_e = ₹18,00,000 \div 18\% = ₹1,00,00,000$$

$$\text{Market Value of A Ltd. (V}_L) = \text{Value of unlevered} = ₹1,00,00,000$$

Equity Capitalization Rate:

$$\text{Equity Capitalization Rate (B Ltd.)} = 18\% \text{ (given in the question)}$$

$$\text{Equity Capitalization Rate (A Ltd.)} = (\text{EBIT} - I) \div *E \text{ (Value of Equity)}$$

$$= (₹18,00,000 - 12\% \times ₹54,00,000) \div ₹46,00,000$$

$$= 25.04\%$$

$$*\text{Value of Equity (E) of A Ltd.} = \text{Value of Firm} - \text{Debt} = ₹1,00,00,000 - ₹54,00,000 = ₹46,00,000$$

Weighted Average Cost of Capital:

$$\text{Weighted Average Cost of Capital (B Ltd.)} = K_e = K_o = 18\%$$

$$\text{Weighted Average Cost of Capital (A Ltd.)} = \text{EBIT} \div V \text{ (Value of Firm)}$$

$$= ₹18,00,000 \div ₹1,00,00,000 = 18\%$$

(b) Various calculation with tax:

Market Value of firms:

$$\begin{aligned} \text{Market Value of B Ltd. (V}_{UL}) &= \text{EBIT (1 - t) } \div K_e \text{ or } K_o \\ &= ₹18,00,000 (1 - 0.40) \div 18\% = \quad \quad \quad \mathbf{₹60,00,000} \end{aligned}$$

$$\begin{aligned} \text{Market Value of A Ltd. (V}_L) &= \text{Value of unlevered + Debt } \times \text{Tax} \\ &= ₹60,00,000 + ₹54,00,000 \times .4 = \quad \quad \quad \mathbf{₹81,60,000} \end{aligned}$$

Equity Capitalization Rate:

$$\text{Equity Capitalization Rate (B Ltd.)} = \quad \quad \mathbf{18\% \text{ (given in the question)}}$$

$$\begin{aligned} \text{Equity Capitalization Rate (A Ltd.)} &= \text{(EBIT - I) (1 - t) } \div *E \text{ (Value of Equity)} \\ &= (\₹18,00,000 - 12\% \times ₹54,00,000) (1 - .4) \div ₹27,60,000 \\ &= \quad \quad \quad \mathbf{25.04\%} \end{aligned}$$

$$\begin{aligned} * \text{Value of Equity (E) of A Ltd.} &= \text{Value of Firm - Debt} \\ &= ₹81,60,000 - ₹54,00,000 = \quad \quad \quad \mathbf{₹27,60,000} \end{aligned}$$

Weighted Average Cost of Capital:

$$\text{Weighted Average Cost of Capital (B Ltd.)} = K_e = K_o = \quad \quad \quad \mathbf{18\%}$$

$$\begin{aligned} \text{Weighted Average Cost of Capital (A Ltd.)} &= \text{EBIT (1 - t) } \div V \text{ (Value of Firm)} \\ &= ₹18,00,000 (1 - 0.4) \div ₹81,60,000 \\ &= \quad \quad \quad \mathbf{13.24\%} \end{aligned}$$

PYQ 6

A Limited and B Limited are identical except for capital structures. A Ltd. has 60 per cent debt and 40 per cent equity, whereas B Ltd. has 20 per cent debt and 80 per cent equity. (All percentages are in market value terms). The borrowing rate for both companies is 8 per cent in a no-tax world, and capital markets are assumed to be perfect.

(a) (i) If X, own 3 per cent of the equity shares of A Ltd., determine his return if the Company has net operating income of ₹4,50,000 and the overall capitalisation rate of the company, K_o is 18 per cent.

(ii) Calculate the implied required rate of return on equity of A Ltd.

(b) B Ltd. has the same net operating income as A Ltd.

(i) Calculate the implied required equity return of B Ltd.

(ii) Analyse why does it differ from that of A Ltd.

[(10 Marks) Jan 2021]

Answer

$$\mathbf{(a) \text{ Value of the A Ltd.}} = \frac{\text{NOI}}{K_o} = \frac{4,50,000}{18\%} = \quad \quad \quad \mathbf{₹25,00,000}$$

$$\mathbf{\text{Value of Shares of A Ltd.}} = 40\% \text{ of } ₹25,00,000 = \quad \quad \quad \mathbf{₹10,00,000}$$

(i) Return of X on Shares on A Ltd

<i>Particulars</i>	<i>₹</i>
Net Operating income	4,50,000

Less: Interest on Debt@ 8% on ₹15,00,000 (60% of ₹25,00,000)	1,20,000
Earnings for Equity Investors	3,30,000
Return on 3% Shares (3% of ₹3,30,000)	9,900

(ii) **Implied required rate of return on Equity** = $\frac{3,30,000}{10,00,000} \times 100 = 33\%$

(b) (i) Return on Shares on B Ltd

Particulars	₹
Net Operating income	4,50,000
Less: Interest on Debt@ 8% on ₹5,00,000 (20% of ₹25,00,000)	40,000
Earnings for Equity Investors	4,10,000

Value of Shares of Beta Ltd. = 80% of ₹25,00,000 = **₹20,00,000**

Implied required rate of return on Equity = $\frac{4,10,000}{20,00,000} \times 100 = 20.50\%$

(ii) It is lower than the A Ltd. because B Ltd. uses less debt in its capital structure. As the equity capitalisation is a linear function of the debt-to-equity ratio when we use the net operating income approach, the decline in required equity return offsets exactly the disadvantage of not employing so much in the way of “cheaper” debt funds.

PYQ 7

The details about two companies R Ltd. and S Ltd. having same operating risk are given below:

Particulars	R Ltd.	S Ltd.
Profit before interest and tax	₹10 Lakhs	₹10 Lakhs
Equity share capital ₹10 each	₹17 Lakhs	₹50 Lakhs
Long term borrowings @ 10%	₹33 Lakhs	-
Cost of Equity (K _e)	18%	15%

(1) Calculate the value of equity of both the companies on the basis of M.M. Approach without tax.

(2) Calculate the total value of both the companies on the basis of M.M. Approach without tax.

[(5 Marks) July 2021]

Answer

(1) **Value of Equity** = $\frac{EBIT - I}{K_e}$

R Ltd. = $\frac{EBIT - I}{K_e} = \frac{10,00,000 - 10\% \text{ of } 33,00,000}{18\%} = 37,22,222$

S Ltd. = $\frac{EBIT - I}{K_e} = \frac{10,00,000 - 0}{15\%} = 66,66,667$

(2) **Value of Companies:**

Value of S Ltd. (V_{UL}) = EBIT ÷ K_o = 10,00,000 ÷ 15% = **66,66,667**

Value of R Ltd. (V_L) = Value of S Ltd. (V_{UL}) = **66,66,667**

Note: Alternatively Value of R Ltd. can be calculated as: V = S + D (V = 37,22,222 + 33,00,000 = 70,22,222).

PYQ 8

The following are the costs and values for the firms A and B according to the traditional approach.

<i>Particulars</i>	<i>Firm A</i>	<i>Firm B</i>
Total value of firm, V (in ₹)	50,000	60,000
Market value of debt, D (in ₹)	0	30,000
Market value equity, E (in ₹)	50,000	30,000
Expected net operating income (in ₹)	5,000	5,000
Cost of debt (in ₹)	0	1,800
Net Income (in ₹)	5,000	3,200
Cost of equity, $K_e = NI/E$	10.00%	10.70%

(i) Compute the Equilibrium value for Firm A and B in accordance with the MM approach. Assume that (a) taxes do not exist and (b) the equilibrium value of K_e is 9.09%.

(ii) Compute Value of Equity and Cost of Equity for both the firms.

[(4 Marks) Nov 22]

Answer

(i) Equilibrium value of Firm A (Unlevered)	=	Net operating income ÷ K_e	
	=	₹5,000 ÷ 9.09%	= ₹55,006
Equilibrium value of Firm B (Levered)	=	Value of Firm A (Unlevered)	
	=	₹55,006	
(ii) Value of Equity Firm A	=	₹55,006	
Cost of Equity Firm A	=	9.09%	
Value of Equity Firm B	=	Value of Firm B – Value of debt	
	=	₹55,006 – ₹30,000	= ₹25,006
Cost of Equity Firm B	=	NI/E	
	=	₹3,200 ÷ ₹25,006	= 12.80%

SUGGESTED REVISION FOR EXAM:

BQ: 5, 6, 8, 10, 11, 12, 14

PYQ: 3, 4

MODIGLIANI AND MILLER (MM) HYPOTHESIS

BQ 1

AB Engineering Ltd. belongs to a risk class for which the capitalization rate is 10%. It currently has outstanding 10,000 shares selling at ₹100 each. The firm is contemplating the declaration of a dividend of ₹5 per share at the end of the current financial year. It expects to have a net income of ₹1,00,000 and has a proposal for making new investments of ₹2,00,000.

Required:

1. Calculate value of firm when dividends are not paid.
2. Calculate value of firm when dividends are paid.

Answer**1. Value of the firm when dividends are not paid:**

Step 1: Calculate price at the end of the period:

$$\begin{aligned} K_e &= 10\%, & P_0 &= ₹100, & D_1 &= 0 \\ P_0 &= \frac{P_1 + D_1}{1 + K_e} \\ ₹100 &= \frac{P_1 + 0}{1 + 0.10} & \text{or} & & P_1 &= ₹110 \end{aligned}$$

Step 2: No. of shares required to be issued:

$$\text{No. of shares } \Delta n = \frac{\text{Funds required} - (E - D)}{\text{Price at end}(P_1)} = \frac{2,00,000 - (1,00,000 - 0)}{110} = 909.09 \text{ shares}$$

Step 3: Calculation of value of firm:

$$\begin{aligned} nP_0 &= \frac{(n + \Delta n)P_1 - I + E}{1 + K_e} \\ nP_0 &= \frac{(10,000 + 909.09)110 - 2,00,000 + 1,00,000}{(1 + 0.10)} = ₹10,00,000 \end{aligned}$$

2. Value of the firm when dividends are paid:

Step 1: Calculate price at the end of the period:

$$\begin{aligned} K_e &= 10\%, & P_0 &= ₹100, & D_1 &= ₹5 \\ P_0 &= \frac{P_1 + D_1}{1 + K_e} \\ ₹100 &= \frac{P_1 + 5}{1 + 0.10} & \text{or} & & P_1 &= ₹105 \end{aligned}$$

Step 2: No. of shares required to be issued:

$$\text{No. of shares } \Delta n = \frac{\text{Funds required} - (E - D)}{\text{Price at end}(P_1)} = \frac{2,00,000 - (1,00,000 - 50,000)}{105} = \mathbf{1,428.57 \text{ shares}}$$

Step 3: Calculation of value of firm:

$$nP_0 = \frac{(n + \Delta n)P_1 - I + E}{1 + K_e}$$

$$nP_0 = \frac{(10,000 + 1,428.57)105 - 2,00,000 + 1,00,000}{(1 + 0.10)} = \mathbf{₹10,00,000}$$

Thus, it can be seen that the value of the firm remains the same in either case.

BQ 2

RST Ltd. has a capital of ₹10,00,000 in equity shares of ₹100 each. The shares are currently quoted at par. The company proposes to declare a dividend of ₹10 per share at the end of the current financial year. The capitalization rate for the risk class of which the company belongs is 12%. Net profit is ₹2,50,000 and amount of new investment during the period is ₹5,00,000. What will be the market price of the share at the end of the year, if

1. Dividend is not declared?
2. Dividend is declared?
3. Assuming that the company pays the dividend and has net profits of ₹5,00,000 and makes new investments of ₹10,00,000 during the period, how many new shares must be issued? Use the MM model.

Answer

Given,

Cost of Equity (K_e)	12%
Number of shares in the beginning (n)	10,000
Current Market Price (P_0)	₹100
Net Profit (E)	₹2,50,000
Expected Dividend	₹10 per share
Investment (I)	₹5,00,000

1. $P_0 = \frac{P_1 + D_1}{1 + K_e}$

$$₹100 = \frac{P_1 + 0}{1 + 0.12} \quad \text{or} \quad P_1 = ₹112 - 0 = \mathbf{₹112}$$

2. $P_0 = \frac{P_1 + D_1}{1 + K_e}$

$$₹100 = \frac{P_1 + 10}{1 + 0.12} \quad \text{or} \quad P_1 = ₹112 - 10 = \mathbf{₹102}$$

3. No. of shares = $\frac{\text{Funds required} - (E - D)}{\text{Price at end}(P_1)}$

$$\Delta n = \frac{10,00,000 - (5,00,000 - 1,00,000)}{102} = \mathbf{5882.35 \text{ or } 5883 \text{ shares}}$$



BQ 3

M Ltd. belongs to a risk class for which the capitalization rate is 10%. It has 25,000 outstanding shares and the current market price is ₹100. It expects a net profit of ₹2,50,000 for the year and the Board is considering dividend of ₹5 per share. M Ltd. requires to raise ₹5,00,000 for an approved investment expenditure. Show, how the MM approach affects the value of M Ltd. if dividends are paid or not paid?

Answer

Given,

Cost of Equity (K_e)	10%
Number of shares in the beginning (n)	25,000
Current Market Price (P_0)	₹100
Net Profit (E)	₹2,50,000
Expected Dividend	₹5 per share
Investment (I)	₹5,00,000

1. Value of the firm when dividends are not paid:

Step 1: Calculate price at the end of the period:

$$K_e = 10\%, \quad P_0 = ₹100, \quad D_1 = 0$$

$$P_0 = \frac{P_1 + D_1}{1 + K_e}$$

$$₹100 = \frac{P_1 + 0}{1 + 0.10} \quad \text{or} \quad P_1 = ₹110$$

Step 2: No. of shares required to be issued:

$$\text{No. of shares } \Delta n = \frac{\text{Funds required} - (E - D)}{\text{Price at end}(P_1)} = \frac{5,00,000 - (2,50,000 - 0)}{110} = 2,272.73 \text{ shares}$$

Step 3: Calculation of value of firm:

$$nP_0 = \frac{(n + \Delta n)P_1 - I + E}{1 + K_e}$$

$$nP_0 = \frac{(25,000 + 2,272.73)110 - 5,00,000 + 2,50,000}{(1 + 0.10)} = ₹25,00,000$$

2. Value of the firm when dividends are paid:

Step 1: Calculate price at the end of the period:

$$K_e = 10\%, \quad P_0 = ₹100, \quad D_1 = ₹5$$

$$P_0 = \frac{P_1 + D_1}{1 + K_e}$$

$$₹100 = \frac{P_1 + 5}{1 + 0.10} \quad \text{or} \quad P_1 = ₹105$$

Step 2: No. of shares required to be issued:

$$\text{No. of shares } \Delta n = \frac{\text{Funds required} - (E - D)}{\text{Price at end } (P_1)} = \frac{5,00,000 - (2,50,000 - 1,25,000)}{105} = \mathbf{3,571.43 \text{ shares}}$$

Step 3: Calculation of value of firm:

$$nP_0 = \frac{(n + \Delta n)P_1 - I + E}{1 + K_e}$$

$$nP_0 = \frac{(25,000 + 3,571.43)105 - 5,00,000 + 2,50,000}{(1 + 0.10)} = \mathbf{₹25,00,000}$$

Thus, it can be seen that the value of the firm remains the same in either case.

BQ 4

Aakash Ltd. has 10 lakh equity shares outstanding at the start of the accounting year 2023. The existing market price per share is ₹150. Expected dividend is ₹8 per share. The rate of capitalization appropriate to the risk class to which the company belongs is 10%.

1. Calculate the market price per share when expected dividends are: (a) declared, and (b) not declared, based on the Miller – Modigliani approach.
2. Calculate number of shares to be issued by the company at the end of the accounting year on the assumption that the net income for the year is ₹3 crores, investment budget is ₹6 crores, when (a) Dividends are declared, and (b) Dividends are not declared.
3. Proof that the market value of the shares at the end of the accounting year will remain unchanged irrespective of whether (a) Dividends are declared, or (ii) Dividends are not declared.

Answer

1. Calculation of market price per share:

(a) When expected dividends are declared:

$$K_e = 10\%, \quad P_0 = ₹150, \quad D_1 = ₹8$$

$$P_0 = \frac{P_1 + D_1}{1 + K_e}$$

$$₹150 = \frac{P_1 + 8}{1 + 0.10} \quad \text{or} \quad P_1 = \mathbf{₹157}$$

(b) When expected dividends are not declared:

$$K_e = 10\%, \quad P_0 = ₹150, \quad D_1 = ₹0$$

$$P_0 = \frac{P_1 + D_1}{1 + K_e}$$

$$₹150 = \frac{P_1 + 0}{1 + 0.10} \quad \text{or} \quad P_1 = \mathbf{₹165}$$

2. Calculation of no. of shares required to be issued:

(a) When expected dividends are declared:



$$\begin{aligned} \text{No. of shares } \Delta n &= \frac{\text{Funds required}-(E-D)}{\text{Price at end}(P_1)} = \frac{6,00,00,000-(3,00,00,000-80,00,000)}{157} \\ &= \mathbf{2,42,038.22 \text{ shares}} \end{aligned}$$

(b) When expected dividends are not declared:

$$\begin{aligned} \text{No. of shares } \Delta n &= \frac{\text{Funds required}-(E-D)}{\text{Price at end}(P_1)} = \frac{6,00,00,000-(3,00,00,000-0)}{165} \\ &= \mathbf{1,81,818.18 \text{ shares}} \end{aligned}$$

3. Calculation of market value of shares at the end:

(a) When expected dividends are declared:

$$\begin{aligned} \text{Market value of shares} &= \text{Total shares at the end} \times \text{Market value per share} \\ &= (10,00,000 + 2,42,038.22) \times 157 = \mathbf{₹19,50,00,000} \end{aligned}$$

(b) When expected dividends are not declared:

$$\begin{aligned} \text{Market value of shares} &= \text{Total shares at the end} \times \text{Market value per share} \\ &= (10,00,000 + 1,81,818.18) \times 165 = \mathbf{₹19,50,00,000} \end{aligned}$$

Hence, it is proved that the total market value of shares remains unchanged irrespective of whether dividends are declared, or not declared.

BQ 5

Ordinary shares of a listed company are currently trading at ₹10 per share with two lakh shares outstanding. The company anticipates that its earnings for next year will be ₹5,00,000. Existing cost of capital for equity shares is 15%. The company has certain investment proposals under discussion which will cause an additional 26,089 ordinary shares to be issued if no dividend is paid or an additional 47,619 ordinary shares to be issued if dividend is paid. Applying the MM hypothesis on dividend decisions.

Calculate the amount of investment and dividend that is under consideration by the company.

Answer

1. Calculation of Investment:

When no dividend is paid:

$$\begin{aligned} \text{No. of shares } \Delta n &= \frac{\text{Funds required}-(E-D)}{\text{Price at end}(P_1)} = \frac{I-(5,00,000-0)}{11.50} \\ 26,089 \times ₹11.50 &= I - ₹5,00,000 \\ I &= \mathbf{₹8,00,024} \end{aligned}$$

Working Note:

When expected dividends are not declared:

$$K_e = 15\%, \quad P_0 = ₹10, \quad D_1 = ₹0$$

$$P_0 = \frac{P_1 + D_1}{1 + K_e}$$

$$₹10 = \frac{P_1 + 0}{1 + 0.15} \quad \text{or} \quad P_1 = ₹11.50$$

2. Calculation of Dividend:

When dividend is paid:

$$P_0 = \frac{P_1 + D_1}{1 + K_e}$$

$$₹10 = \frac{P_1 + D_1}{1 + 0.15} \quad \text{or} \quad P_1 = ₹11.50 - D_1$$

Now,

$$\text{No. of shares } \Delta n = \frac{I - (E - D)}{P_1} = \frac{8,00,024 - (5,00,000 - 2,00,000D_1)}{P_1}$$

$$47,619 \times P_1 = 3,00,024 + 2,00,000D_1 \quad (P_1 = 11.50 - D_1)$$

$$47,619 \times (11.50 - D_1) = 5,47,619 - 47,619D_1 = 3,00,024 + 2,00,000D_1$$

$$2,47,619D_1 = 2,47,595$$

$$D_1 = ₹1.00 \text{ per share}$$

WALTER MODEL

BQ 6

XYZ ltd. which earns ₹10 per share is capitalized at 10% and has a return on investment of 12%. Determine the optimum dividend payout ratio and the price of the share at optimum payout.

Answer

(1) The optimum dividend payout ratio is 'Zero', since $r > K_e$.

(2) Calculation of Price of share at optimum payout:

$$P = \frac{D + (E - D) \times \frac{r}{K_e}}{K_e} = \frac{0 + (10 - 0) \times \frac{0.12}{0.10}}{0.10} = ₹120.00$$

BQ 7

The following figures are collected from the annual report of XYZ Ltd.:

Net Profit	₹30 lakhs
Outstanding 12% preference shares	₹100 lakhs
No. of Equity shares	3 lakhs
Return on Investment	20%
Cost of capital i.e. (K_e)	16%



What should be the approximate dividend payout ratio so as to keep the share price at ₹42 by using Walter model?

Answer

$$\text{EPS} = \frac{\text{PAT} - \text{Preference Dividend}}{\text{No of Equity Shares}} = \frac{30,00,000 - 12\% \text{ of } 1,00,00,000}{3,00,000} = ₹6$$

$$P = \frac{D + (E - D) \times \frac{r}{K_e}}{K_e} = \frac{D + (6 - D) \times \frac{0.20}{0.16}}{0.16} = 42$$

$$6.72 = \frac{0.16D + 1.2 - 0.20D}{0.16}$$

$$1.0752 = 1.2 - 0.04D \quad \text{or} \quad D = 3.12$$

Dividend Payout ratio:

$$= \frac{\text{DPS}}{\text{EPS}} \times 100 = \frac{3.12}{6} \times 100 = 52\%$$

BQ 8

The following information pertains to M/s XY Ltd.

Earnings of the Company	₹5,00,000
Dividend Payout ratio	60%
No. of shares outstanding	1,00,000
Equity capitalization rate	12%
Rate of return on investment	15%

1. What would be the market value per share as per Walter's model?
2. What is the optimum dividend payout ratio according to Walter's model and the market value of Company's share at that payout ratio?

Answer

1. Calculation of market value per share as per Walter's model:

$$P = \frac{D + (E - D) \times \frac{r}{K_e}}{K_e} = \frac{3 + (5 - 3) \times \frac{0.15}{0.12}}{0.12} = ₹45.83$$

$$\text{EPS} = \frac{\text{PAT}}{\text{No of Equity Shares}} = \frac{5,00,000}{1,00,000} = ₹5$$

$$\text{DPS} = \text{EPS} \times \text{Dividend payout ratio} = ₹5 \times 60\% = ₹3$$

2. According to Walter's model when the return on investment is more than the cost of equity capital, the price per share increases as the dividend pay-out ratio decreases. Hence, the optimum dividend pay-out ratio in this case is nil.

$$P \text{ (at 0 Payout)} = \frac{D + (E - D) \times \frac{r}{K_e}}{K_e} = \frac{0 + (5 - 0) \times \frac{0.15}{0.12}}{0.12} = ₹52.08$$

BQ 9

The earning per share of a company is ₹10 and the rate of capitalization applicable to it is 10 per cent.

The company has three options of paying dividend i.e. (1) 50%, (2) 75% and (3) 100%.

Calculate the market price of share as per Walter's model if it can earn a return of (a) 15%, (b) 10% and (c) 5% on its retained earnings.

Answer

$$\text{Market value of share (P)} = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e}$$

Calculation of Market Value per Share as per Walter's Model

Rate of Earning (r)	DP Ratio 50%	DP Ratio 75%	DP Ratio 100%
(a) 15%	$\frac{5 + (10 - 5) \times \frac{.15}{.10}}{.10}$ <p style="text-align: center;">= ₹125</p>	$\frac{7.5 + (10 - 7.5) \times \frac{.15}{.10}}{.10}$ <p style="text-align: center;">= ₹112.50</p>	$\frac{10 + (10 - 10) \times \frac{.15}{.10}}{.10}$ <p style="text-align: center;">= ₹100</p>
(b) 10%	$\frac{5 + (10 - 5) \times \frac{.10}{.10}}{.10}$ <p style="text-align: center;">= ₹100</p>	$\frac{7.5 + (10 - 7.5) \times \frac{.10}{.10}}{.10}$ <p style="text-align: center;">= ₹100</p>	$\frac{10 + (10 - 10) \times \frac{.10}{.10}}{.10}$ <p style="text-align: center;">= ₹100</p>
(c) 5%	$\frac{5 + (10 - 5) \times \frac{.05}{.10}}{.10}$ <p style="text-align: center;">= ₹75</p>	$\frac{7.5 + (10 - 7.5) \times \frac{.05}{.10}}{.10}$ <p style="text-align: center;">= ₹87.50</p>	$\frac{10 + (10 - 10) \times \frac{.05}{.10}}{.10}$ <p style="text-align: center;">= ₹100</p>

BQ 10

The following information is supplied to you:

Total Earnings	₹2,00,000
No. of equity shares (of ₹100 each)	20,000
Dividend paid	₹1,50,000
Price/Earnings ratio	12.5

Applying Walter's Model:

1. Ascertain whether the company is following an optimal dividend policy.
2. Find out what should be the P/E ratio at which the dividend policy will have no effect on the value of the share.
3. Will your decision change, if the P/E ratio is 8 instead of 12.5?

Answer

$$1. \quad K_e = \frac{1}{PE} = \frac{1}{12.5} = 8\%$$

$$r = \frac{\text{Total Earnings}}{\text{Total Funds}} \times 100 = \frac{2,00,000}{20,000 \text{ Shares} \times 100 \text{ per share}} \times 100 = 10\%$$

r > K_e, Therefore as per Walter model optimum dividend payout is Nil and company is paying dividend to shareholders means company is not following optimum dividend policy.



2. The P/E ratio at which the dividend policy will have no effect on the value of the share is such at which the k_e would be equal to the rate of return (r) of the firm.

$$K_e = r = 10\%$$

$$PE = \frac{1}{K_e} = \frac{1}{.10} = 10 \text{ times}$$

3. If the P/E is 8 instead of 12.5, then the K_e which is the inverse of P/E ratio, would be 12.5:

$$K_e = \frac{1}{PE} = \frac{1}{8} = 12.5\%$$

In such a situation $K_e > r$ and optimum dividend payout will be 100%.

GORDON MODEL

BQ 11

X Ltd. is a no growth company, pays a dividend of ₹5 per share. If the cost of capital is 10%, what should be the current market price of the share?

Answer

$$P_0 = \frac{D}{K_e} = \frac{5}{0.10} = ₹50$$

BQ 12

XYZ is company having share capital of ₹10 lakhs of ₹10 each. It distributed current dividend of 20% per annum. Annual growth rate in dividend expected is 2%. The expected rate of return on its equity capital is 15%, what should be the current market price of the share?

Answer

$$P_0 = \frac{D_0(1+g)}{K_e-g} = \frac{2(1+.02)}{0.15-0.02} = ₹15.69$$

BQ 13

A firm had paid dividend at ₹2 per share last year. The estimated growth of the dividends from the company is estimated to be 5% p.a. Determine the estimated market price of the equity share with 5% growth rate and if the estimated growth rate of dividends (i) rises to 8%, and (ii) falls to 3%. Also find out the present market price of the share, given that the required rate of return of the equity investors is 15%.

Answer

$$P_0 = \frac{D_0(1+g)}{K_e-g} = \frac{2(1+.05)}{0.15-0.05} = ₹21$$

1. MPS with 8% growth rate:

$$P_0 = \frac{D_0(1+g)}{K_e-g} = \frac{2(1+.08)}{0.15-0.08} = ₹30.86$$

2. MPS with 3% growth rate:

$$P_0 = \frac{D_0(1+g)}{K_e-g} = \frac{2(1+.03)}{0.15-0.03} = ₹17.17$$

BQ 14

By taking the following data of three different firms i.e. growth, normal and declining firm calculate the current price of share by using the Gordon model after that again calculate revised price of share with 0.4 retained earning and check the relationship between Gordon and Walter model.

<i>Factors</i>	<i>Growth Firm $r > K_e$</i>	<i>Normal Firm $r = K_e$</i>	<i>Declining Firm $r < K_e$</i>
R (Rate of Return on Retained Earnings)	15%	10%	8%
K (Cost of Capital)	10%	10%	10%
E (Earning Per Share)	₹10	₹10	₹10
B (Retained Earning)	0.6	0.6	0.6
1 - B	0.4	0.4	0.4

Answer

Calculation of current price of share as per Gordon model:

$$P_0 = \frac{D_1}{K_e - g}$$

Growth	=	$\frac{10 \times 0.4}{0.10 - 0.09}$	=	₹400
Normal	=	$\frac{10 \times 0.4}{0.10 - 0.06}$	=	₹100
Declining	=	$\frac{10 \times 0.4}{0.10 - 0.048}$	=	₹76.92

Working note:

Growth	=	$b \times r$	=	9%
Normal	=	$15\% \times .6$	=	6%
Declining	=	$10\% \times .6$	=	4.8%

Calculation of revised price of share as per Gordon model when b is 0.4 and payout is 0.6:

Growth	=	$\frac{10 \times 0.6}{0.10 - 0.06}$	=	₹150
Normal	=	$\frac{10 \times 0.6}{0.10 - 0.04}$	=	₹100
Declining	=	$\frac{10 \times 0.6}{0.10 - 0.032}$	=	₹88.23

Working note:

Growth	=	$b \times r$	=	6%
Normal	=	$15\% \times .4$	=	4%
Declining	=	$10\% \times .4$	=	3.2%

From the above analysis it can be concluded that:



When $r > k$, the market value increases with retention ratio, when $r < k$, the market value of share stands to decrease and when $r = k$, the market value is not affected by dividend policy.

The conclusion of the Gordon's model is similar to that of Walter's model.

BQ 15

The following figures are collected from the annual report of XYZ Ltd.:

Net Profit	₹30,00,000
Outstanding 12% Preference Shares	₹1,00,00,000
No. of Equity Shares	3,00,000
Return on Investment	20%
Cost of Capital	16%

Calculate price per share using Gordon's Model when dividend payout is (1) 25%, (2) 50% and (3) 100%.

Answer

Calculation of Price of Share as per Gordon model:

$$P_0 = \frac{D_1}{K_e - g}$$

(1) When 25% payout = $\frac{6 \times 0.25}{0.16 - 0.15} = ₹150$

(2) When 50% payout = $\frac{6 \times 0.50}{0.16 - 0.10} = ₹50$

(3) When 100% payout = $\frac{6 \times 1.00}{0.16 - 0.00} = ₹37.50$

Working note:

(a) **Growth** = $b \times r$

When 25% payout = $20\% \times .75 = 15\%$

When 50% payout = $20\% \times .50 = 10\%$

When 100% payout = $20\% \times .00 = 0\%$

(b) **Earning Per Share** = $(PAT - PD) \div \text{Number of shares}$
 = $(30,00,000 - 12\% \text{ of } 1,00,00,000) \div 3,00,000 = ₹6$

BQ 16

The annual report of XYZ Ltd. provides the following information for the Financial Year 2020-21:

Net Profit	₹50,00,000
Outstanding 15% Preference Shares	₹1,00,00,000
No. of Equity Shares	5,00,000
Return on Investment	20%
Cost of Capital i.e. (K_e)	16%

Calculate price per share using Gordon's Model when dividend payout is (1) 25%, (2) 50% and (3) 100%.

Answer

Calculation of Price of Share as per Gordon model:

$$P_0 = \frac{D_1}{K_e - g}$$

(1) When 25% payout = $\frac{7 \times 0.25}{0.16 - 0.15} = ₹175$

(2) When 50% payout = $\frac{7 \times 0.50}{0.16 - 0.10} = ₹58.33$

(3) When 100% payout = $\frac{7 \times 1.00}{0.16 - 0.00} = ₹43.75$

Working note:

(a) **Growth** = $b \times r$

When 25% payout = $20\% \times .75 = 15\%$

When 50% payout = $20\% \times .50 = 10\%$

When 100% payout = $20\% \times .00 = 0\%$

(b) **Earning Per Share** = $(PAT - PD) \div \text{Number of shares}$

= $(50,00,000 - 15\% \text{ of } 1,00,00,000) \div 5,00,000 = ₹7$

BQ 17

A N Ltd. gives you the following information:

The appropriate market rate of discount is 8% and that the company is expected to enjoy an above-average performance for eight years with dividends growing at say 10% per annum. After that time, because of competition and the company losing its present technological or marketing lead, the growth in dividends will revert to the average for all companies-say 4%. The present dividend is ₹0.10 per share.

Compute the current value of equity share of the company.

Answer

Calculation of Present Value or Current Market Value of Share

Year	Expected benefits	PVF @ 8%	DCF
1	0.10 + 10% = ₹0.11	0.926	0.101
2	0.11 + 10% = ₹0.121	0.857	0.103
3	0.121 + 10% = ₹0.133	0.794	0.106
4	0.133 + 10% = ₹0.146	0.735	0.107
5	0.146 + 10% = ₹0.161	0.681	0.110
6	0.161 + 10% = ₹0.177	0.630	0.112
7	0.177 + 10% = ₹0.195	0.583	0.114
8	0.195 + 10% = ₹0.214	0.540	0.116
(9 to ∞)	$P_8 = ₹5.55$	0.540	3.00
Present value of all future benefits or Current market value of Share			₹3.87

$$P_8 = \frac{D_9}{K_e - g} = \frac{.214 + 4\%}{8\% - 4\%} = ₹5.55$$

BQ 18

A&R Ltd. is a large-cap multinational company listed in BSE in India with a face value of ₹100 per share. The company is expected to grow @ 15% p.a. for next four years then 5% for an indefinite period. The shareholders expect 20% return on their share investments. Company paid ₹120 as dividend per share for the FY 2022-23. The shares of the company traded at an average price of ₹3,122 on last day.

Find out the intrinsic value of per share and state whether shares are overpriced or under-priced.

Answer

Calculation of Present Value or Current Market Value or Intrinsic Value of Share

Year	Expected benefits	PVF @ 20%	DCF
1	120.00 + 15% = ₹138.00	0.833	114.95
2	138.00 + 15% = ₹158.70	0.694	110.14
3	158.70 + 15% = ₹182.50	0.579	105.67
4	182.50 + 15% = ₹209.88	0.482	101.16
(5 to ∞)	$P_4 = ₹1,469.16$	0.482	708.13
Present value of all future benefits or Intrinsic value of Share			₹1,140.05

$$P_4 = \frac{D_5}{K_e - g} = \frac{209.88 + 5\%}{20\% - 5\%} = ₹1,469.16$$

Intrinsic value of share is ₹1,140.05 as compared to latest market price of ₹3,122. Market price of a share is overpriced by ₹1,981.95.

TRADITIONAL MODEL (GRAHAM AND DODD MODEL)

BQ 19

The following information regarding the equity shares of M ltd. is given that Market price is ₹58.33, Dividend per share is ₹5 and Multiplier is 7.

According to the Graham & Dodd approach to the dividend policy, compute the EPS.

Answer

$$\begin{aligned} P &= M (D + E/3) \\ 58.33 &= 7 (5 + E/3) \\ E &= ₹9.99 \text{ or } ₹10 \text{ approx.} \end{aligned}$$

BQ 20

The earning per share of a company is ₹30 and dividend payout is 60%. Multiplier is 2.

Determine the price per share as per Graham & Dodd model.

Answer

$$\begin{aligned} \text{Price per share (P)} &= M (D + E/3) \\ P &= 2 (30 \times 0.60 + 30/3) \\ P &= 2 (18 + 10) = ₹56 \end{aligned}$$

BQ 21

The dividend payout ratio of H Ltd. is 40%. If the company follows traditional approach to dividend policy with a multiplier of 9, what will be the P/E ratio.

Answer

Since the dividend payout ratio is 40%

$$D = 40\% \text{ of } E \text{ i.e. } 0.4E$$

$$P = M(D + E/3) = 9(D + E/3) = 9(0.4E + E/3)$$

$$P = 9(0.4E + E/3) = 9\left(\frac{1.2E+E}{3}\right) = 3(2.2E) = 6.6E$$

$$P/E \text{ ratio} = \frac{MPS}{EPS} = \frac{P}{E} = \frac{6.6E}{E} = \mathbf{6.6times}$$

LINTER'S MODEL

BQ 22

Given the last year's dividend is ₹9.80, speed of adjustment = 45%, target payout ratio 60% and EPS for current year ₹20.

Calculate current year's dividend using Linter's model.

Answer

$$\begin{aligned} D_1 &= D_0 + [(EPS \times \text{Target payout}) - D_0] \times Af \\ &= 9.80 + [(20 \times 60\%) - 9.80] \times 0.45 = \mathbf{₹10.79} \end{aligned}$$

MISCELLANEOUS

BQ 23

With the help of following figures calculate the market price of a share of a company by using:

1. Walter's formula
2. Dividend growth model (Gordon's formula)

Earning per share (EPS)	₹10
Dividend per share (DPS)	₹6
Cost of capital (k)	20%
Internal rate of return on investment	25%
Retention Ratio	40%

Answer

(a) Walter's formula:

$$P = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{6 + (10-6) \times \frac{0.25}{0.20}}{0.20} = \mathbf{₹55}$$

(b) Gordon's formula (Dividend Growth model):

$$P_0 = \frac{D_1}{K_e - g} = \frac{6}{0.20 - 0.10} = \mathbf{₹60}$$

$$G = b \times r = 25\% \times .4 = 10\%$$



BQ 24

The following information is given below in case of Aditya Ltd.:

Earnings per share	₹60
Capitalisation rate	15%
Return on investment	25%
Dividend payout ratio	30%

- (a) Compute price per share using Walter’s Model.
- (b) What would be optimum dividend payout ratio per share under Gordon’s Model.

Answer

(a) Price per share using Walter’s Model:

$$P = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{18 + (60-18) \times \frac{0.25}{0.15}}{0.15} = ₹586.67$$

(b) As per Gordon’s model, when $r > K_e$, optimum dividend payout ratio is ‘Zero’.

BQ 25

In the month of May of the current financial year, shares of RT Ltd. was sold for ₹1,460 per share. A long term earnings growth rate of 7.5% is anticipated. RT Ltd. is expected to pay dividend of ₹20 per share.

- (a) Calculate rate of return an investor can expect to earn assuming that dividends are expected to grow along with earnings at 7.5% per year in perpetuity?
- (b) It is expected that RT Ltd. will earn about 10% on retained earnings and shall retain 60% of earnings. In this case, State whether, there would be any change in growth rate and cost of Equity?

Answer

(a) $K_e = \frac{D_1}{P_0} + g = \frac{20}{1,460} + 7.5\% = 8.87\%$

(b) With rate of return on retained earnings (r) 10% and retention ratio (b) 60%, new growth rate will be as follows:

$$g \text{ (revised growth rate)} = b \times r = 0.10 \times 0.60 = 0.06 \text{ or } 6\%$$

Accordingly, dividend will also get changed and to calculate this, first we shall calculate previous retention ratio (b_1) and then EPS assuming that rate of return on retained earnings (r) is same. With previous growth rate of 7.5% and $r = 10\%$, the retention ratio comes out to be:

$$0.075 = b_1 \times 0.10 \quad \text{and} \quad \text{payout ratio} = 0.25$$

$$\text{EPS} = ₹20 \div 0.25 \text{ (.75 retention)} = ₹80$$

$$\text{Revised } D_1 = ₹80 \times 0.40 = ₹32$$

$$\text{Revised } K_e = \frac{D_1}{P_0} + g = \frac{32}{1,460} + 6\% = 8.19\%$$

BQ 26

Mr H is currently holding 1,00,000 shares of HM ltd, and currently the share of HM ltd is trading on Bombay Stock Exchange at ₹50 per share. Mr A have a policy to re-invest the amount of any dividend received into the shared back again of HM ltd. If HM ltd has declared a dividend of ₹10 per share.

Determine the no of shares that Mr A would hold after he re-invests dividend in shares of HM ltd.

Answer

Ex-dividend price of Share	=	₹40 (50 – 10)	
Dividend received	=	₹10,00,000 (1,00,000 shares × ₹10)	
Additional shares purchased	=	₹10,00,000 ÷ ₹40	= 25,000
Total holding	=	1,00,000 + 25,000	= 1,25,000 Shares

BQ 27

Following information is given pertaining to DG ltd:

No of shares outstanding	:	1 lakh shares	
Earnings Per share	:	₹25 per share	
P/E Ratio	:	20	
Book Value per share	:	₹400 per share	

If company decides to repurchase 25,000 shares, at the prevailing market price, what is the resulting book value per share after repurchasing?

Answer

Current Market price	=	EPS × P/E = 25 × 20	
	=	₹500 per share	
Amount paid for repurchase	=	₹1,25,00,000 (25,000 shares × ₹500 per share)	
Book value before repurchase	=	₹4,00,00,000 (₹400 × 1 lakh shares)	
Book Value after repurchase	=	₹2,75,00,000 (4 Cr. – 1.25 Cr.)	
No of shares after repurchase	=	75,000 shares	
Book value per share	=	2,75,00,000 ÷ 75,000	
	=	₹367 per share	



PAST YEAR QUESTIONS

PYQ 1

Following information relating to Jee Ltd. are given:

Profit after tax	:	₹10,00,000
Dividend payout ratio	:	50%
Number of Equity shares	:	50,000
Cost of equity	:	10%
Rate of return on investment	:	12%

- (1) What would be the market value per share as per as per Walter’s Model?
- (2) What is the optimum dividend payout ratio according to Walter’s Model and market value of equity share at that payout ratio?

[(5 Marks) Nov 2018]

Answer

(1) **Market value (P) per share as per Walter’s Model:**

$$\begin{aligned}
 P \text{ (Market value of share)} &= \frac{D + (E - D) \times \frac{r}{K_e}}{K_e} = \frac{10 + (20 - 10) \times \frac{0.12}{0.10}}{0.10} \\
 &= \text{₹}220.00
 \end{aligned}$$

$$\begin{aligned}
 E \text{ (EPS)} &= \text{₹}10,00,000 \text{ (PAT)} \div 50,000 \text{ shares} \\
 &= \text{₹}20
 \end{aligned}$$

- (2) According to Walter’s Model when the return on investment is more than the cost of equity capital, the price per share increases as the dividend payout ratio decreases. Hence, the optimum dividend payout ratio in this case Nil. So, at a payout ratio zero, the market value of company’s share will be:

$$\begin{aligned}
 P \text{ (Market value of share)} &= \frac{D + (E - D) \times \frac{r}{K_e}}{K_e} = \frac{0 + (20 - 0) \times \frac{0.12}{0.10}}{0.10} \\
 &= \text{₹}240.00
 \end{aligned}$$

PYQ 2

The following information is supplied to you:

Total Earning	:	₹40,00,000
Number of Equity Shares (of ₹100 each)	:	4,00,000
Dividend Per Share	:	₹4
Cost of Capital	:	16%
Internal Rate of Return	:	20%
Retention Ratio	:	60%

Calculate the market price of a share of company by using:

- (1) Walter’s Formula,
- (2) Gordon’ Formula.

[(5 Marks) May 2019]

Answer

(1) Market Price of Share (P) as per Walter's Formula:

$$P \text{ (Market value of share)} = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{4 + (10-4) \times \frac{0.20}{0.16}}{0.16}$$

$$= ₹71.875$$

$$E \text{ (EPS)} = ₹40,00,000 \text{ (Earning)} \div 4,00,000 \text{ shares}$$

$$= ₹10$$

(2) Market Price of Share (P) as per Gordon's Formula:

$$P_0 \text{ (Market value of share)} = \frac{D_1}{K_e - g} = \frac{4.00}{0.16 - 0.12} = ₹100.00$$

$$G \text{ (Growth Rate)} = b \times r = 20\% \times .6 = 12\%$$

PYQ 3

Following figures and information were extracted from the company A Ltd.

Earnings of the company	₹10,00,000
Dividend paid	₹6,00,000
No. of shares outstanding	2,00,000
Price earnings ratio	10
Rate of return on investment	20%

You are required to calculate:

- (1)** Current market price of the share.
- (2)** Capitalization rate of its risk class.
- (3)** What should be the optimum payout ratio?
- (4)** What should be the market price per share at optimal payout ratio? (use Walter's model)

[(5 Marks) Nov 2019]

Answer

(1) Current market price of share:

$$\text{Current Market Price of Share} = \text{EPS} \times \text{PE Ratio}$$

$$= \frac{10,00,000}{2,00,000} \times 10 = ₹50$$

(2) Capitalization rate of its risk class:

$$\text{Capitalization rate (K}_e\text{)} = 1/\text{PE}$$

$$= 1/10 = 0.10 \text{ or } 10\%$$

(3) Optimum payout:

$r > K_e$, Therefore dividend payout should be *Nil*.

(4) Market Price of Share (P) as per Walter's Formula as per optimal payout ratio:



$$P \text{ (Market price of share)} = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{0 + (5-0) \times \frac{0.20}{0.10}}{0.10} = ₹100$$

PYQ 4

The following figures are extracted from the annual report of RJ Ltd.:

Net Profit	₹50 lakhs
Outstanding 13% preference shares	₹200 lakhs
No. of Equity shares	6 lakhs
Return on Investment	25%
Cost of capital i.e. (K_e)	15%

You are required to compute the approximate dividend payout ratio by keeping the share price at ₹40 by using Walter model?

[(5 Marks) Nov 2020]

Answer

$$EPS = \frac{PAT - \text{Preference Dividend}}{\text{No of Equity Shares}} = \frac{50,00,000 - 13\% \text{ of } 2,00,00,000}{6,00,000} = ₹4$$

$$P = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{D + (4-D) \times \frac{0.25}{0.15}}{0.15} = 40$$

$$6 = \frac{0.15D + 1 - 0.25D}{0.15}$$

$$0.9 = 1 - 0.10D \quad \text{or} \quad D = 1$$

$$\text{Dividend Payout ratio} = \frac{DPS}{EPS} \times 100 = \frac{1}{4} \times 100 = 25\%$$

PYQ 5

The following information is taken from ABC Ltd.

Net Profit for the year	₹30,00,000
12% Preference shares capital	₹1,00,00,000
Equity share capital (Share of ₹10 each)	₹60,00,000
Internal rate of return on investment	22%
Cost of Equity capital	18%
Retention ratio	75%

Calculate the market price of the share using:

- Gordon's Model
- Walter's Model

[(5 Marks) Jan 2021]

Answer

1. Calculation of Price of share as per Gordon model:

$$P_0 = \frac{D_1}{K_e - g} = \frac{3 \times 0.25}{0.18 - 0.165} = ₹50$$

2. Calculation of Price of share as per Walter model:

$$P = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{0.75 + (3 - 0.75) \times \frac{0.22}{0.18}}{0.18} = \text{₹}19.44$$

Working note:

(a) Growth = $b \times r = 22\% \times .75 = 16.50\%$

(b) EPS = $(PAT - PD) \div \text{Number of shares}$
 = $(30,00,000 - 12\% \text{ of } 1,00,00,000) \div 6,00,000 = \text{₹}3$

(c) DPS = $EPS \times \text{Payout ratio} = \text{₹}3 \times 25\% = \text{₹}0.75$

PYQ 6

The following information relates to LMN Ltd.

Earnings of the Company	₹30,00,000
Dividend Payout ratio	60%
No. of shares outstanding	5,00,000
Rate of return on investment	15%
Equity capitalized rate	13%

Required:

1. Determine what would be the market value per share as per Walter's model?
2. Compute optimum dividend payout ratio according to Walter's model and the market value of company's share at that payout ratio?

[(5 Marks) July 2021]

Answer

1. Calculation of market value per share as per Walter's model:

$$P = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{3.60 + (6 - 3.60) \times \frac{0.15}{0.13}}{0.13} = \text{₹}48.99$$

$$EPS = \frac{PAT}{\text{No of Equity Shares}} = \frac{30,00,000}{5,00,000} = \text{₹}6$$

$$DPS = EPS \times \text{Dividend payout ratio} = \text{₹}6 \times 60\% = \text{₹}3.60$$

2. According to Walter's model when the return on investment is more than the cost of equity capital, the price per share increases as the dividend pay-out ratio decreases. Hence, the optimum dividend payout ratio in this case is nil.

$$P \text{ (at 0 Payout)} = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{0 + (6 - 0) \times \frac{0.15}{0.13}}{0.13} = \text{₹}53.25$$

PYQ 7

X Ltd. is a manufacturing company. Current market price per share is ₹2,185. During the F.Y. 2020-21, the company paid ₹140 as dividend per share. The company is expected to grow @12% p.a. for next four years, then 5% p.a. for an indefinite period. Expected rate of return of shareholders is 18% p.a.

- (i) Find out intrinsic value per share.
- (ii) State whether shares are overpriced or underpriced.

Year	1	2	3	4	5
Discounting Factor@18%	0.847	0.718	0.608	0.515	0.436

[(5 Marks) Dec 2021]

Answer

(i) Calculation of Intrinsic Value of Share

Year	Expected benefits	PVF @ 18%	DCF
1	140.00 + 12% = ₹156.80	0.847	132.81
2	156.80 + 12% = ₹175.62	0.718	126.10
3	175.62 + 12% = ₹196.69	0.608	119.59
4	196.69 + 12% = ₹220.29	0.515	113.45
(5 to ∞)	P ₄ = ₹1,779.27	0.515	916.32
Present value of all future benefits or Intrinsic value of Share			₹1,408.27

$$P_4 = \frac{D_5}{K_e - g} = \frac{220.29 + 5\%}{18\% - 5\%} = ₹1,779.27$$

(ii) Intrinsic value of share is ₹1,408.27 as compared to latest market price of ₹2,185. Market price of a share is overpriced by ₹776.73.

PYQ 8

Following information are given for a company:

Earnings per share	₹10
P/E ratio	12.5
Rate of return on investment	12%
Market price per share as per Walter's model	₹130

You are required to calculate:

- (a) Dividend payout ratio.
- (b) Market price of share at optimum dividend payout ratio.
- (c) P/E ratio, at which the dividend policy will have no effect on the price of share.
- (d) Market Price of share at this P/E ratio.
- (e) Market price of share using Dividend growth model.

[(5 Marks) May 23]

Answer

$$\begin{aligned}
 \text{(a) Market price of share (P)} &= \frac{D + (E - D) \times \frac{r}{K_e}}{K_e} \\
 130 &= \frac{D + (10 - D) \times \frac{0.12}{0.08}}{0.08} \\
 10.40 &= D + (10 - D) \times \frac{0.12}{0.08} \\
 10.40 &= D + 15 - 1.5 D \\
 .5D &= 4.6 \\
 D &= ₹9.20
 \end{aligned}$$

$$\text{Dividend Payout} = \frac{9.20}{10.00} \times 100 = 92\%$$

Working Note:

$$K_e = 1/PE = 1/12.5 = 8\%$$

(b) $r > K_e$, Therefore as per Walter model optimum dividend payout is **Nil**

$$\text{Market price of share (P)} = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{0 + (10-0) \times \frac{0.12}{0.08}}{0.08} = \text{₹187.5}$$

(c) The P/E ratio at which the dividend policy will have no effect on the value of the share is such at which the k_e would be equal to the rate of return (r) of the firm.

$$K_e = r = 12\%$$

$$PE = 1/K_e = 1/12\% = \text{8.33 times}$$

(d) Market price of share (P) = EPS × PE = 10 × 8.33 = **₹83.33**

(e) Market price of share using Dividend growth model:

$$P_0 = \frac{D_1}{K_e - g} = \frac{9.20}{0.08 - 0.0096} = \text{₹130.68}$$

Working note:

$$G = b \times r = 12\% \times .08 = 0.96\%$$

PYQ 9

(a) EPS of a company is ₹60 and Dividend payout ratio is 60%. Multiplier is 5. Determine price per share as per Graham & Dodd model.

(b) Last Year's dividend is ₹6.34, adjustment factor is 45%, target payout ratio is 60% and current year's EPS is ₹12. Compute current's year's dividend using Linter's model.

[(5 Marks) Nov 23]

Answer

(a) $P = \frac{M(D + E/3)}{5(36 + 60/3)} = \text{₹280}$

(b) $D_1 = D_0 + [(EPS \times \text{Target payout}) - D_0] \times Af$
 $= 6.34 + [(12 \times 60\%) - 6.34] \times 0.45 = \text{₹6.73}$

PYQ 10

INFO Ltd is a listed company having share capital of ₹2,400 Crores of ₹5 each. During the year:

Dividend distributed	1000%
Expected Annual growth rate in dividend	14%
Expected rate of return on its equity capital	18%

Required:

- (a) Calculate price of share applying Gordon's growth Model.
- (b) What will be the price of share if the Annual growth rate in dividend is only 10%?



- (c) According to Gordon's growth Model, if Internal Rate of Return is 25%, than what should be the optimum dividend payout ratio in case of growing stage of company? Comment.

[(5 Marks) Nov 23]

Answer

$$(a) P_0 = \frac{D_0(1+g)}{K_e-g} = \frac{50(1+.14)}{0.18-0.14} = ₹1,425$$

$$(b) P_0 = \frac{D_0(1+g)}{K_e-g} = \frac{50(1+.10)}{0.18-0.10} = ₹687.50$$

- (c) When r (25%) is higher than Ke (18%) in case of growing stage company, Optimum payout is Nil.

Working Notes:

$$D_0 = 1,000\% \text{ of } ₹5 = ₹50$$

SUGGESTED REVISION FOR EXAM:

BQ: 1, 5, 7, 10, 14, 17, 18, 21, 22, 25, 27

PYQ: 6, 8

TABLE 1

Table I – Present Value Table (PVIF)														
Present Value of ₹1 at the end of n years														
Years	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%
1	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696	0.8333	0.8000	0.7692
2	0.9070	0.8900	0.8734	0.8573	0.8417	0.8264	0.8116	0.7972	0.7831	0.7695	0.7561	0.6944	0.6400	0.5917
3	0.8638	0.8396	0.8163	0.7938	0.7722	0.7513	0.7312	0.7118	0.6931	0.6750	0.6575	0.5787	0.5120	0.4552
4	0.8227	0.7921	0.7629	0.7350	0.7084	0.6830	0.6587	0.6355	0.6133	0.5921	0.5718	0.4823	0.4096	0.3501
5	0.7835	0.7473	0.7130	0.6806	0.6499	0.6209	0.5935	0.5674	0.5428	0.5194	0.4972	0.4019	0.3277	0.2693
6	0.7462	0.7050	0.6663	0.6302	0.5963	0.5645	0.5346	0.5066	0.4803	0.4556	0.4323	0.3349	0.2621	0.2072
7	0.7107	0.6651	0.6227	0.5835	0.5470	0.5132	0.4817	0.4523	0.4251	0.3996	0.3759	0.2791	0.2097	0.1594
8	0.6768	0.6274	0.5820	0.5403	0.5019	0.4665	0.4339	0.4039	0.3762	0.3506	0.3269	0.2326	0.1678	0.1226
9	0.6446	0.5919	0.5439	0.5002	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843	0.1938	0.1342	0.0943
10	0.6139	0.5584	0.5083	0.4632	0.4224	0.3855	0.3522	0.3220	0.2946	0.2697	0.2472	0.1615	0.1074	0.0725
11	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505	0.3173	0.2875	0.2607	0.2366	0.2149	0.1346	0.0859	0.0558
12	0.5568	0.4970	0.4440	0.3971	0.3555	0.3186	0.2858	0.2567	0.2307	0.2076	0.1869	0.1122	0.0687	0.0429
13	0.5303	0.4688	0.4150	0.3677	0.3262	0.2897	0.2575	0.2292	0.2042	0.1821	0.1625	0.0935	0.0550	0.0330
14	0.5051	0.4423	0.3878	0.3405	0.2992	0.2633	0.2320	0.2046	0.1807	0.1597	0.1413	0.0779	0.0440	0.0254
15	0.4810	0.4173	0.3624	0.3152	0.2745	0.2394	0.2090	0.1827	0.1599	0.1401	0.1229	0.0649	0.0352	0.0195
16	0.4581	0.3936	0.3387	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069	0.0541	0.0281	0.0150
17	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929	0.0451	0.0225	0.0116
18	0.4155	0.3505	0.2959	0.2502	0.2120	0.1799	0.1528	0.1300	0.1108	0.0946	0.0808	0.0376	0.0180	0.0089
19	0.3957	0.3305	0.2765	0.2317	0.1945	0.1635	0.1377	0.1161	0.0981	0.0829	0.0703	0.0313	0.0144	0.0068
20	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486	0.1240	0.1037	0.0868	0.0728	0.0611	0.0261	0.0115	0.0053

TABLE 2

Table II – Annuity Factor Table (PVAF)
Present Value of Annuity of ₹1 per year (Cumulative Discounting Factor)

Years	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%
1	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696	0.8333	0.8000	0.7692
2	1.8594	1.8334	1.8080	1.7833	1.7591	1.7355	1.7125	1.6901	1.6681	1.6467	1.6257	1.5278	1.4400	1.3609
3	2.7232	2.6730	2.6243	2.5771	2.5313	2.4869	2.4437	2.4018	2.3612	2.3216	2.2832	2.1065	1.9520	1.8161
4	3.5460	3.4651	3.3872	3.3121	3.2397	3.1699	3.1024	3.0373	2.9745	2.9137	2.8550	2.5887	2.3616	2.1662
5	4.3295	4.2124	4.1002	3.9927	3.8897	3.7908	3.6959	3.6048	3.5172	3.4331	3.3522	2.9906	2.6893	2.4356
6	5.0757	4.9173	4.7665	4.6229	4.4859	4.3553	4.2305	4.1114	3.9975	3.8887	3.7845	3.3255	2.9514	2.6427
7	5.7864	5.5824	5.3893	5.2064	5.0330	4.8684	4.7122	4.5638	4.4226	4.2883	4.1604	3.6046	3.1611	2.8021
8	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349	5.1461	4.9676	4.7988	4.6389	4.4873	3.8372	3.3289	2.9247
9	7.1078	6.8017	6.5152	6.2469	5.9952	5.7590	5.5370	5.3282	5.1317	4.9464	4.7716	4.0310	3.4631	3.0190
10	7.7217	7.3601	7.0236	6.7101	6.4177	6.1446	5.8892	5.6502	5.4262	5.2161	5.0188	4.1925	3.5705	3.0915
11	8.3064	7.8869	7.4987	7.1390	6.8052	6.4951	6.2065	5.9377	5.6869	5.4527	5.2337	4.3271	3.6564	3.1473
12	8.8633	8.3838	7.9427	7.5361	7.1607	6.8137	6.4924	6.1944	5.9176	5.6603	5.4206	4.4392	3.7251	3.1903
13	9.3936	8.8527	8.3577	7.9038	7.4869	7.1034	6.7499	6.4235	6.1218	5.8424	5.5831	4.5327	3.7801	3.2233
14	9.8986	9.2950	8.7455	8.2442	7.7862	7.3667	6.9819	6.6282	6.3025	6.0021	5.7245	4.6106	3.8241	3.2487
15	10.3797	9.7122	9.1079	8.5595	8.0607	7.6061	7.1909	6.8109	6.4624	6.1422	5.8474	4.6755	3.8593	3.2682
16	10.8378	10.1059	9.4466	8.8514	8.3126	7.8237	7.3792	6.9740	6.6039	6.2651	5.9542	4.7296	3.8874	3.2832
17	11.2741	10.4773	9.7632	9.1216	8.5436	8.0216	7.5488	7.1196	6.7291	6.3729	6.0472	4.7746	3.9099	3.2948
18	11.6896	10.8276	10.0591	9.3719	8.7556	8.2014	7.7016	7.2497	6.8399	6.4674	6.1280	4.8122	3.9279	3.3037
19	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.8393	7.3658	6.9380	6.5504	6.1982	4.8435	3.9424	3.3105
20	12.4622	11.4699	10.5940	9.8181	9.1285	8.5136	7.9633	7.4694	7.0248	6.6231	6.2593	4.8696	3.9539	3.3158

TABLE 3

Table III - Compound Value Table (FVIF)															
Compound Value of ₹1 after n year (Growth Factor)															
Years	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%
1	1.050	1.060	1.070	1.080	1.090	1.100	1.120	1.130	1.150	1.160	1.180	1.200	1.240	1.280	1.320
2	1.102	1.124	1.115	1.166	1.188	1.210	1.254	1.300	1.322	1.346	1.392	1.440	1.538	1.638	1.742
3	1.158	1.191	1.225	1.260	1.295	1.331	1.405	1.482	1.521	1.561	1.643	1.728	1.907	2.097	2.300
4	1.216	1.262	1.311	1.360	1.412	1.464	1.574	1.689	1.749	1.811	1.939	2.074	2.364	2.984	3.036
5	1.276	1.338	1.403	1.469	1.539	1.611	1.762	1.925	2.011	2.100	2.288	2.488	2.932	3.436	4.008
6	1.340	1.419	1.501	1.677	1.677	1.772	1.974	2.193	2.313	2.436	2.700	2.986	3.635	4.396	5.290
7	1.407	1.504	1.606	1.714	1.828	1.949	2.211	2.505	2.660	2.826	3.186	3.583	4.508	5.630	6.983
8	1.477	1.594	1.718	1.851	1.993	2.144	2.467	2.853	3.059	3.278	3.759	4.300	5.590	7.206	9.217
9	1.551	1.689	1.838	1.999	2.172	2.358	2.773	3.252	3.518	3.803	4.436	5.160	6.931	9.223	12.116
10	1.629	1.791	1.967	2.159	2.367	2.594	3.106	3.707	4.046	4.411	5.234	6.192	8.594	11.806	16.060
11	1.710	1.898	2.105	2.332	2.580	2.853	3.479	4.206	4.652	5.117	6.176	7.430	10.657	15.112	21.119
12	1.796	2.012	2.252	2.518	2.813	3.138	3.896	4.818	5.350	5.936	7.288	8.916	13.215	19.343	27.983
13	1.888	2.132	2.410	2.730	3.006	3.452	4.363	5.492	6.153	6.886	8.599	10.699	16.386	24.795	36.937
14	1.980	2.261	2.579	2.937	3.342	3.797	4.887	6.261	7.071	7.988	10.147	12.839	20.319	31.691	48.757
15	2.079	2.397	2.579	3.172	3.642	4.177	5.474	7.138	8.13	9.266	11.974	15.407	25.196	40.565	64.359
16	2.186	2.540	2.952	3.426	3.970	4.595	6.130	8.137	9.35	10.748	14.129	18.488	31.243	51.923	84.954
17	2.292	2.613	3.159	3.700	4.328	5.554	6.866	9.276	10.70	12.468	16.672	22.186	38.741	66.461	112.41
18	2.407	2.854	3.380	5.996	4.717	5.560	7.690	10.533	12.3	14.463	19.673	26.623	48.039	85.071	148.02
19	2.527	3.026	3.617	4.316	5.142	6.116	8.613	12.743	14.2	16.777	23.214	31.948	59.568	108.89	159.39
20	2.653	3.207	3.870	4.661	5.604	6.728	9.646	13.743	16.3	19.461	27.393	38.338	73.864	139.38	257.92