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

LEARNING OBJECTIVES

After studying this chapter you will be able to:

- *Understand the meaning of investment decisions or capital budgeting decisions.*
- *Understand various techniques of capital budgeting.*
- *Understand traditional and discounted cash flow techniques.*
- *Know the importance of capital budgeting decisions.*
- *Understand the meaning of capital budgeting and its role in financial management.*

TRADITIONAL TECHNIQUES

BQ 1
Consider the following investment opportunity:

A machine is available for purchase at a cost of ₹80,000. We expect it to have a life of five years and to have a scrap value of ₹10,000 at the end of the five year period. We have estimated that it will generate additional profits over its life as follows:

Year	Amount (₹)
1	20,000
2	40,000
3	30,000
4	15,000
5	5,000

These estimates are of profits before depreciation.

You are required to calculate the return on capital employed (ARR).
[ARR 10% on original investment and 17.78% on average investment]

BQ 2
A project requiring an investment of ₹10,00,000 and it yields profit after tax and depreciation which is as follows:

Year	Profit after tax and depreciation (₹)
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):

Accounting Rate of Return $=$ $\dfrac{\text{Average Profit After Tax}}{\text{Average Investment}} \times 100$

$= \dfrac{92,000}{5,40,000} \times 100$ $=$ **17.04%**

Alternative 2 (Total Investment Basis):

Accounting Rate of Return $=$ $\dfrac{\text{Average Profit After Tax}}{\text{Initial Investment}} \times 100$

$= \dfrac{92,000}{10,00,000} \times 100$ $=$ **9.20%**

Alternative 3 (Annual Basis):

Accounting Rate of Return $=$ $\dfrac{\text{Profit After Tax}}{\text{Investment at the beginning of the year}} \times 100$

Year 1 $=$ $\dfrac{50,000}{10,00,000} \times 100$ $=$ **5.00%**

Year 2 $=$ $\dfrac{75,000}{8,16,000} \times 100$ $=$ **9.19%**

Year 3 $=$ $\dfrac{1,25,000}{6,32,000} \times 100$ $=$ **19.78%**

Year 4	=	$\frac{1,30,000}{4,48,000} \times 100$	=	*29.02%*
Year 5	=	$\frac{80,000}{2,64,000} \times 100$	=	*30.30%*
Average ARR	=	(5% + 9.19% + 19.78% + 29.02% + 30.30%) ÷ 5 years		
	=	*18.66%*		

Working Notes:

Average Profit After Tax	=	(50,000 + 75,000 + 1,25,000 + 1,30,000 + 80,000) ÷ 5		
	=	92,000 per annum		
Average Investment	=	(10,00,000 + 80,000) ÷ 2	=	5,40,000
Depreciation per annum	=	(10,00,000 – 80,000) ÷ 5 years	=	1,84,000

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 before depreciation for each year is ₹1,50,000.

> **Determine Accounting (Book) Rate of Return.**

Answer
Alternative 1 (Average Investment Basis):

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

Alternative 2 (Total Investment Basis):

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

Alternative 3 (Annual Basis):

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

Working Notes:

Average Profit After Tax	=	Profit before depreciation – depreciation		
	=	1,50,000 - 70,000	=	80,000
Average Investment	=	(3,00,000 + 90,000) ÷ 2	=	1,95,000
Depreciation per annum	=	(3,00,000 – 90,000) ÷ 3 years	=	70,000

BQ 4

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

Accounting Rate of Return	=	$\dfrac{\text{Average Profit After Tax}}{\text{Average Investment}} \times 100$		
	=	$\dfrac{80,000}{2,40,000} \times 100$	=	**33.33%**
Average Investment	=	[(3,00,000 + 45,000) + (45,000 + 90,000)] ÷ 2		
	=	2,40,000		

BQ 5

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

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

BQ 6

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

Payback Period	=	6 year + 9,000/40,000	=	**6.225 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

BQ 7

ABC Limited is considering a new five-year project. Its investment costs and annual profits are projected as

follows:

Particulars	Year	₹
Investment	0	(2,50,000)
Profits	1	40,000
	2	30,000
	3	20,000
	4	10,000
	5	10,000

The residual value at the end of the project is expected to be ₹40,000 and depreciation of the original investment is on straight line basis.

Using average profits and average capital employed calculated the ARR for the project and the payback period.

Answer

$$ARR = \frac{\text{Average Profit After Tax}}{\text{Average Investment}}$$

$$= \frac{(40,000+30,000+20,000+10,000+10,000) \div 5}{(2,50,000+40,000) \div 2} = \textbf{15.17\%}$$

$$\text{Payback period} = 3 \text{ years} + \frac{34,000}{52,000} = \textbf{3.654 years}$$

Working Notes:

Calculation of cash inflow

Year	PAT + Depreciation	CFAT	Cumulative CFAT
1	40,000 + 42,000	82,000	82,000
2	30,000 + 42,000	72,000	1,54,000
3	20,000 + 42,000	62,000	216,000
4	10,000 + 42,000	52,000	2,68,000
5	10,000 + 42,000	52,000	3,20,000

$$\text{Annual Depreciation} = \frac{2,50,000 - 40,000}{5 \text{ years}} = 42,000$$

DISCOUNTED PAYBACK, NPV & PI TECHNIQUES (DCF)

BQ 8

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

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

BQ 9

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 10

Machine A costs ₹1,00,000 payable immediately. Machine B costs ₹1,20,000 half payable immediately and half payable in one year's time. The cash receipts expected are as follows:

Year (at the end)	A	B
1	20,000	–
2	60,000	60,000
3	40,000	60,000
4	30,000	80,000
5	20,000	–

Calculate NPV and PI of both the machines, if discounting rate is 7%.

Answer
Calculation of NPV:

Statement of NPV (Machine A)

Years	Particulars	₹	DF @ 7%	PV
0	Investment (outflow)	(1,00,000)	1.0000	(1,00,000)
1	Cash receipts	20,000	0.9346	18,692
2	Cash receipts	60,000	0.8734	52,404
3	Cash receipts	40,000	0.8163	32,652
4	Cash receipts	30,000	0.7629	22,887
5	Cash receipts	20,000	0.7130	14,260
	NPV			40,897

Statement of NPV (Machine B)

Years	Particulars	₹	DF @ 7%	PV
0	Investment (outflow)	(60,000)	1.0000	(60,000)
1	Investment (outflow)	(60,000)	0.9346	(56,076)
2	Cash receipts	60,000	0.8734	52,404
3	Cash receipts	60,000	0.8163	48,978
4	Cash receipts	80,000	0.7629	61,032
	NPV			46,338

$$\text{Calculation of PI} \quad = \quad \frac{\text{PV of Inflows}}{\text{PV of Outflows}}$$

$$\text{Machine A} \quad = \quad \frac{1,40,897}{1,00,000} \quad = \quad 1.41 \text{ times}$$

Machine B	=	$\dfrac{1,62,414}{1,16,076}$	= *1.399 times*

BQ 11

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.

Particulars	Project A	Project B	Project C	Project D
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

Period	PV factor	Project A	Project B	Project C	Project D
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 12

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

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

BQ 13

Santosh & Company is considering setting up a new unit. The following data has been compiled by the company for the purpose of determining the acceptability of the proposal for setting up the new unit.

1. Land (Total ₹5,00,000)
    a. To be paid at the time of purchase (t_0) — ₹2,00,000
    b. 1st, 2nd & 3rd installments at the end of next 3 following years — ₹1,00,000

2. Factory buildings (Total ₹20,00,000)

a. Initial payment on signing of contract	₹2,00,000
b. At the end of year 2	₹10,00,000
c. Balance at the end of year 3	₹8,00,000

3. Plant, Machinery & Equipment:

a. To be paid at the beginning of year 4	₹15,00,000
b. To be paid at the beginning of year 5	₹5,00,000

4. Extra margin for working capital (at the end of year 5)   ₹4,00,000

5. Operations will begin in the 6th year and will continue for 10 years upto year 15. Assume revenue and costs at the end of each year.

6. Buildings, Plant, Machinery and equipment will be depreciated on straight line method over the 10 years starting from year 6, as under:

      a. Buildings @ 5% p.a.
      b. Plant, machinery and equipment @ 10% p.a.

7. Buildings are expected to be sold for ₹6,00,000 and land for ₹8,00,000 at the end.

8. Plant, Machinery & Equipment will have a salvage value of ₹2,00,000.

9. Cost of Capital is 12%.

10. Other operating data:
      a. Annual Sales: ₹30,00,000.
      b. Variable costs of operation: ₹12,00,000.
      c. Fixed costs (excluding depreciation): ₹8,00,000; and Tax rate: 50%.

Assuming profit or loss on sale of assets at end has no tax effect. Advise whether the company should accept the project or reject it on the basis of NPV of the project.

[NPV: Negative 11.722 lacs Approximately; Reject the proposal]

BQ 14

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 15

ABC Ltd. has specialised in the manufacture of a particular type of DVD Player. Recently, it has developed a new model and is confident of selling all the 8,000 units (new product) that would be manufactured in a year. The required capital equipment would cost ₹25,00,000 and that would have an economic life of 4 years with no significant salvage value at the end of such period. During the first four years, the promotional expenses would be as planned below:

Year	1	2	3	4
Expenses:				
Advertisement	₹1,00,000	₹75,000	₹60,000	₹30,000
Others	₹50,000	₹75,000	₹90,000	₹1,20,000

Variable costs of producing and selling a unit would be ₹250. Additional fixed operating costs to be incurred because of this new product are budgeted at ₹75,000 per year. The management expects a discounted return of 15% (after tax) on investments in the new product.

You are required to work out an initial selling price per unit of the new product that may be fixed with a view to obtaining the desired return on investment. Assume a tax rate of 40% and use of straight line method of depreciation for tax purpose.

[₹408.47]

BQ 16

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 17

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:

Main equipment (t_0 - t_8) $= \dfrac{\text{Original Cost} - \text{Subsidy} - \text{Salvage}}{\text{Life of Equipment}} = \dfrac{1,20,00,000}{8 \text{ Years}}$

$= $ **15,00,000**

Additional equipment (t_3 - t_8) $= \dfrac{\text{Original Cost} - \text{Salvage}}{\text{Life of Equipment}} = \dfrac{9,00,000}{6 \text{ Years}}$

$= $ **1,50,000**

3. Tax for year 2   =   50% of (26,00,000 – 13,00,000)   =   *6,50,000*

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

BQ 18

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:

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

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

3. Tax for year 2 = 30% of (23,93,000 – 10,63,000) = **3,99,000**

BQ 19

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 20

TATA Ltd. has decided to diversify its production and wants to invest its surplus funds on the most profitable project. It has under consideration only two projects 'A' and 'B'. The cost of project 'A' is ₹100 lakhs and that of 'B' is ₹150 lakhs. Both projects are expected to have a life of 8 years only and at the end of this period. 'A' will have a salvage value of ₹4 lakhs and 'B' ₹14 lakhs. The running expenses of 'A' will be ₹35 lakhs per year and that of 'B' ₹20 lakhs per year. In either case the company expects a rate of return of 10%. The company's tax rate is 50%. Depreciation is charged on straight line basis. Which project should the company take up?

Note: Present value of annuity of ₹1 for eight years at 10% is 5.335 and present value of ₹1 received at the end of the eight year is 0.467.

Answer

Statement Showing Present Value of Outflow

Particulars	*Plant A*	*Plant B*
Annual running expenses (cash outflow)	35,00,000	20,00,000
Depreciation (non cash)	12,00,000	17,00,000
Total expenses eligible for tax saving	47,00,000	37,00,000
Tax saving @ 50% (cash inflow)	23,50,000	18,50,000
Annual outflow (running expenses – tax saving)	11,50,000	1,50,000
Sum of discounting factor/ Annuity for 8 years @ 10%	5.335	5.335
PV of Annual Outflow	61,35,250	8,00,250
PV of initial outflow (Initial outflow × 1.00)	1,00,00,000	1,50,00,000
PV of Total Outflow	1,61,35,250	1,58,00,250
Less: PV of Salvage (salvage × 0.467)	(1,86,800)	(6,53,800)
PV of Net Outflow	*1,59,48,450*	*1,51,46,450*

Select Plant B having lower PV of net outflow.

Note: Since revenue from the Projects are not given therefore, it is assumed that they generate same revenue and then decision will be based on minimum PV of operational Cost.

BQ 21

SONY Video Ltd. is considering building an assembly plant and the company has two options, out of which it wishes to choose the best plant. The projected output is 10,000 units per month.

The following data are available:

Particulars	*Plant A*	*Plant B*
Initial cost	₹30,00,000	₹22,00,000
Direct Labour cost p.a.		
(1st Shift)	₹15,00,000	₹7,50,000
(2nd Shift)		₹9,50,000
Overhead (per year)	₹2,50,000	₹2,10,000

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

You are to determine what would be the desirable choice.

Answer

Statement Showing Present Value of Outflow

Particulars	*Plant A*	*Plant B*
Direct labour cost:		
1st Shift	15,00,000	7,50,000
2nd Shift	-	9,50,000
Overhead	2,50,000	2,10,000
Annual outflow	17,50,000	19,10,000
Cumulative PV factor/ Annuity for 10 years @ 10%	6.1446	6.1446

PV of Annual Outflow	1,07,53,050	1,17,36,186
PV of initial outflow (Initial outflow × 1.00)	30,00,000	22,00,000
PV of Total Outflow	**1,37,53,050**	**1,39,36,186**

Select Plant A having lower PV of outflow.

UNEQUAL LIFE OF PROJECTS

BQ 22

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 23

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:

Particulars	Machine 'X'	Machine 'Y'
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:

Year	t_1	t_2	t_3
PVIF0.09.t	0.917	0.842	0.772

Answer

Statement Showing Evaluation of Two Machines

Particulars	Machine 'X'	Machine 'Y'
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 24

Total fund available is ₹3,00,000. Determine the optimal combination of projects assuming that the projects are **(a)** Divisible or **(b)** Indivisible.

Project Name	Initial Investment	NPV
P	₹1,00,000	₹20,000
Q	₹3,00,000	₹35,000
R	₹50,000	₹16,000
S	₹2,00,000	₹25,000
T	₹1,00,000	₹30,000

Answer

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

Projects	PI (1+ NPV/Investment)	Rank	Project Cost	Project (%)	Investment
P	1 + 20,000/1,00,000 = 1.20	3	₹1,00,000	100%	₹1,00,000
Q	1 + 35,000/3,00,000 = 1.11	5	₹3,00,000	-	-
R	1 + 16,000/50,000 = 1.32	1	₹50,000	100%	₹50,000
S	1 + 25,000/2,00,000 = 1.13	4	₹2,00,000	25%	₹50,000 (b.f.)
T	1 + 30,000/1,00,000 = 1.30	2	₹1,00,000	100%	₹1,00,000
Total Investment					**₹3,00,000**

Optimum investment: 100% of P, R, T and ¼ of S.

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

Possible Combinations	Combined Investment	Combined NPV
P + R + T	₹2,50,000	₹66,000
P + S	₹3,00,000	₹45,000
Q	₹3,00,000	₹35,000
R + S	₹2,50,000	₹41,000
S + T	₹3,00,000	₹55,000

Invest in combination of P, R and T having highest combined NPV and invest remaining ₹50,000 elsewhere.

BQ 25

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 26

National Bottling Company is contemplating to replace one of its bottling machines with a new and more efficient machine. The old machine has a cost of ₹10,00,000 and a useful life of ten year. The machine was bought five years back. The company does not expect to realize any return from scrapping the old machine at the end of ten years but if it is sold today to another company in the industry. National Bottling Company would receive ₹6,00,000 lakhs for it.

The new machine has a purchase price of ₹20,00,000. It has an estimated salvage value of ₹2,00,000 and has useful life of five years. The new machine will have a greater capacity and annual sales are expected to increase from ₹10 lakhs to ₹12 lakhs. Operating efficiencies with the new machine will also produce savings of ₹2lakhs a year. Depreciation is on a straight line basis over a ten years life.

The cost of capital is 8% and a 50% tax rate is applicable. The present value interest factor for an annuity for five years at 8% is 3.993 and present value interest factor at the end of five years is 0.681.

Should the company replace the old machine?

[NPV ₹3,890; replace the machine having positive NVP]

BQ 27

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 28

ABC company is having difficulties with an automated grinding machine has 4 years of service life, its operating cost are fairly sizable compared to its revenues. For the next four years, the revenues generated will be ₹5,20,000 annually but the annual cash expenses will be ₹3,80,000. In addition it must take depreciation of ₹80,000 per year until the machine reaches zero book value.

The machine could be sold today for net cash of ₹80,000 which is less than its current book value of ₹1,60,000. This is not good since if the machine were held for 4 years it could probably be sold for ₹80,000 net cash.

The firm's alternative is to invest in a new grinding machine costing ₹4,00,000 not counting the ₹80,000 needed to transport and install it. The new machine would generate a revenue of ₹9,20,000 with cash expense of ₹5,80,000.

It would be depreciated over a 4 year period to a book value of ₹1,60,000 at which time it could be sold for ₹1,40,000 net cash. Depreciation would be by the straight line method. The new machine would require tying up an additional ₹2,00,000 of inventory and receivable over the 4 year period.

What is the differential after tax cash flow stream for this proposal? Assume tax rate of 50% on Income and Capital gain. Also evaluate the proposal assuming discount rate of 10%.

[NPV ₹25,990; Replace the machine having positive NPV]

BQ 29

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 30

BS electronics is considering a proposal to replace one of its machines. In this connection, the following information is available:

The existing machine was bought 3 years ago for ₹10 lakhs. It was depreciated at 25% p.a. on reducing balance basis. It has remaining life of 5 years but its maintenance cost is expected to increase by ₹50,000 p.a. from the 6th year of its installation. Its present realizable value is ₹6 lakhs.

The new machine costs ₹15 lakhs and is subject to the same rate of depreciation. On sale after 5 years it is expected to net ₹9 lakhs. With the new machine, operating costs (excluding depreciation) are expected to decrease by ₹1,00,000 p.a. In addition the speed of the new machine would increase productivity on account of which net revenues would increase by ₹1.5 lakhs p.a. The tax rate applicable is 50% and the cost of capital 10%. Assume tax saving on loss.

Is the proposal financially viable? Please advise the firm on the basis of Net Present Value of the proposal.

[NPV ₹2.2 lacs Appx; Replace the machine]

BQ 31

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%:

Year	1	2	3	4	5
PVF	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

Year	Particulars	₹	DF @ 12%	PV
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:**

Particulars	₹
(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:**

Particulars	1	2	3	4	
Increase in Sales (45,000 units × ₹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 existance.

BQ 32

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	(20,000)	0.756	(15,120)
	3	(28,600)	0.658	(18,819)
	3	(30,000)	0.658	(19,740)
	3	10,000	0.658	6,580
				(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:

Particulars	₹
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.

INTERNAL RATE OF RETURN (IRR)

BQ 33
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:

$$\text{IRR} = L + \frac{NPV_L}{NPV_L - NPV_H} \times (H - L) = 10\% + \frac{2,280}{2,280 - (-4,190)} \times (12\% - 10\%)$$

$$= \textbf{10.70\%}$$

BQ 34

A company has to select one of the following two projects:

	Project A	Project B
Cost (Initial Outflow)	₹11,000	₹10,000
Cash inflows:		
Year 1	₹6,000	₹1,000
Year 2	₹2,000	₹1,000
Year 3	₹1,000	₹2,000
Year 4	₹5,000	₹10,000

Using the Internal rate of return method suggest which project is preferable with the help of 10% and 12% discount rate.

[A: 11.27%, B: 10.24%]

BQ 35

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 period

Approximate Payback   =   10,00,000 ÷ 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.

$NPV_{12\%}$ =   (10,00,000) + 4.111 × 2,50,000   =   27,750

$NPV_{13\%}$ =   (10,00,000) + 3.998 × 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:

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

BQ 36

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

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

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

$$\mathbf{IRR} = LR + \frac{NPV_{LR}}{NPV_{LR} - NPV_{HR}} \times (HR - LR) = 15\% + \frac{6,490}{6,490 + 2,262} \times (16\% - 15\%) = \mathbf{15.74\%}$$

Calculation of NPV at 15% and 16%:

$NPV_{15\%}$ =   (3,60,000) + 3.35 × 1,09,400   =   6,490

$NPV_{16\%}$ =   (3,60,000) + 3.27 × 1,09,400   =   (2,262)

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 37

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 is 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) Inspite 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.

BQ 38

Two investment projects are being considered with the following cash flow projections:

	Project 1	Project 2
Initial outlay	(200)	(200)
Cash inflows:		
Year 1	10	120
Year 2	30	90
Year 3	210	50
Year 4	50	10

Required:

a. Prepare on a single graph present value profits for each project. Use interest rates from 0% to 20% at 5% intervals.

b. Using the graph paper to determine the IRR for each of the projects.

c. State for which range of costs of capital Project 1 would be preferred to Project 2.

Answer

a. **Single graph showing present value profits for projects 1 and 2.**
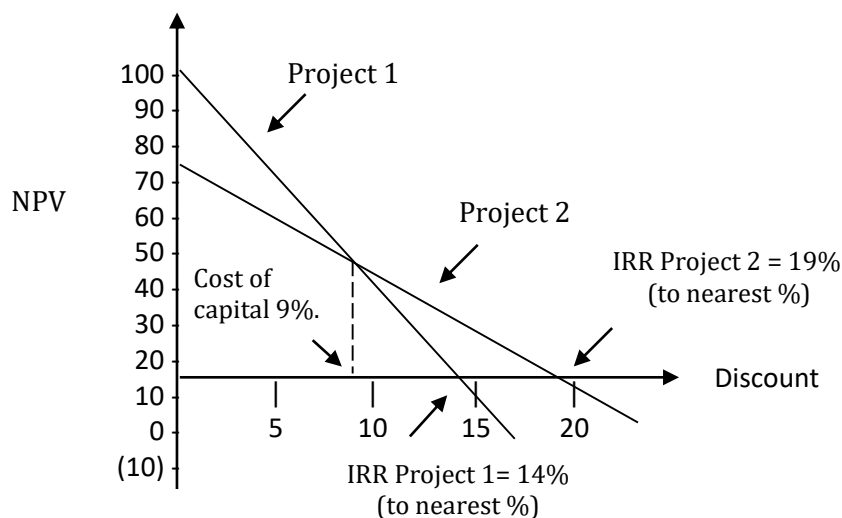
Project 1

Year	₹	PV @ 0%	DF @ 5%	PV	DF @ 10%	PV	DF @ 15%	PV	DF @ 20%	PV
0	(200)	(200)	1.000	(200)	1.000	(200)	1.000	(200)	1.000	(200)
1	10	10	0.952	9.52	0.909	9.09	0.870	8.70	0.833	8.33
2	30	30	0.907	27.21	0.826	24.78	0.756	22.68	0.694	20.82

3	210	210	0.864	181.44	0.751	157.71	0.657	137.97	0.579	121.59
4	50	50	0.823	41.15	0.683	34.15	0.572	28.60	0.482	24.10
NPV	*100*	*100*	*-*	*59.32*	*-*	*25.73*	*-*	*-2.05*		*-25.16*

Project 2

Year	*₹*	*PV @ 0%*	*DF @ 5%*	*PV*	*DF @ 10%*	*PV*	*DF @ 15%*	*PV*	*DF @ 20%*	*PV*
0	(200)	(200)	1.000	(200)	1.000	(200)	1.000	(200)	1.000	(200)
1	120	120	0.952	114.24	0.909	109.08	0.870	104.40	0.833	99.96
2	90	90	0.907	81.63	0.826	74.34	0.756	68.04	0.694	62.46
3	50	50	0.864	43.20	0.751	37.55	0.657	32.85	0.579	28.95
4	10	10	0.823	8.23	0.683	6.83	0.572	5.72	0.482	4.20
NPV	*70*	*70*	*-*	*47.30*	*-*	*27.80*	*-*	*11.01*		*3.81*

b.   IRR Project 1   =   14% (to nearest %)
         IRR Project 2   =   19% (to nearest %)

c.   If the cost of capital is < 9% (rounded)   :   project 1 would be preferred.
         If the cost of capital is > 9% (rounded)   :   Project 2 would be preferred.

      The later cash inflows from Project 1 are more heavily discounted the higher the rate of interest in comparison with the earlier cash inflows on Project 2.

MODIFIED INTERNAL RATE OF RETURN (MIRR)

BQ 39
Using details given below, calculate MIRR considering 8% cost of Capital.

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

Answer
Statement of Compounding Value

Years	*Particulars*	*₹*	*CVF @ 8%*	*CV*
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 40
A company has to make a choice between two projects namely A and B. The initial capital outlay of two projects

are ₹1,35,000 and ₹2,40,000 respectively for A and B. There will be no scrap value at the end of the life of both the projects. The opportunity cost of capital of the company is 16%.

The annual cash flow are as under:

Year	Project A	Project B	DF @ 16%
1	-	60,000	0.862
2	30,000	84,000	0.743
3	1,32,000	96,000	0.641
4	84,000	1,02,000	0.552
5	84,000	90,000	0.476

You are required to calculate for each project:

(i) Discounted payback period,
(ii) Profitability index,
(iii) Net present value.

Answer

(i) Discounted Payback Period

Year	Project 'A' (₹)	Project 'B' (₹)	DF @ 16%	PV 'A'	Cumulative PV	PV 'B'	Cumulative PV
1	-	60,000	0.862	-	-	51,720	51,720
2	30,000	84,000	0.743	22,290	22,290	62,412	1,14,132
3	1,32,000	96,000	0.641	84,612	1,06,902	61,536	1,75,668
4	84,000	1,02,000	0.552	46,368	1,53,270	56,304	2,31,972
5	84,000	90,000	0.476	39,984	1,93,254	42,840	2,74,812

$$\text{Discounted Payback Period} = \text{LLY} + \frac{\text{Initial Outflows} - \text{Cumulative PV upto LLY}}{\text{PV of inflows of ULY}}$$

$$\text{Project A} = 3 \text{ years} + \frac{1,35,000 - 1,06,902}{46,468} = \textbf{3.605 years}$$

$$\text{Project B} = 4 \text{ years} + \frac{2,40,000 - 2,31,972}{42,840} = \textbf{4.187 years}$$

(ii) **Profitability Index (PI)** $= \dfrac{\text{PV of Inflows}}{\text{PV of Outflows}}$

$$\text{Project A} = \frac{1,93,254}{1,35,000} = \textbf{1.43}$$

$$\text{Project B} = \frac{2,74,812}{2,40,000} = \textbf{1.145}$$

(iii) Net Present Value

Year	Particulars	Project 'A' (₹)	Project 'B' (₹)	DF @ 16%	PV 'A'	PV 'B'
0	Outflows	(1,35,000)	(2,40,000)	1.000	(1,35,000)	(2,40,000)
1	Cash Inflows	-	60,000	0.862	-	51,720
2	Cash Inflows	30,000	84,000	0.743	22,290	62,412
3	Cash Inflows	1,32,000	96,000	0.641	84,612	61,536
4	Cash Inflows	84,000	1,02,000	0.552	46,368	56,304
5	Cash Inflows	84,000	90,000	0.476	39,984	42,840
	NPV				**58,254**	**34,812**

BQ 41

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 $= \dfrac{\text{PV of Inflows}}{\text{PV of Outflows}} = \dfrac{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 42

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	Cumulative Discounted CF	Discounted CF	Cumulative 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

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

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

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

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

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

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 43

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 $= \text{LR} + \dfrac{\text{NPV}_{LR}}{\text{NPV}_{LR} - \text{NPV}_{HR}} \times (\text{HR} - \text{LR}) = 10\% + \dfrac{2,51,850}{2,51,850 + 1,17,800} \times (15\% - 10\%)$

$= $ **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 44

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:

Project	Investment required	Present value of future cash flows
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

Project	Investment required	PV of future cash flows	Net Present Value
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	₹6,80,000*	₹9,10,000	₹2,30,000
(Refer working note)			

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

Total investment	=	Investment in project 1 & 3 + Investment in project 2 + Plant extension cost
	=	4,40,000 + 1,15,000 + 1,25,000
	=	*₹6,80,000*

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

BQ 45
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,

Present value of inflows	=	Present value of outflows
Present value of outflows	=	Annual cost of saving × Cumulative discount factor @ IRR 12% for 4 years
	=	₹1,00,000 × 3.038
Cost of project	=	₹3,03,800

(b) Cost of Capital:

Cum DF @ cost of capital for 4 years $= \dfrac{\text{Present Value of Inflows}}{\text{Annual Inflows}} = \dfrac{3,23,243.20}{1,00,000}$

$= 3.232$

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)

Hence, Cost of capital = **9%**

(c) Net Present Value of cash inflows:

PI	$= \dfrac{\text{PV of Inflows}}{\text{PV of Outflows}}$		
1.064	$= \dfrac{\text{PV of Inflows}}{3,03,800}$		
PV of Inflows	= 3,03,800 × 1.064	=	₹3,23,243
NPV	= PV of inflows – PV of outflows		
	= ₹3,23,243.20 – ₹3,03,800	=	₹19,443.20

(d) Payback Period:

Payback period $= \dfrac{\text{Initial Outflow}}{\text{Equal Annual Cash Inflows}} = \dfrac{3,03,800}{1,00,000}$

$=$ **3.038 years**

BQ 46

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:

Year	0	1	2	3	4	5	6
PV Factor	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

Year	Particulars	₹	PV Factor @ 10%	PV of Cash flow
0	Initial Outflows	(1,00,000)	1.0000	(1,00,000)

1	Inflows – Service Charges	36,000 – 20,000	0.9091	14,546
2	Inflows	36,000	0.8264	29,750
3	Inflows + Salvage	36,000 + 25,000	0.7513	45,829
NPV				**(9,875)**

Option 2 (Part of the Machine is replaced):

Statement of NPV

Year	Particulars	₹	PV Factor @ 10%	PV of Cash flow
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 47

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:

(₹ In Lakh)

Year	1	2	3	4
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:

Year	1	2	3	4
PV Factors @14%	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

<div align="center">

Net Present Value   **(₹In Lakh)**
</div>

Year	Particulars	₹	DF @ 14%	PV
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
	NPV			**528.16**

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:

<div align="center">

Statement of CFAT

(₹In Lakh)
</div>

Particulars	1	2	3	4
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 payment)	(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 48

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÷10,000	=	*1 year*
Project B	=	7,500 + 2,500÷7,500	=	*1.33 years*
Project C	=	2,000 + 4,000 + 4,000÷12,000	=	*2.33 years*
Project D	=	10,000÷10,000	=	*1 year*

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

Project A	=	$\dfrac{(10{,}000 - 10{,}000)}{10{,}000 \times \frac{1}{2}} \times 100$	=	*0%*
Project B	=	$\dfrac{(15{,}000 - 10{,}000) \div 2}{10{,}000 \times \frac{1}{2}} \times 100$	=	*50%*
Project C	=	$\dfrac{(18{,}000 - 10{,}000) \div 3}{10{,}000 \times \frac{1}{2}} \times 100$	=	*53.33%*
Project D	=	$\dfrac{(16{,}000 - 10{,}000) \div 3}{10{,}000 \times \frac{1}{2}} \times 100$	=	*40%*

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):

IRR	=	*0%*

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

PVAF for 2 years	=	10,000÷7,500	=	1.33 (This factor is found under 32%)
IRR	=	*32%*		

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

NPV at 20% = 2,000 × 0.833 + 4,000 × 0.694 + 12,000 × 0.579 - 10,000 = +1,390

NPV at 30% = 2,000 × 0.769 + 4,000 × 0.592 + 12,000 × 0.455 - 10,000 = -634

IRR = $L + \dfrac{NPV_L}{NPV_L - NPV_H} \times (H - L)$ = $20\% + \dfrac{1{,}390}{1{,}390 - (-634)} \times (30\% - 20\%)$

= *26.87%*

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

NPV at 20%	=	10,000 × 0.833 + 3,000 × 0.694 + 3,000 × 0.579 - 10,000
	=	+2,149
NPV at 30%	=	10,000 × 0.769 + 3,000 × 0.592 + 3,000 × 0.455 - 10,000
	=	+831
NPV at 40%	=	10,000 × 0.714 + 3,000 × 0.510 + 3,000 × 0.364 - 10,000
	=	-238

IRR = $L + \dfrac{NPV_L}{NPV_L - NPV_H} \times (H - L)$ = $30\% + \dfrac{831}{831 - (-238)} \times (40\% - 30\%)$

= *37.77%*

(iv) **NPV:**

Project A:

NPV at 10%	=	10,000 × 0.909 – 10,000	=	**- 910**
NPV at 30%	=	10,000 × 0.769	=	**-2,310**

Project B:

NPV at 10%	=	7,500 × (0.909 + 0.826) – 10,000	=	**+3,013**
NPV at 30%	=	7,500 × (0.769 + 0.592) – 10,000	=	**+208**

Project C:

NPV at 10%	=	2,000 × 0.909 + 4,000 × 0.826 +12,000 × 0.751 – 10,000
	=	**+4,134**
NPV at 30%	=	2,000 × 0.769 + 4,000 × 0.592 + 12,000 × 0.455 – 10,000
	=	**-633**

Project D:

NPV at 10%	=	10,000 × 0.909 + 3,000 × (0.826 + 0.751) – 10,000	=	**+3,821**
NPV at 30%	=	10,000 × 0.769 + 3,000 × (0.592 + 0.455) – 10,000	=	**+831**

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

Ranks					
Projects	*PBP*	*ARR*	*IRR*	*NPV 10%*	*NPV 30%*
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 49

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.

Period	*Project A (₹)*	*Project B (₹)*	*Project C (₹)*
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	-

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

Payback Period:

Project A	=	5,000 ÷ 900	=	*5.56 years*
Project B	=	700 + 800 + 900 + 1,000 + 1,100 + 500 ÷ 1,200		
	=	*5.42 years*		
Project C	=	2,000 + 2,000 + 1,000 ÷ 2,000	=	*2.50 years*

NPV:

Project A:

NPV at 10%	=	900 × 6.145 – 5,000	=	*530.50*

Project B:

NPV at 10% = 700 × 0.909 + 800 × 0.826 + 900 × 0.751 + 1,000 × 0.683 + 1,100 × 0.621 + 1,200 × 0.564 + 1,300 × 0.513 + 1,400 × 0.467 + 1,500 × 0.424 + 1,600 × 0.386 – 5,000

= *1,590.20*

Project C:

NPV at 10% = 2,000 × 0.909 + 2,000 × 0.826 + 2,000 × 0.751 + 1,000 × 0.683 – 5,000

= *655*

IRR:

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

PVAF for 10 years = 5,000 ÷ 900 = *5.55*
(This factor is found between 12% and 13%)

NPV at 12%	=	900 × 5.650 – 5,000	=	*85.00*
NPV at 13%	=	900 × 5.426 – 5,000	=	*(116.60)*

$$IRR = L + \frac{NPV_L}{NPV_L - NPV_H} \times (H - L)$$

$$= 12\% + \frac{85}{85 + 116.60}(13\% - 12\%) = 12.42\%$$

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

NPV at 10% = *1,590.20*

NPV at 20% = 700 × 0.833 + 800 × 0.694 + 900 × 0.579 + 1,000 × 0.482 + 1,100 × 0.402 + 1,200 × 0.335 + 1,300 × 0.279 + 1,400 × 0.233 + 1,500 × 0.194 + 1,600 × 0.162 – 5,000

= *(775.30)*

$$IRR = L + \frac{NPV_L}{NPV_L - NPV_H} \times (H - L) = 10\% + \frac{1,590.20}{1,590.20 + 775.30}(20\% - 10\%)$$

= *16.72%*

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

NPV at 15%	=	$2{,}000 \times 0.870 + 2{,}000 \times 0.756 + 2{,}000 \times 0.658 + 1{,}000 \times 0.572 - 5{,}000$
	=	**140**

NPV at 18%	=	$2{,}000 \times 0.847 + 2{,}000 \times 0.718 + 2{,}000 \times 0.609 + 1{,}000 \times 0.516 - 5{,}000$
	=	**(136)**

IRR $= L + \dfrac{NPV_L}{NPV_L - NPV_H} \times (H-L) = 15\% + \dfrac{140}{140 + 136}(18\% - 15\%)$

$= $ **16.52%**

ARR using average investment base:

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

Project A $= \dfrac{400}{5{,}000 \times 1/2} \times 100 = $ **16%**

Project B $= \dfrac{650}{5{,}000 \times 1/2} \times 100 = $ **26%**

Project C $= \dfrac{500}{5{,}000 \times 1/2} \times 100 = $ **20%**

Working Note:

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

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

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

Project A $= \dfrac{7{,}000 - 5{,}000}{4 \text{ Years}} = $ **500 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 50

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:

Year	Cash Flow	
	Project A (₹)	Project B (₹)
0	(40,00,000)	(20,00,000)
1	8,00,000	7,00,000
2	14,00,000	13,00,000
3	13,00,000	12,00,000

4	12,00,000	-
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:

Year	*Project A*	*Project B*
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
The cash flows of two mutually exclusive Projects are as under:

Project	t_0	t_1	t_2	t_3	t_4	t_5	t_6
P	(40,000)	13,000	8,000	14,000	12,000	11,000	15,000
J	(20,000)	7,000	13,000	12,000	-	-	-

Required:
(1) Estimate the net present value (NPV) of the Project 'P' and 'J' using 15% as the hurdle rate.
(2) Estimate the internal rate of return (IRR) of the Project 'P' and 'J'.
(3) Why there is a conflict in the project choice by using NPV and IRR criterion?
(4) Which criteria you will use in such a situation? Estimate the value at that criterion. Make a project choice.

The present value interest factor values at different rates of discount are as under:

Rate	t_0	t_1	t_2	t_3	t_4	t_5	t_6
0.15	1.00	0.8696	0.7561	0.6575	0.5718	0.4972	0.4323
0.18	1.00	0.8475	0.7182	0.6086	0.5158	0.4371	0.3704
0.20	1.00	0.8333	0.6944	0.5787	0.4823	0.4019	0.3349
0.24	1.00	0.8065	0.6504	0.5245	0.4230	0.3411	0.2751
0.26	1.00	0.7937	0.6299	0.4999	0.3968	0.3149	0.2499

[(7 Marks) May 2004]

Answer
(1) Calculation of NPV using 15% as hurdle rate:

Project P	=	(40,000) × 1.00 + 13,000 × 0.8696 + 8,000 × 0.7561 + 14,000 × 0.6575 + 12,000 × 0.5718 + 11,000 × 0.4972 + 15,000 × 0.4323
	=	*5,374*

Project J	=	(20,000) × 1.00 + 7,000 × 0.8696 + 13,000 × 0.7561 + 12,000 × 0.6575
	=	*3,807*

(2) Calculation of IRR

Project P:

NPV (20% rate)	=	(40,000) × 1.00 + 13,000 × 0.8333 + 8,000 × 0.6944 + 14,000 × 0.5787 + 12,000 × 0.4823 + 11,000 × 0.4019 + 15,000 × 0.3349
	=	*(278)*

$$\text{IRR} = 15\% + \frac{5,374}{5,374 + 278} \times 5\% \qquad = \qquad \textbf{19.75\%}$$

Project J:

NPV (20% rate)	=	(20,000) × 1.00 + 7,000 × 0.8333 + 13,000 × 0.6944 + 12,000 × 0.5787
	=	*1,805*

NPV (25% rate)	=	(20,000) × 1.00 + 7,000 × 0.8000 + 13,000 × 0.6400 + 12,000 × 0.5120
	=	*64*

NPV (26% rate)	=	(20,000) × 1.00 + 7,000 × 0.7937 + 13,000 × 0.6299 + 12,000 × 0.4999
	=	*(257)*

$$\text{IRR} = 25\% + \frac{64}{64 + 257} \times 1\% \qquad = \qquad \textbf{25.20\%}$$

(3) The conflict between NPV and IRR rule in the case of mutually exclusive project situation arises due to re-investment rate assumption. NPV rule assumes that intermediate cash flows are reinvested at k and IRR assumes that they are reinvested at r. The assumption of NPV rule is more realistic.

(4) When there is a conflict in the project choice by using NPV and IRR criterion, we would prefer to use "Equal Annualized Criterion" in case of unequal life (otherwise normal NPV). According to this criterion the net annual cash inflow in the case of Projects 'P' and 'J' respectively would be:

Project 'P'	=	₹5,374 / 3.7845	=	***₹1,420***
Project 'J'	=	₹3,807 / 2.2832	=	***₹1,667***

Advise: Since the cash inflow per annum in the case of project 'J' is more than that of project 'P', so Project J is recommended.

PYQ 2

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 Overheads	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) Estimate the internal rate of return of the replacement decision.
(iii) 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

[(8+3+1 = 12 Marks) Nov 2005]

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	₹1,00,000
(2,50,000 – Nil) × 40%	
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)	₹9,60,000
(excluding Depreciation and Allocated overheads)	
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
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) *Calculation of IRR:*
Since NPV computed in Part *(i)* is positive. Let us discount cash flows at higher rate say at 25% or 30%

<p style="text-align:center">***Statement of NPV***</p>

Year	Particulars	₹	DF @ 25%	PV	DF @ 30%	PV
0	Initial outflows	(58,50,000)	1.0000	(58,50,000)	1.0000	(58,50,000)
1 - 5	Cash Flow After Tax	22,84,000	2.6893	61,42,361	2.4355	55,62,682
5	Incremental Salvage	2,29,000	0.3277	75,043	0.2693	61,670
	NPV			*3,67,404*		*-2,25,648*

$$\text{IRR} = 25\% + \frac{3,67,404}{3,67,404 + 2,25,648} \times 5\% = \textbf{28.10\%}$$

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

PYQ 3
A Company is considering a proposal of installing a drying equipment. The equipment would involve a cash outlay of ₹6,00,000 and net Working Capital of ₹80,000. The expected life of the project is 5 years without any salvage value. Assume that the company is allowed to charge depreciation on straight-line-basis for Income-tax purpose.

The estimated before-tax cash inflows are given below:

Year	1	2	3	4	5
Before tax cash	₹2,40,000	₹2,75,000	₹2,10,000	₹1,80,000	₹1,60,000

The applicable Income-tax rate to the Company is 35%. If the Company's opportunity cost of capital is 12%, calculate the equipment's net present value, discounted payback period, payback period, and internal rate of return.

The PV factors at 12%, 14% and 15% are:

Year	1	2	3	4	5	Total
PV factor @ 12%	0.8929	0.7972	0.7118	0.6355	0.5674	3.6048
PV factor @ 14%	0.8772	0.7695	0.6750	0.5921	0.5194	3.4332
PV factor @ 15%	0.8696	0.7561	0.6575	0.5718	0.4972	3.3522

[(10 Marks) May 2006]

Answer

(1) Net Present Value

Year	Particulars	₹	DF @ 12%	PV
0	Initial outflows	(6,80,000)	1.0000	(6,80,000)
1	CFAT	1,98,000	0.8929	1,76,794
2	CFAT	2,20,750	0.7972	1,75,982
3	CFAT	1,78,500	0.7118	1,27,056
4	CFAT	1,59,000	0.6355	1,01,045
5	CFAT and working capital (1,46,000 + 80,000)	2,26,000	0.5674	1,28,234
	NPV			**29,111**

Working Notes:

Calculation of CFAT:

Particulars	1	2	3	4	5
Before tax cash inflows	2,40,000	2,75,000	2,10,000	1,80,000	1,60,000
Less: Depreciation (6 lac ÷ 5)	1,20,000	1,20,000	1,20,000	1,20,000	1,20,000
Profit before tax (PBT)	1,20,000	1,55,000	90,000	60,000	40,000
Less: Tax @ 35%	42,000	54,250	31,500	21,000	14,000
Profit after tax (PAT)	78,000	1,00,750	58,500	39,000	26,000
Add: Depreciation	1,20,000	1,20,000	1,20,000	1,20,000	1,20,000
CFAT	**1,98,000**	**2,20,750**	**1,78,500**	**1,59,000**	**1,46,000**

(2) **Discounted Payback Period** $= 4 \text{ years} + \dfrac{6,80,000 - 5,80,877}{1,28,234} =$ **4.77 years**

(3) **Payback Period** $= 3 \text{ years} + \dfrac{6,80,000 - 5,97,250}{1,59,000} =$ **3.52 years**

(4) **Internal Rate of Return:**

Calculation of NPV by Using DF @ 12% and 14%

Year	Particulars	₹	DF @ 12%	PV	DF @ 14%	PV
0	Outflows	(6,80,000)	1.0000	(6,80,000)	1.0000	(6,80,000)
1	Inflows	1,98,000	0.8929	1,76,794	0.8772	1,73,686
2	Inflows	2,20,750	0.7972	1,75,982	0.7695	1,69,867
3	Inflows	1,78,500	0.7118	1,27,056	0.6750	1,20,488
4	Inflows	1,59,000	0.6355	1,01,045	0.5921	94,144
5	Inflows	2,26,000	0.5674	1,28,234	0.5194	1,17,384
	NPV			**29,111**	**NPV**	**(4431)**

$$\text{IRR} = \text{LR} + \frac{\text{NPV}_{LR}}{\text{NPV}_{LR} - \text{NPV}_{HR}} \times (\text{HR - LR}) = 12\% + \frac{29,111}{29,111 - (4,431)} \times (14 - 12)$$

$$= 12\% + 1.736\% = \textbf{13.736\%}$$

PYQ 4

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

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

The cash flows of Machine 'A' and 'B' are real cash flows. The costs are forecasted in rupees of constant purchasing power. Ignore Taxes.

The present value factors at 9% are:

Years	t_1	t_2	t_3
$PVIF_{0.90t}$	0.9174	0.8417	0.7722
$PVIFA_{0.09.2} = 1.7591$			
$PVIFA_{0.09.3} = 2.5313$			

Which machine would you recommend the company to buy?

[(8 Marks) Nov 2006]

Answer

Statement Showing Evaluation of Two Machines

Particulars	Machine 'A'	Machine 'B'
Initial outflow/ Purchase cost of machines	7,50,000	5,00,000
Annual running cost	2,00,000	3,00,000
Life of machines	3 years	2 years
PV of annual running cost	5,06,260	5,27,730
(Annual running cost × PVIFA)	(2,00,000 × 2.5313)	(3,00,000 × 1.7591)
Present value of total outflow	12,56,260	10,27,730
(initial outflow + PV of annual running cost)		
÷ PVIFA	÷ 2.5313	÷ 1.7591
Equivalent Annual outflow	*4,96,290*	*5,84,236*

Select the Machine A having lower equivalent annualized outflow.

PYQ 5

XYZ Ltd. is planning to introduce a new product with a project life of 8 years. The project is to setup in Special Economic Zone (SEZ), qualifies for one time (at starting) tax free subsidy from the State Government of ₹25,00,000 on capital investment. Initial equipment cost will be ₹1.75 crores. Additional equipment cost ₹12,50,000 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 ₹1,25,000. A Working Capital of ₹20,00,000 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	Units sold
1	72,000
2	1,08,000
3	2,60,000
4 – 5	2,70,000
6 – 8	1,80,000

A sales price of ₹120 per unit is expected and variable expenses will amount to 60% of sales revenue. Fixed cash operating costs will amount ₹18,00,000 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 percent 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

Note: The PV factors at 12% are

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

[(10 Marks) Nov 2007]

Answer

Net Present Value

Year	Particulars	₹	DF @ 12%	PV
0	Initial outflows (175 – 25 + 20) Lacs	(1,70,00,000)	1.000	(1,70,00,000)
1	CFAT	16,56,000	0.893	14,78,808
2	CFAT	29,97,000	0.797	23,88,609
3	CFAT less Additional Equipment (80,38,500 – 12,50,000)	67,88,500	0.712	48,33,412
4 – 5	CFAT	84,42,000	1.203	1,01,55,726
6 – 8	CFAT	54,18,000	1.363	73,84,734
8	Working Capital and Salvage (20,00,000 + 1,25,000)	21,25,000	0.404	8,58,500
	NPV			**1,00,99,789**

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

Working Notes:

1. **Depreciation:**

   Main equipment (t_0 - t_8) $= \dfrac{\text{Original Cost} - \text{Subsidy} - \text{Salvage}}{\text{Life of Equipment}}$

   $= \dfrac{175 \text{ Lacs} - 25 \text{ Lacs} - \text{Nil}}{8 \text{ Years}}$ $=$ **18,75,000**

   Additional equipment (t_4 - t_8) $= \dfrac{\text{Original Cost} - \text{Salvage}}{\text{Life of Equipment}}$ $= \dfrac{12,50,000 - 1,25,000}{5 \text{ Years}}$

   $=$ **2,25,000**

2. **Tax for year 2** $=$ 30% of (15,09,000 – 2,19,000) $=$ **3,87,000**

3. 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 @ ₹120 p.u.	86,40,000	1,29,60,000	3,12,00,000	3,24,00,000	2,16,00,000
Less: VC @ 60%	51,84,000	77,76,000	1,87,20,000	1,94,40,000	1,29,60,000
Contribution	34,56,000	51,84,000	1,24,80,000	1,29,60,000	86,40,000
Less: Cash FC	(18,00,000)	(18,00,000)	(18,00,000)	(18,00,000)	(18,00,000)
Less: Depreciation	(18,75,000)	(18,75,000)	(18,75,000)	(21,00,000)	(21,00,000)
PBT	(2,19,000)	15,09,000	88,05,000	90,60,000	47,40,000
Less: Tax @ 30%	-	(3,87,000)	(26,41,500)	(27,18,000)	(14,22,000)
PAT	(2,19,000)	11,22,000	61,63,500	63,42,000	33,18,000
Add: Depreciation	18,75,000	18,75,000	18,75,000	21,00,000	21,00,000
CFAT	**16,56,000**	**29,97,000**	**80,38,500**	**84,42,000**	**54,18,000**

PYQ 6

C Ltd. is considering investing in a project. The expected original investment in the project will be ₹2,00,000 the life of project will be 5 with no salvage value.

The expected net cash inflow after depreciation but before tax during the life of the project will be as following:

Year	1	2	3	4	5
₹	85,000	1,00,000	80,000	80,000	40,000

The project will be depreciated at the rate of 20% on original cost. The company is subjected to 30% tax rate:

Required:

(i) Calculate Payback Period and Average Rate of Return (ARR).
(ii) Calculate Net Present Value and Net Present Value Index, if cost of capital is 10%.
(iii) Calculate Internal Rate of Return (IRR).

Note: The P.V. factors are:

Year	P.V. @ 10%	P.V. @ 37%	P.V. @ 38%	P.V. @ 40%
1	.909	.730	.725	.715
2	.826	.533	.525	.510
3	.751	.389	.381	.364
4	.683	.284	.276	.260
5	.621	.207	.200	.186

[(8 Marks) May 2008]

Answer

(i) Calculation of Payback Period and ARR

$$\text{Payback Period} = 1 \text{ year} + \frac{2,00,000 - 99,500}{1,10,000} \times 12 \text{ Months} = 1.91 \text{ yrs}$$

$$\text{ARR} = \frac{\text{Average PAT}}{\text{Initial Investment}} \times 100 = \frac{53,900}{2,00,000} \times 100 = 26.95\%$$

Working Notes:

$$\text{Average PAT} = \frac{59,500 + 70,000 + 56,000 + 56,000 + 28,000}{5 \text{ Years}} = 53,900$$

(ii) Calculation of NPV and NPV Index (PI):

Net Present Value

Year	Particulars	₹	DF @ 10%	PV
0	Initial outflows	(2,00,000)	1.000	(2,00,000)
1	Cash Flow After Tax	99,500	0.909	90,446
2	Cash Flow After Tax	1,10,000	0.826	90,860
3	Cash Flow After Tax	96,000	0.751	72,096
4	Cash Flow After Tax	96,000	0.683	65,568
5	Cash Flow After Tax	68,000	0.621	42,228
	NPV			**1,61,198**

$$\text{NPV Index (PI)} = \frac{\text{PV of Inflows}}{\text{PV of Outflows}} = \frac{3,61,198}{2,00,000} = 1.81$$

(iii) Calculation of IRR:

NPV by using DF @ 37%, 38% and 40%

Year	₹	PVF at 37%	PV at 37%	PVF at 38%	PV at 38%	PVF at 40%	PV at 40%
0	(2,00,000)	1.000	(2,00,000)	1.000	(2,00,000)	1.000	(2,00,000)
1	99,500	0.730	72,635	0.725	72,138	0.714	71,043
2	1,10,000	0.533	58,630	0.525	57,750	0.510	56,100
3	96,000	0.389	37,344	0.381	36,576	0.364	34,944

4	96,000	0.284	27,264	0.276	26,496	0.260	24,960
5	68,000	0.207	14,076	0.200	13,600	0.186	12,648
	NPV		*+9,949*		*+6,560*		*(305)*

$$\text{IRR} = \text{LR} + \frac{\text{NPV}_{\text{LR}}}{\text{NPV}_{\text{LR}} - \text{NPV}_{\text{HR}}} \times (\text{HR} - \text{LR}) = 38\% + \frac{6{,}560}{6{,}560 - (305)} \times (40 - 38)$$

$$= 38\% + 1.91\% = \mathbf{\textit{39.91\%}}$$

Working Notes:

Calculation of PAT and CFAT

Particulars	*1*	*2*	*3*	*4*	*5*
Cash inflows after depreciation before tax	85,000	1,00,000	80,000	80,000	40,000
Less: Tax @ 30%	25,500	30,000	24,000	24,000	12,000
PAT	59,500	70,000	56,000	56,000	28,000
Add: Depreciation (2,00,000 ÷ 5)	40,000	40,000	40,000	40,000	40,000
CFAT	*99,500*	*1,10,000*	*96,000*	*96,000*	*68,000*

PYQ 7

A company wants to invest in machinery that would cost ₹50,000 at the beginning of year 1. It is estimated that the net cash inflows from operations will be ₹18,000 per annum for 3 years, if the company opts to service a part of the machine at the end of year 1 at ₹10,000 and the scrap value at the end of year 3 will be ₹12,500.

However, if the company decides not to services the part, it will have to be replaced at the end of year 2 at ₹15,400. But in this case the machine will work for the 4th year also and get operational cash inflow of ₹18,000 for the 4th year. It will have to be scrapped at the end of year 4 at ₹9,000. Assuming cost of capital at 10% and ignoring taxes.

Will you recommend the purchase of this machine based on the net present value of its cash flows?

If the supplier gives a discount of ₹5,000 for purchase, what would be your decision? (The present value factors at the end of years 0, 1, 2, 3, 4, 5 and 6 are respectively 0.9091, 0.8264, 0.7513, 0.6830, 0.6209 and 0.5644).

[(7 Marks) Nov 2008]

Answer
Option 1 (Part of the Machine is serviced):

Statement of NPV

Year	Particulars	₹	PV Factor @ 10%	PV of Cash flow
0	Initial Outflows	(50,000)	1.0000	(50,000)
1	Inflows – Service Charges	18,000 – 10,000	0.9091	7,273
2	Inflows	18,000	0.8264	14,875
3	Inflows + Salvage	18,000 + 12,500	0.7513	22,915
	NPV			*(4,937)*

Option 2 (Part of the Machine is replaced):

Statement of NPV

Year	Particulars	₹	PV Factor @ 10%	PV of Cash flow
0	Initial Outflows	(50,000)	1.0000	(50,000)
1	Inflows	18,000	0.9091	16,364
2	Inflows – Replacement	18,000 – 15,400	0.8264	2,149
3	Inflows	18,000	0.7513	13,523
4	Inflows + Salvage	18,000 + 9,000	0.6830	18,441
	NPV			*477*

Decision: Option I has a negative NPV whereas option II has a positive NPV ₹477. Therefore, option II (replacement of part) shall be opted.

If the supplier gives a discount of ₹5,000 for purchases:

Option 1:	*NPV*	=	(4,937) + 5,000	=	*63*
Option 2:	*NPV*	=	477 + 5,000	=	*5,477*

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).

PYQ 8

A company is required to choose between two machines 'A' and 'B'. The two machines have identical capacity, do exactly the same job, but designed differently.

Machine A costs ₹6,00,000, having useful life of three years. It costs ₹1,20,000 per year to run. Machine B is an economic model costing ₹4,00,000, having useful life of two years. It costs ₹1,80,000 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%.

$$PVIF_{0.10, 1} = 0.9091, \qquad PVIF_{0.10, 2} = 0.8264, \qquad PVIF_{0.10, 3} = 0.7513.$$

Which machine would you recommend the company to buy?

[(8 Marks) May 2009]

Answer

Statement Showing Evaluation of Two Machines

Particulars	*Machine 'A'*	*Machine 'B'*
Initial outflow/ Purchase cost of machines	6,00,000	4,00,000
Annual running cost	1,20,000	1,80,000
Life of machines	3 years	2 years
PV of annual running cost	2,98,416	3,12,390
(Annual running cost × PVIFA)	(1,20,000 × 2.4868)	(1,80,000 × 1.7355)
Present value of total outflow	8,98,416	7,12,390
(initial outflow + PV of annual running cost)		
÷ PVIFA	÷ 2.4868	÷ 1.7355
Equivalent Annual outflow	*3,61,273*	*4,10,481*

Select the Machine A having lower equivalent annualized outflow.

PYQ 9

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 is ₹12,000 per annum; net of taxes.

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

[(8 Marks) Nov 2009]

Answer

(ii)   *Net Present Value*

Year	*Particulars*	*₹*	*DF @ 10%*	*PV*
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)*

Recommendation: Reject the offer having negative NPV.

$$\textit{Profitability Index} \quad = \quad \frac{\text{PV of Inflows}}{\text{PV of Outflows}} \quad = \quad \frac{74,944}{80,000} \quad = \quad \textit{.937}$$

Recommendation: Reject the offer having PI less than 1.

Working Notes:

Calculation of CFAT:

Particulars	₹
Sales	40,000
Less: Operating cost	7,500
Less: Depreciation (80,000 – 6,000) ÷ 8 years	9,250
Net Income	23,250
Less: Tax @ 30% (Assumed)	6,975
PAT	16,275
Add: Depreciation	9,250
Cash inflows after tax per annum	25,525
Less: Loss of commission income	12,000
Net CFAT	*13,525*

Note: Since the tax rate is not mentioned in the question, therefore, it is assumed to be 30 percent in the given solution.

PYQ 10

The management of P Limited is considering to select a machine out of the two mutually exclusive machines. The Company's cost of capital is 12 percent and corporate tax rate for the company is 30 percent. Details of the machines are as follows

	Machine I	Machine II
Cost of machine	₹10,00,000	₹15,00,000
Expected life	5 Years	6 Years
Annual income before tax and depreciation	₹3,45,000	₹4,55,000

Depreciation is to be charged on straight line basis.

You are required to:

(i) Calculate the discounted payback period, net present value and internal rate of return for each machine.

(ii) Advise the management of P Limited as to which machine they should take up:

The present value factors of ₹1 are as follows:

Year	1	2	3	4	5	6
At 12%	.893	.797	.712	.636	.567	.507
At 13%	.885	.783	.693	.613	.543	.480
At 14%	.877	.769	.675	.592	.519	.456
At 15%	.870	.756	.658	.572	.497	.432
At 16%	.862	.743	.641	.552	.476	.410

[(9 Marks) May 2010]

Answer

Net Present Value:

Machine I	=	10,86,909 – 10,00,000	=	*86,909*
Machine II	=	16,18,074 – 15,00,000	=	*1,18,074*

Equivalent NPV:

Machine I	=	86,909 ÷ 3.605		=	*24,108*
Machine II	=	1,18,074 ÷ 4.111		=	*28,721*

Discounted Pay Back Period:

Machine I $\quad=\quad$ 4 Years $+ \dfrac{10,00,000 - 9,15,958}{1,70,951} =$ *4.49 Years*

Machine II $\quad=\quad$ 5 Years $+ \dfrac{15,00,000 - 14,18,569}{1,99,505} =$ *5.41 Years*

Internal Rate of Return:

Machine I:

Sum of PV Factor @ IRR $\quad=\quad \dfrac{\text{Initial Investment}}{\text{Annual Cash Inflow}} \quad=\quad \dfrac{10,00,000}{3,01,500}$

$= \quad$ *3.3167*

PV factor falls between 15% and 16%:

NPV at 15% $\quad=\quad$ 3,01,500 × 3.353 – 10,00,000 = *10,930*

NPV at 16% $\quad=\quad$ 3,01,500 × 3.274 – 10,00,000 = *(12,889)*

IRR $\quad=\quad$ LR $+ \dfrac{NPV_{LR}}{NPV_{LR} - NPV_{HR}} \times$ (HR - LR) $\quad=\quad$ 15% $+ \dfrac{10,930}{10,930 - (12,889)} \times$ (16 - 15)

$= \quad$ 15% + 0.459% $\qquad\qquad = \quad$ *15.459%*

Machine II:

Sum of PV Factor @ IRR $\quad=\quad \dfrac{\text{Initial Investment}}{\text{Annual Cash Inflow}} \quad=\quad \dfrac{15,00,000}{3,93,500}$

$= \quad$ *3.8119*

PV factor falls between 14% and 15%:

NPV at 14% $\quad=\quad$ 3,93,500 × 3.888 – 15,00,000 = *29,928*

NPV at 15% $\quad=\quad$ 3,93,500 × 3.785 – 15,00,000 = *(10,603)*

IRR $\quad=\quad$ LR $+ \dfrac{NPV_{LR}}{NPV_{LR} - NPV_{HR}} \times$ (HR - LR) $\quad=\quad$ 14% $+ \dfrac{29,928}{29,928 - (10,603)} \times$ (15 - 14)

$= \quad$ 14% + 0.738% $\qquad\qquad = \quad$ *14.738%*

Working Notes:

Calculation of CFAT

Particulars	Machine 1	Machine 2
Cash Flow Before Tax	3,45,000	4,55,000
Less: Depreciation	2,00,000	2,50,000
Profit Before Tax	1,45,000	2,05,000
Less: Tax @ 30%	43,500	61,500
Profit After Tax	1,01,000	1,43,500
Add: Deprecation	2,00,000	2,50,000
Cash Flow After Tax	**3,01,500**	**3,95,500**

Calculation of PV and Cumulative PV

Year	PVF @ 12%	I CFAT	I PV	I Cum PV	II CFAT	II PV	II Cum PV
1	0.893	3,01,500	2,69,240	2,96,240	3,93,500	3,51,396	3,51,396
2	0.797	3,01,500	2,40,296	5,09,536	3,93,500	3,13,620	6,65,016
3	0.712	3,01,500	2,14,668	7,24,204	3,93,500	2,80,172	9,45,188
4	0.636	3,01,500	1,91,754	9,15,958	3,93,500	2,50,266	11,95,454
5	0.567	3,01,500	1,70,951	10,86,909	3,93,500	2,23,115	14,18,569
6	0.507	-	-	-	3,93,500	1,99,505	16,18,074

Conclusion: On the basic of IRR and Discounted Payback Period Machine I is better but on the basic of NPV and ENPV machine II is better. Since, Machine I has better ranking under two techniques so Machine I should be selected.

PYQ 11

A company has to make a choice two machines 'X' and 'Y'. The two machines have identical capacity, do exactly the same job, but designed differently.

Machine X costs ₹5,50,000 and will last for three years. It costs ₹1,25,000 per year to run. Machine Y is an economic model costing ₹4,00,000 will last for two years. It costs ₹1,50,000 per year to run.

The cash flows of machine 'X' and 'Y' are real cash flows. The costs are forecasted in rupees of constant purchasing power. Ignore taxes. The present value factors at 12% are:

Years	t_1	t_2	t_3
$PVIF_{0.12t}$	0.8929	0.7972	0.7118
$PVIFA_{0.12.2} = 1.6901$			
$PVIFA_{0.12.3} = 2.4019$			

Which machine would you recommend the company to buy?

[(8 Marks) Nov 2010]

Answer

Statement Showing Evaluation of Two Machines

Particulars	Machine 'X'	Machine 'Y'
Initial outflow/ Purchase cost of machines	5,50,000	4,00,000
Annual running cost	1,25,000	1,50,000
Life of machines	3 years	2 years
PV of annual running cost	3,00,238	2,53,515
(Annual running cost × PVIFA)	(1,25,000 × 2.4019)	(1,50,000 × 1.6901)
Present value of total outflow	8,50,238	6,53,515
÷ PVIFA	÷ 2.4019	÷ 1.6901
Equivalent Annual outflow	***3,53,986***	***3,86,672***

Select the Machine X having lower equivalent annualized outflow.

PYQ 12

A Ltd. Is considering the purchase of a machine which will perform some operations which are at present preformed by workers. Machines X and Y are alternative models. The following details are available:

Particulars	Machine X	Machine Y
Cost of machine	₹1,50,000	₹2,40,000
Estimated life of machine	5 years	6 years
Estimated cost of maintenance per annum	₹7,000	₹11,000
Estimated cost of indirect materials per annum	₹6,000	₹8,000
Estimated savings in scrap per annum	₹10,000	₹15,000
Estimated cost of supervision per annum	₹12,000	₹16,000
Estimated saving in wages per annum	₹90,000	₹1,20,000

Depreciation will be charged on straight line basis. The tax rate is 30%. Evaluate the alternation according to:

(a) Average rate of return method, and

(b) Present value index method assuming cost of capital being 10%.

(The present value of ₹1.00 @ p.a. for 5 years is 3.79 and for 6 years is 4.354)

[(8 Marks) Nov 2011]

Answer

(a) Statement Showing Evaluation of Two Machines (ARR)

Particulars	Machine X	Machine Y
A. Savings:		
Saving in scrap (materials)	10,000	15,000
Savings in wages	90,000	1,20,000
Total savings (A)	1,00,000	1,35,000
B. Cost:		
Cost of maintenance	7,000	11,000
Cost of indirect materials	6,000	8,000
Cost of supervision	12,000	16,000
Depreciation (Cost of machine ÷ Life of machine)	30,000	40,000
Total cost (B)	55,000	75,000
Profit (A – B)	*45,000*	*60,000*
Less: Tax @ 30%	13,500	18,000
Profit after tax	*31,500*	*42,000*
$ARR\left(\dfrac{\text{PAT}}{\text{Investment}} \times 100\right)$	$\left(\dfrac{31,500}{1,50,000} \times 100\right)$	$\left(\dfrac{42,000}{2,40,000} \times 100\right)$
	21%	*17.50%*
Selection as per ARR	*Yes*	*No*

(b) Statement Showing Evaluation of Two Machines (PI)

Particulars	Machine X	Machine Y
Profit after tax	31,500	42,000
Add: Depreciation	30,000	40,000
CFAT	61,500	82,000
Annuity factor for 5 years and 6 years	3.79	4.354
PV of Inflows	2,33,085	3,57,028
PV of outflows (Initial outflows × 1.000)	1,50,000	2,40,000
$PI\left(\dfrac{\text{PV of Inflows}}{\text{PV of Outflows}}\right)$	$\left(\dfrac{2,33,085}{1,50,000}\right)$	$\left(\dfrac{3,57,028}{2,40,000}\right)$
	1.5539	*1.4876*
Selection as per PI	*Yes*	*No*

PYQ 13
ANP Ltd. Is providing the following information:

Annual cost of saving	₹96,000
Useful life	5 years
Salvage value	zero
Internal rate of return	15%
Profitability index	1.05

Table of discount factor:

Discount Factor	Years					
	1	2	3	4	5	Total
15%	0.870	0.756	0.658	0.572	0.497	3.353
14%	0.877	0.769	0.675	0.592	0.519	3.432
13%	0.886	0.783	0.693	0.614	0.544	3.52

You are required to calculate:
- *(a)* Cost of the project
- *(b)* Payback period
- *(c)* Net present value of cash inflow
- *(d)* Cost of capital

[(8 Marks) May 2012]

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 5 years
	=	₹96,000 × 3.353
Cost of project	=	**₹3,21,888**

(b) **Payback Period:**

Payback period $= \dfrac{\text{Initial Outflow}}{\text{Equal Annual Cash Inflows / Saving}}$

$= \dfrac{3,21,888}{96,000}$ = **3.353 years**

(c) **Net Present Value of cash inflows:**

$PI = \dfrac{\text{PV of Inflows}}{\text{PV of Outflows}}$

$1.05 = \dfrac{\text{PV of Inflows}}{3,21,888}$

PV of Inflows = 3,21,888 × 1.05 = **₹3,37,982.4**

NPV = PV of inflows – PV of outflows
= ₹3,37,982.40 – ₹3,21,888 = **₹16,094.40**

(d) **Cost of Capital:**

Cum DF @ cost of capital for 5 years $= \dfrac{\text{Present Value of Inflows}}{\text{Annual Inflows}}$

$= \dfrac{3,37,982.40}{96,000}$ = 3.52065

Cost of capital = **13% (Given in table)**

PYQ 14
SS limited is considering the purchase of a new automatic machine which will carry out some operations which are at present performed by manual labour. NM-A₁ and NM-A₂ two alternative models are available in the market.

The following details are collected:

Particulars	Machine NM-A₁	Machine NM-A₂
Cost of machine	₹20,00,000	₹25,00,000
Estimated life of machine	5 years	5 years
Estimated saving in direct wages per annum	₹7,00,000	₹9,00,000
Estimated savings in scrap per annum	₹60,000	₹1,00,000
Estimated additional cost of indirect materials per annum	₹30,000	₹90,000
Estimated additional cost of indirect labour per annum	₹40,000	₹50,000
Estimated additional cost of maintenance per annum	₹45,000	₹85,000

Depreciation will be charged on a straight line method. Corporate tax rate is 30 percent and expected rate of return may be 12 percent.

You are required to evaluate the alternatives by calculating the:

(1) Pay- back Period
(2) Accounting (Average) Rate of Return and
(3) Profitability Index or P.V. Index (P.V. factor for ₹1 @ 12% 0.893; 0.797; 0.712; 0.636; 0.567)

[(10 Marks) Nov 2012]

Answer

Statement of Evaluation

Particulars	*NM-A$_1$*	*NM-A$_2$*	*Better*
(1) Pay- back Period: (Initial Outflow ÷ CFAT)	$\dfrac{20,00,000}{5,71,500}$	$\dfrac{25,00,000}{6,92,500}$	"NM-A$_1$"
	3.499 years	*3.61 years*	
(2) ARR (Average): $\dfrac{PAT\ (Avg)}{Avg\ Investment} \times 100$	$\dfrac{1,71,500}{\frac{1}{2} \times 20,00,000} \times 100$	$\dfrac{1,92,500}{\frac{1}{2} \times 25,00,000} \times 100$	"NM-A$_1$"
	17.15%	*15.40%*	
(3) Profitability Index: $\dfrac{PV\ of\ Inflows}{PV\ of\ Outflows}$	$\dfrac{5,71,500 \times 3.605}{20,00,000}$	$\dfrac{6,92,500 \times 3.605}{25,00,000}$	"NM-A$_1$"
	1.03	*0.998*	

Working Note:

Calculation of Profit After Tax & CFAT:

Particulars	*Machine NM-A$_1$*	*Machine NM-A$_2$*
(i) **Savings:**		
Saving in scrap (materials)	60,000	1,00,000
Savings in wages	7,00,000	9,00,000
Total savings (A)	7,60,000	10,00,000
(ii) **Cost:**		
Cost of indirect materials	30,000	90,000
Cost of indirect labour	40,000	50,000
Cost of maintenance	45,000	85,000
Depreciation (Cost of machine ÷ Life of machine)	4,00,000	5,00,000
Total cost (B)	5,15,000	7,25,000
Profit (i) – (ii)	*2,45,000*	*2,75,000*
Less: Tax @ 30%	73,500	82,500
Profit after tax	*1,71,500*	*1,92,500*
Add: Depreciation	4,00,000	5,00,000
CFAT	*5,71,500*	*6,92,500*

PYQ 15

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?

[(8 Marks) Nov 13]

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

Select the Machine A having lower equivalent annualized outflow.

PYQ 16

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:

Profitability Index $= \dfrac{\text{PV of Inflows}}{\text{PV of Outflows}} = \dfrac{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 17

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 $= \dfrac{\text{Initial Outflow}}{\text{Equal Annual Cash Inflows}} = \dfrac{1,71,000}{60,000}$

$= \textit{2.855 years}$

(c) Cost of Capital:

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

PI	=	$\dfrac{\text{PV of Inflows}}{\text{PV of Outflows}}$		
1.064	=	$\dfrac{\text{PV of Inflows}}{1,71,300}$		
PV of Inflows	=	1,71,300 × 1.064	=	*₹1,82,263.2*
NPV	=	PV of inflows – PV of outflows		
	=	₹1,82,263.20 – ₹1,71,300	=	*₹10,963.20*

PYQ 18

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 Machanised System:

Cost of machine	₹20 lakhs
Life of machine	10 years
Depreciation (on straight line basis)	10%
Cash Operating cost of machanised 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:

Particulars	₹
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	13,00000
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 19

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:

Discount Factor	Years			
	1	**2**	**3**	**4**
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:

Present value of inflows	=	Annual cash inflow × Cumulative discount factor @ Cost of Capital for 4 years
Cost of project + NPV	=	80,000 × Cumulative discount factor @ Cost of Capital for 4 years
2,28,400 + 9,524	=	80,000 × PVIFA$_4$
PVIFA 4 years	=	2.974
Cost of capital	=	*13%*

Alternatively

Cum DF @ cost of capital for 4 years = $\dfrac{\text{Present Value of Inflows}}{\text{Annual Inflows}}$ = $\dfrac{2,37,924}{80,000}$

= 2.974

Cost of capital = **13%**

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):

NPV = Cost of project × (PI - 1)

NPV = 2,28,400 × (1.0417 - 1) = **₹9,524**

(d) Discounted Payback Period:

Discounted Payback Period = $LLY + \dfrac{\text{Initial Outflows} - \text{Cumulative PV upto LLY}}{\text{PV of inflows of ULY}}$

= 3 years + $\dfrac{2,28,400 - 1,88,880}{49,040}$ = **3.806 years**

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 20

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:

Year	Net Cash Flow (₹)	Present value of 1 at 10% discount rate	Present value of 1 at 15% discount rate
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:

Payback period = 14,00,000 + 14,00,000 + 14,00,000 + 14,00,000 + 14,00,000 + 10,00,000/16,00,000 = **5.625 Years**

(b) **Calculation of NPV**

Years	Cash Inflow	PVIF @ 10%	Present value
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:**

Profitability index = PV of Inflow ÷ PV of Outflow

= 97,92,200 ÷ 80,00,000 = *1.224*

(d) **Calculation of IRR:**

NPV at 10% = 17,92,200

NPV at 15% = 14,00,000 × 3.353 + 16,00,000 × .432 + 20,00,000 × .376 + 30,00,000 ×.327 + 20,00,000 × .284 + 8,00,000 × .247 − 80,00,000

= - 1,16,000

IRR = $L + \dfrac{NPV_L}{NPV_L - NPV_H} \times H - L$

= $10\% + \dfrac{17,92,200}{17,92,200 \ (\ 1,16,000)} \times 5\%$ = *14.70%*

PYQ 21

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:

Year	0	1	2	3	4	5
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:

Year	0	1	2	3	4	5
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:**

Payback period A   =   35,000 + 80,000 + 55,000 + 30,000/75,000   =   *3.4 Years*

Payback period B   =   2,00,000/2,18,000   =   *0.92 Years*

Calculation of Present Value of pre-tax cash inflows:

Years	Cash Inflow A	Cash Inflow B	PVIF @ 10%	Present value A	Present value B
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:

Discounted payback A   =   31,850 + 66,400 + 41,250 + 51,000 + 9,500/12,400
           =   *4.77 Years*

Discounted payback B   =   1,98,380 + 1,620/8,300
           =   *1.2 Years*

(c)   Desirability factor:

Desirability factor   =   PV of Inflow ÷ PV of Outflow

Project A   =   2,02,900 ÷ 2,00,000   =   *1.0145*

Project B   =   2,18,760 ÷ 2,00,000   =   *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 22

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	=	$\dfrac{\text{Initial Outflow}}{\text{Annual Cash Inflow}}$	=	$\dfrac{2,46,190}{70,000}$
	=	*3.517 years*		

(3)   Net Present Value:

PI	=	$\dfrac{\text{PV of Inflows}}{\text{PV of Outflows}}$	=	$\dfrac{\text{PV of Inflow}}{2,46,190}$
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:

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

PYQ 23

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:

Year	Units
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:

Year	(₹ in lacs)
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

Year	1	2	3	4	5	6	7	8
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

Year	Particulars	₹	DF @ 10%	PV
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:** $= \dfrac{\text{Original Cost less Salvage}}{\text{Life of Equipment}} = \dfrac{2,40,00,000}{8 \text{ Years}}$

   $= \textbf{30,00,000}$

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 24

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

Projects	C_o	C_1	C_2	C_3	C_4
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 × 0.909 + 2,000 × 0.826 + 6,000 × 0.751 – 10,000   =   ***(2,024)***

Project B = 0 × 0.909 + 2,000 × 0.826 + 4,000 × 0.751 + 6,000 × 0.683 – 2,000
= ***6,754***

Project C = 2,000 × 0.909 + 2,000 × 0.826 + 6,000 × 0.751 + 10,000 × 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 25

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.

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 26

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 1st year in addition of fixed cost	₹20,000
Maintenance expenses in 5th 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.

Note: 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

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
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	1,00,000	1,00,000	1,00,000	1,00,000
Less: Advertisement expenses	20,000	-	-	-
Less: Maintenance expenses	-	-	30,000	-
Cash Inflow	**1,80,000**	**2,00,000**	**1,70,000**	**2,00,000**

Advise: CK limited should buy machine having positive NPV.

PYQ 27

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 (Net Present Value) = 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 (Profitability Index) = 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:

Particulars	1	2	3	4
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:

Particulars	1	2	3	4
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 28

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:

Particulars	Existing Machine	New Machine
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.

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

The discounting factor table given below:

Discounting Factors	Year 1	Year 2	Year 3	Year 4
10%	0.909	0.826	0.751	0.683

[(10 Marks) July 2021]

Answer

Statement of NPV

Year	Particulars	₹	DF @ 10%	PV
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:**

Particulars		₹
(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:**

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

PYQ 29

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

	Machine 1	Machine 2
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.

Required:

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

(ii) Calculate the sensitivity of your recommendation in part *(i)* to changes in the contribution generated by machine 1.

Year	1	2	3	4	5	6
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

Particulars	Machine 1	Machine 2
(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
	(1,20,000 × 0.712)	(1,00,000 × 0.567)
Net present value (B + E – A – C - D)	6,99,440	13,42,110
÷ PVIFA	÷ 2.402	÷ 3.605
Annualized Equivalent NPV	*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*

(ii) Calculation of the sensitivity of contribution generated by machine 1:

Difference in Equivalent Annualized Criterion of Machines required for changing the recommendation in part (i) = 3,72,291 - 2,91,191 = ₹81,100

Sensitivity relating to contribution	=	(₹81,100 ÷ ₹11,60,000) × 100 =	*6.99% yearly*

PYQ 30

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
Add: Reduction in prod. delays	3,00,000	3,00,000	3,00,000	3,00,000	3,00,000
Add: Reduction in lost sales	2,50,000	2,50,000	2,50,000	2,50,000	2,50,000
Add: Gain due to timely billing	2,00,000	2,00,000	2,00,000	2,00,000	2,00,000
Less: Salaries computer specialist (₹5,00,000 × 2)	(10,00,000)	(10,00,000)	(10,00,000)	(10,00,000)	(10,00,000)
Less: Maintenance & Op. cost	(2,00,000)	(1,80,000)	(1,60,000)	(1,40,000)	(1,20,000)
Less: 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
Less: 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
Add: Depreciation	4,20,000	4,20,000	4,20,000	4,20,000	4,20,000
Add: Maint. & Op. cost (accrual)	2,00,000	1,80,000	1,60,000	1,40,000	1,20,000
Less: 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 31

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 it 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:

t	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 32

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.

Given:

t	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:

Particulars	Case (i)	Case (ii)
Sales	40,000	40,000
Less: Operating cost	7,500	7,500
Less: Depreciation (80,000 – 6,000) ÷ 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 33

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.

Year	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

Year	Particulars	₹	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 (3,85,225 – 3,00,000)	85,225	0.797	67,924
3	Incremental CFAT	3,73,705	0.712	2,66,078
4	Incremental CFAT + Incremental Salvage + WC (3,64,489 + 1,00,000 + 5,50,000)	10,14,489	0.636	6,45,215
	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

SUGGESTED REVISION

Ques. No.	Observations or KEY Points (Note down during revisions)	Page No. of Practical Register	1st & 2nd Revision	3rd, 4th & 5th Revision	Revision during Exams
BQ (Book Questions covering Study Module of ICAI, PM, RTP's, MTP's and Important Questions)					
1			Y	-	-
2			Y	Y	-
3			Y	Y	Y
4			Y	-	-
5			Y	-	-
6			Y	Y	-
7			Y	Y	Y
8			Y	Y	-
9			Y	Y	-
10			Y	Y	-
11			Y	Y	-
12			Y	Y	-
13			Y	Y	Y
14			Y	Y	-
15			Y	Y	Y
16			Y	Y	Y
17			Y	Y	Y
18			Y	Y	-
19			Y	Y	Y
20			Y	Y	Y
21			Y	Y	-
22			Y	Y	Y
23			Y	Y	-
24			Y	Y	Y
25			Y	Y	-
26			Y	Y	-
27			Y	Y	-
28			Y	Y	Y
29			Y	Y	Y
30			Y	Y	-
31			Y	Y	Y
32			Y	Y	Y
33			Y	Y	-
34			Y	Y	Y
35			Y	Y	-
36			Y	Y	Y
37			Y	Y	-
38			Y	Y	-
39			Y	Y	Y
40			Y	Y	Y
41			Y	Y	Y
42			Y	Y	Y
43			Y	Y	-
44			Y	Y	Y
45			Y	Y	Y
46			Y	Y	-
47			Y	Y	Y
48			Y	Y	-

49			Y	Y	-
50			Y	Y	-
PYQ (Past Year Questions)					
1			Y	Y	Y
2			Y	Y	Y
3			Y	Y	Y
4			Y	Y	Y
5			Y	Y	-
6			Y	Y	-
7			Y	Y	-
8			Y	-	-
9			Y	Y	Y
10			Y	Y	-
11			Y	-	-
12			Y	Y	-
13			Y	Y	Y
14			Y	Y	-
15			Y	-	-
16			Y	-	-
17			Y	-	-
18			Y	Y	-
19			Y	-	-
20			Y	Y	-
21			Y	Y	Y
22			Y	-	-
23			Y	Y	Y
24			Y	Y	Y
25			Y	Y	Y
26			Y	Y	-
27			Y	-	-
28			Y	Y	Y
29			Y	Y	Y
30			Y	Y	Y
31			Y	Y	Y
32			Y	Y	-
33			Y	Y	Y

CHAPTER - 8

COST OF CAPITAL

LEARNING OBJECTIVES

After studying this chapter you will be able to:

- *Understand the concept of "Cost of Capital" that impacts the capital investments decisions for a business.*
- *Understand what are the sources of capital (Debt, Equity Shares, Preference Shares and Retained Earnings)?*
- *Understand what is the cost employing each of these sources of capital?*
- *Know, what is weighted average cost of capital (WACC), overall cost of capital for business and also what is marginal cost of capital?*
- *Summarize how cost of capital is important in financial management.*

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
Searock Ltd has issued 14% convertible debentures of ₹100 each at par. Each debenture will be convertible into 8 Equity shares of ₹10 each at a premium of ₹5 per share. The conversion will take place at the end of 4 years. The corporate tax rate is assumed to be 40%. The flotation cost is 5% of the issue amount.

Calculate the cost of convertible debentures.

[K$_d$ 13.63%]

BQ 8
N Ltd. has raised a term loan of ₹2 crores from a commercial bank on a prime lending rate plus 4%. The prime leading rate of the Bank is 12%. The company's corporate rate of tax is 40%.

Calculate the cost of debt raised from the Bank.

[K$_d$ 9.60%]

BQ 9

A company is considering raising of funds of about ₹100 lakhs by one of two alternative methods, viz. 14% Institutional term loan and 13% non-convertible debentures. The term loan option would attract no major incidental cost. The debentures would have to be issued at a discount of 2.5% and would involve cost of issue of ₹1,00,000.

Advise the company as to the better option based on the effective cost of capital in each case. Assume a tax rate of 35%.

[K_{TL} 9.10%; K_d 8.756%]

Conclusion: Debenture is better option than Institutional term loan.

BQ 10

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 11

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.

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

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

$$IRR/K_d = LR + \frac{NPV_L}{NPV_L - NPV_H} \times (H - L)$$

$$= 15\% + \frac{-7.081}{-7.081 - 0.874} \times (16\% - 15\%) = \textbf{\textit{15.89\%}}$$

BQ 12

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 10%	DCF	Present Value 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**

$$\text{IRR/}K_d \quad = \quad LR + \frac{NPV_L}{NPV_L - NPV_H} \times (H - L) \quad = \quad 10\% + \frac{6.74}{6.74 - (-8.51)} \times (15\% - 10\%)$$

$$= \quad \textit{12.21\%}$$

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 13

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:

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

Alternative 2: Using present value method:

Calculation of NPV at two discount rates:

Year	Cash Flow	Present Value 15%	DCF	Present Value 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

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

$$= \quad \textbf{\textit{17.43\%}}$$

BQ 14

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:

$$V_B \quad = \quad \frac{1,400}{(1.06)^1} + \frac{1,320}{(1.06)^2} + \frac{1,240}{(1.06)^3} + \frac{1,160}{(1.06)^4} + \frac{1,080}{(1.06)^5}$$

$$= \quad ₹1,320.75 + ₹1,174.80 + ₹1,041.14 + ₹918.88 + ₹807.05 \quad = \quad \textbf{\textit{₹5,262.62}}$$

COST OF PREFERENCE SHARE CAPITAL (K_p)

BQ 15

Green fields Ltd. has issued 10,00,000 irredeemable preference shares of ₹150 each at a coupon rate of 14% p.a. The issue expenses are ₹15 per share.

Calculate the cost of preference share capital.

[K_p 15.55%]

BQ 16

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

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

BQ 17

Dell Ltd. has ₹100 preference share redeemable at a premium of 10% with 15 years maturity. The coupon rate is 12% Flotation cost is 5%. Issue price is ₹95.

Calculate the cost of preference shares.

[K_p 13.33%]

Note: Floatation cost has been calculated on the basis of face value i.e. 5% of ₹100.

BQ 18

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

Calculate the cost of preference share capital.

Answer

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

BQ 19

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

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

BQ 20

ILU Ltd. issued ₹10,00,000, 10% Preference shares which are redeemable after 10 years. Compute K_p in each of the following conditions:

(a) Preference Shares are issued at par and redeemable at par.
(b) Preference Shares are issued at par and redeemable at a premium of 10%.
(c) Preference Shares are issued at a discount of 10% and redeemable at par.
(d) Preference Shares are issued at a discount of 10% and redeemable at a premium of 10%.

[K_p (a) 10%, (b) 10.476%, (c) 11.579%, (d) 12.00%]

BQ 21

Calculate the cost of capital in the following cases:

(i) X Ltd. issues 12% debentures of face value ₹100 each and realizes ₹95 per debenture. The debentures are redeemable after 10 years at a premium of 10%.
(ii) Y Ltd. issues preference shares of face value ₹100 each carrying 14% dividend and it realizes ₹92 per share. The shares are repayable after 12 years at par.

Note: Both companies are paying Income tax at 50%.

Answer
(i) **Cost of debt (K_d)**

$$K_d = \frac{I(1-t) + \left(\dfrac{RV - NP}{n}\right)}{\dfrac{RV + NP}{2}} \times 100 = \frac{12(1-0.50) + \left(\dfrac{110-95}{10}\right)}{\dfrac{110+95}{2}} \times 100$$

$$= \textbf{7.32\%}$$

(ii) **Cost of preference capital (K_p):**

$$K_p = \frac{PD + \left(\dfrac{RV - NP}{n}\right)}{\dfrac{RV + NP}{2}} \times 100 = \frac{14 + \left(\dfrac{100 - 92}{12}\right)}{\dfrac{100 + 92}{2}} \times 100 = \textbf{\textit{15.28\%}}$$

COST OF EQUITY SHARE CAPITAL (K_e)

BQ 22
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 23
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 ended 31st March, 2022 is ₹9,60,000.

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

Answer

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

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

BQ 24
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:*

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

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

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

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

BQ 25
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

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

BQ 26

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. **[Kₑ 26%]**

BQ 27

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.

[Kₑ 12.81%]

BQ 28

The shares of Compbell Ltd. are selling at ₹24 per share. The firm had paid dividend @ ₹1.80 per share last year. The estimated growth of the company is approximately 5% per year.

Determine the cost of equity capital of the company.

[Kₑ 12.875%]

BQ 29

A company's current price of share is ₹60 and dividend per share is ₹4. If capitalization rate is 12 percent.

What is the dividend growth rate?

[Growth 5%]

Note: "Dividend per share is ₹4" has been treated as D_0.

BQ 30

(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) Kₑ 20%, (b) Kₑ 32%, (c) P₀ ₹200, (d) P₀ ₹315]

BQ 31

Your company's share is quoted in the market at ₹20 currently. The company pays a dividend of ₹1.00 per share the investor expects a growth rate of 5 per cent per year.

Compute:

(a) The company's cost of equity capital,
(b) If the anticipated growth rate is 6% p.a., calculate the indicated market price per share.
(c) If the company's cost of capital is 8% and the anticipated growth rate is 5% p.a., calculate the indicated price if the dividend of ₹1.00 per share is to be maintained.

Answer

(a) K_e $=$ $\dfrac{D_1}{P_0} + g$ $=$ $\dfrac{1.00}{20.00} + .05$ $=$ **10%**

(b) P_0 $=$ $\dfrac{D_1}{K_e - g}$ $=$ $\dfrac{1.00}{10\% - 6\%}$ $=$ **₹25.00**

(c) P_0 $=$ $\dfrac{D_1}{K_e - g}$ $=$ $\dfrac{1.00}{8\% - 5\%}$ $=$ **₹33.33**

Note: "The company pays dividend of ₹1.00" has been treated as D_1.

BQ 32

A company's share is quoted in market at ₹40 currently. A company pays a dividend of ₹2 per share and investors expect a growth rate of 10% per year.

Compute:

1. The company's cost of equity capital.
2. If anticipated growth rate is 11% p.a. calculate the indicated market price per share.
3. If the company's cost of capital is 16% and anticipated growth rate is 10% p.a. Calculate the market price if dividend of ₹2 per share is to be expected.

Answer

1. K_e $= \dfrac{D_1}{P_0} + g$ $= \dfrac{2.00}{40.00} + .10$ $=$ **15%**

2. P_0 $= \dfrac{D_1}{K_e - g}$ $= \dfrac{2.00}{15\% - 11\%}$ $=$ **₹50.00**

3. P_0 $= \dfrac{D_1}{K_e - g}$ $= \dfrac{2.00}{16\% - 10\%}$ $=$ **₹33.33**

Note: "The company pays dividend of ₹2.00" has been treated as D_1.

BQ 33

ABC Ltd. is run managed by an efficient team that insists on reinvesting 60% of its earnings in projects that provide an ROE (Return of Equity) of 10%, despite the fact that the firm's capitalization rate (K_e) is 15%. The firm's current Year's earnings are expected to be ₹10.00 per share.

At what price will the stock of ABC Ltd. sell?

Answer

P_0 $= \dfrac{D_1}{K_e - g}$ $= \dfrac{4.00}{15\% - 6\%}$ $=$ **₹44.44**

Where, D_1 $=$ EPS × Dividend payout ratio ()
$=$ 10 × 40% $=$ ₹4.00

g $=$ (b) Dividend retention ratio × (r) ROE
$=$ 60% × 10% $=$ 6%

BQ 34

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 35

Modern Ltd.'s share beta factor is 1.40. The risk free rate of interest on government securities is 9%. The expected rate of return on companies equity shares is 16%.

Calculate cost of equity capital based on capital asset pricing model.

[K_e 18.80%]

BQ 36

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

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

BQ 37

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

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

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

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

BQ 38

The Beta coefficient of Computech Ltd. is 1.2. The company has been maintaining 5% rate of growth in dividends and earnings. Current year expected dividend is ₹2.40 per share. Return on Government securities is 10%. Return on Market portfolio is 14%. The current market price of one share of Computech Ltd. is ₹28. The earnings per share is ₹3.90.

Calculate the cost of equity capital basing on:

(i) Dividend yield method,
(ii) Dividend growth model,
(iii) Capital asset pricing Model.

Answer
(i) *Dividend yield method:*

$$K_e \quad = \quad \frac{D_1}{P_0} \times 100 \quad = \quad \frac{2.40}{28.00} \times 100 \quad = \quad \mathbf{8.57\%}$$

(ii) *Dividend growth model:*

$$K_e \quad = \quad \frac{D_1}{P_0} + g \quad = \quad \frac{2.40}{28.00} + .05 \quad = \quad \mathbf{13.57\%}$$

(iii) *Capital Asset Pricing Model:*

$$K_e \quad = \quad R_f + \beta (R_m - R_f) = \quad 10\% + 1.2 \times (14\% - 10\%) \quad = \quad \mathbf{14.80\%}$$

BQ 39

As an investment manager you are given the following information:

Investment	Initial price	Dividends	Yearend price	Beta risk
Shares of Cement Ltd	₹25	₹2	₹50	0.80
Shares of Steel Ltd	₹35	₹2	₹60	0.70
Shares of Liquor Ltd	₹45	₹2	₹135	0.50
Govt. of India Bonds	₹1,000	₹140	₹1,005	0.99
Total	*₹1,105*	*₹146*	*₹1,250*	-

Risk free return 14%.

You are required to calculate:

(i) Expected rate of return of market portfolio, and
(ii) Expected return in each security, using capital asset pricing model.

Answer
(i) **Expected returns on market portfolio:**

$$= \frac{\text{Dividends} + \text{Capital appreciation}}{\text{Investment}} \times 100 = \frac{146 + 145\,(1{,}250 - 1{,}105)}{1{,}105} \times 100 = \textbf{26.33\%}$$

(ii) **Expected returns on individual security:**

K_e	=	$R_f + \beta\,(R_m - R_f)$		
Cement Ltd	=	14% + 0.8 (26.33% - 14%)	=	**23.86 %**
Steel Ltd	=	14% + 0.7 (26.33% - 14%)	=	**22.63%**
Liquor Ltd	=	14% + 0.5 (26.33% - 14%)	=	**20.17%**
GOI Bonds	=	14% + 0.99 (26.33% - 14%)	=	**26.21%**

BQ 40
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 11%	DCF	Present Value 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:

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

BQ 41
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:

$$1 + Y_1 = \frac{D_1 + P_1}{P_0} = \frac{1 + 9.75}{9} = 1.1944$$

$$1 + Y_2 = \frac{D_2 + P_2}{P_1} = \frac{1 + 11.50}{9.75} = 1.2821$$

$$1 + Y_3 = \frac{D_3 + P_3}{P_2} = \frac{1.2 + 11}{11.50} = 1.0609$$

$$1 + Y_4 \quad = \quad \frac{D_4 + P_4}{P_3} \quad = \quad \frac{1.25 + 10.60}{11} \quad = \quad 1.0772$$

Geometric mean:

$$K_e \quad = \quad [(1 + Y_1) \times (1 + Y_2) \times \ldots(1 + Y_n)]^{1/n} - 1$$

$$K_e \quad = \quad [1.1944 \times 1.2821 \times 1.0609 \times 1.0772]^{1/4} - 1 \quad = \quad \textbf{\textit{0.15 or 15\%}}$$

BQ 42

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):

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

Note: Dividend ₹2 is treated as D_0, student may treat it as D_1 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

$$IRR/K_d \quad = \quad LR + \frac{NPV_L}{NPV_L - NPV_H} \times (H - L) \quad = \quad 5\% + \frac{10.70}{10.70 - (26.20)} (10\% - 5\%) \quad = \textbf{\textit{6.45\%}}$$

COST OF RETAINED EARNINGS (K_r)

BQ 43
ABC Company provides the following details:

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

Calculate the cost of retained earnings.

Answer

$$K_r = \frac{D_1}{P_0} + g = \frac{4.19\,(1+.05)}{50} + 0.05 = \textbf{13.80\%}$$

BQ 44

ABC Company provides the following details:

R_f	=	7%	ß	=	1.20	$R_m - R_f$ =	6%

Calculate the cost of retained earnings based on CAPM method.

Answer

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

BQ 45

The cost of Equity capital of Spectrun Ltd. is 24%. The personal taxation of individual share holders is 35%.

Calculate the cost of retained earnings.

Answer

$$K_r = K_e\,(1 - t_p) = 24\%\,(1 - 0.35) = \textbf{15.6\%}$$

BQ 46

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

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

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

WEIGHTED AVERAGE COST OF CAPITAL (K₀)

BQ 47

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 48

Hindustan Chemicals Ltd. has paid up equity capital 6,00,000 equity shares of ₹10 each. The current market price of share is ₹24. During the current year, the company is expected to declare a dividend of ₹6 per share. The company has also previously issued 14% preference shares of ₹10 each aggregating ₹30 lakhs and 13% 50,000 debentures of ₹100 each. The company's corporate tax rate is at 40%, the growth in dividends on equity shares is expected at 5%. In case of preference shares the company has received only 95% of the face value of shares after deducting issue expenses.

Calculate WACC of the Company.

Answer

$$WACC \ (K_o) \quad = \quad K_eW_e + K_pW_p + K_dW_d$$

$$= \quad 30\% \times \frac{60}{140} + 14.74\% \times \frac{30}{140} + 7.80\% \times \frac{50}{140} \quad = \quad \textbf{\textit{18.80\%}}$$

Calculation of Kₑ, Kₚ and K_d

$$K_e \quad = \quad \frac{D_1}{P_0} + g \quad = \quad \frac{6}{24} + .05 \quad = \quad \textbf{\textit{30\%}}$$

$$K_p \quad = \quad \frac{PD}{NP} \times 100 \quad = \quad \frac{1.4}{9.5} \times 100 \quad = \quad \textbf{\textit{14.74\%}}$$

$$K_d \quad = \quad I \ (1 - t) \quad = \quad 13\% \ (1 - 0.40) \quad = \quad \textbf{\textit{7.80\%}}$$

BQ 49

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)

Capital Structure	Amount	Weight	Specific Cost	Cost of Capital
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 50
The capital structure of Bombay Traders Ltd. as on 31.03.2022 is as follows:

	(₹Crores)
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) Kₑ 7.50%, Kᵣ 7.50%, K_d 7%, K_o 7.40%; (b) Kₑ 9%, Kᵣ 9%, K_d 7%, K_TL 8%, K_o 8.45%]

BQ 51
M/s. Albert & Co. has the following capital structure as on 31st March, 2022:

10% Debentures	₹3,00,000
9% Preference Shares	₹2,00,000
Equity Share Capital (5,000 shares of ₹100 each)	₹5,00,000
Total	**₹10,00,000**

The equity shares of the company are quoted at ₹102 and the company is expected to declare a dividend of ₹9 per share for 2022. Growth rate is 5%.

(i) Assuming the tax rate applicable to the company at 50%. Calculate the weighted average cost of capital. State your assumptions, if any.

(ii) Assuming in the exercise, that the company can raise additional term loan at 12% for ₹5,00,000 to finance an expansion, calculate the revised weighted cost of capital. The company's assessment is that it will be in a position to increase the dividend from ₹9 per share to ₹10 per share, but the business risk associated with new financing way bring down the market price from ₹102 to ₹96 per share.

[(i) Kₑ 13.82%, K_p 9%, K_d 5%, K_o 10.21%; (ii) Kₑ 15.42%, K_p 9%, K_d 5%, K_TL 6%, K_o 9.34%]

BQ 52
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

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

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

BQ 53
The following figures are taken from the current balance sheet of Delaware & Company:

Capital (Shares of ₹10 each)	₹8,00,000
Share Premium	₹2,00,000
Reserves	₹6,00,000
Shareholder's funds	**₹16,00,000**
12% Irredeemable debentures (₹100 each)	₹4,00,000

An annual ordinary dividend of ₹2 per share has just been paid. In the past ordinary dividends have grown at a rate of 10% per annum and this rate of growth is expected to continue. Annual interest has recently been paid on the debentures. The ordinary shares are currently quoted at ₹27.50 and the debentures at 80%. Ignore taxation.

You are required to estimate the weighted average cost of capital (based on market values) for Delaware & Company.

Answer
Statement of WACC (Market Value Weights)

Capital Structure	Amount	Weight	Specific Cost	Cost of Capital
Equity Fund including Reserve and Share Premium	22,00,000	0.8730	0.18	0.1571
Irredeemable Debentures	3,20,000	0.1270	0.15	0.0191
Total	*25,20,000*	*1.000*	*WACC*	*0.1762*

(1) Calculation of Market Value:

Market value of Equity Fund = (₹8,00,000 ÷ ₹10) × ₹27.50 = ₹22,00,000

Market value of debenture = ₹4,00,000 × 80% = ₹3,20,000

(2) Calculation of K_e, K_p and K_d

$$K_e = \frac{D_1}{P_0} + g = \frac{2 + 10\% \text{ of } 2}{27.50} + .10 = \textbf{18\%}$$

$$K_d = \frac{I}{NP} \times 100 = \frac{12\% \text{ of } 100}{80} \times 100 = \textbf{15\%}$$

Note: Debentures issued at market price; alternatively students may take different assumption i.e. Debentures issued at par.

Note: Since, K_e and K_r are same therefore, we use market value of Equity fund.

BQ 54
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

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

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

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

Statement of WACC (Book Value Weights)

Capital Structure	Amount	Weight	Specific Cost	Cost of Capital
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)

Capital Structure	Amount	Weight	Specific Cost	Cost of Capital
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 55

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_o.

BQ 56

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 if 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% floatation cost, 10 years of maturity, sale price, ₹100.

(ii) ₹100 per preference share redeemable at par, 12% dividend rate, 5% floatation cost, 10 years of maturity, sale price, ₹100.

(iii) Equity share has ₹2 floatation 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

Particular	Market value	Weight	Cost (K)	Weighted cost
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:

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

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

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

BQ 57

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% floatation cost, 10 years of maturity. The market price per debenture is ₹105.
(ii) ₹100 per preference share redeemable at par, 5% coupon rate, 2% floatation cost, 10 years of maturity.
(iii) Equity share has ₹4 floatation 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) $\quad K_e \quad = \quad \dfrac{D_1}{P_0 - F} + g \quad = \quad \dfrac{1}{24 - 4} + 0.05 \quad = \quad \textit{10\%}$

(b) **Cost of Debt (K_d):**

Calculation of IRR/K_d

$$IRR/K_d \quad = \quad LR + \frac{NPV_L}{NPV_L - NPV_H} \times (H - L) \quad = \quad 5\% + \frac{14.65}{14.65 - (-0.83)} \times (7\% - 5\%)$$

$$= \quad \textit{6.89\%}$$

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$_d$

$$IRR/K_d = LR + \frac{NPV_L}{NPV_L - NPV_H} \times (H - L) = 3\% + \frac{9.25}{9.25 - (-7.79)} \times (5\% - 3\%)$$

$$= \textit{4.09\%}$$

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 58

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

Sources of Fund	Book Value	Market Value
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:
1. *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.

2. *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.

3. *Preference Shares:* 15% Preference shares with face value of ₹100 would realise ₹105 per share.

4. *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%.

5. *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

Particulars	Book Value	Weight (W)	Cost (K)	Weighted cost
Equity Shares	₹1,20,00,000	0.615	0.1850	0.1138
Retained Earnings	₹30,00,000	0.154	0.1754	0.0270
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**	**0.1722**

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

Particulars	Market Value	Weight (W)	Cost (K)	Weighted cost
*Equity Shares	₹1,60,00,000	0.655	0.1850	0.1212
*Retained Earnings	₹40,00,000	0.164	0.1754	0.0288
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**	**0.1744**

Working notes:

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

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

$$K_r \quad = \quad \frac{D_1}{P_0} + g \quad = \quad \frac{15}{130} + 6\% \quad = \quad \textbf{\textit{17.54\%}}$$

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

$$\quad = \quad \textbf{\textit{10.95\%}}$$

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

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

NP of Debenture   =   MV of Debenture – Floatation Cost
                            =   ₹93.75 - ₹2 (2% of ₹100)   =   **₹91.75**

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

Market value of Equity Shares	=	₹2,00,00,000 × 120/150	=	₹1,60,00,000
Market value of Retained Earnings	=	₹2,00,00,000 × 30/150	=	₹40,00,000

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

BQ 59
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
(1)   **Value of Debt** $= \quad \frac{\text{Interest}}{\text{Cost of debt }(K_d)} \quad = \quad \frac{7,50,000}{8\%}$

$$= \quad \textbf{\textit{₹93,50,000}}$$

(2) **Value of Equity Capital** $=$ $\dfrac{\text{Operating Profit} - \text{Interest}}{\text{Cost of equity } (K_e)}$ $=$ $\dfrac{34,50,000 - 7,50,000}{16\%}$

$=$ **₹1,68,75,000**

(3) **New cost of Equity after proposal:**

$=$ $\dfrac{\text{Operating Profit} - \text{Interest}}{\text{Equity Capital}}$

$=$ $\dfrac{34,50,000 + 14,25,000 - 7,50,000 - 8\% \text{ of } 75,00,000}{1,68,75,000}$ $=$ **20.90%**

(a) Calculation of WACC Before the New Proposal

Particulars	Book Value	Weight (W)	Cost (K)	Weighted cost
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

Particulars	Book Value	Weight (W)	Cost (K)	Weighted cost
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 (MCC)

BQ 60

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

Marginal WACC $=$ $K_eW_e + K_dW_d$ $=$ $18\% \times 0.80 + 8.125\% \times 0.20$ $=$ **16.025%**

Calculation of Marginal K_e and K_d

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

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

BQ 61
XYZ & Company provides you with the following information:

Source	Amount	After-tax cost of capital
Equity	₹2,00,000	12%
Debentures	₹2,00,000	4%

The company is considering an investment proposal requiring an additional investment of ₹1,00,000. It has taken decision to finance this amount by taking a loan from a financial institution at a cost of 10%. Presuming that corporate rate of tax is 50%.

You are required to find out:

(i) Marginal cost of capital after tax,

(ii) Weighted average cost before additional financing,
(iii) Weighted average cost after additional financing and
(iv) What will be the weighted average cost, if the additional amount of debt of ₹1,00,000 is raised proportionately from equity and debt at the existing specific cost.

[(i) Kₒ 5%; (ii) Kₒ 8%; (iii) Kₒ 7.40%; (iv) Kₒ 8%]

BQ 62
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:

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
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**

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

(b) After tax cost of new preference shares

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

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

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

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

$$K_dW_d + K_pW_p + K_rW_r = 8.33\% \times .15 + 11.96\% \times .05 + 15\% \times .80 = \textbf{13.85\%}$$

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

Equity (retained earnings in this case) = 80% of the total capital

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

Retained earnings $\quad = \quad$ ₹2.36 × 50% × 10,000 $\quad = \quad$ ***₹11,800***

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

$K_dW_d + K_pW_p + K_eW_e \quad = \quad$ 8.33% × .15 + 11.96% × .05 + 15.90% × .80 $\quad = \quad$ ***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:

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

WN: Calculation of growth:

Growth from year 2012 to 2013 $\quad = \quad$ (1.10 – 1.00) ÷ 1.00 $\quad = \quad$ ***10%***

[Same rate of growth is found in future years]

BQ 63

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:

Project cost	*Cost of debt*	*Cost of equity*
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

Project cost	*Financing*	*Weight (W)*	*Cost (K)*	*Weighted cost*
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%

Project	*Fund requirement*	*Cost of capital*
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 is the capital structure of Simons Company Ltd. as on 31.12.1998:

Equity shares (10,000 shares of ₹100 each)	₹10,00,000
10% Preference shares of ₹100 each	₹4,00,000
12% Debentures	₹6,00,000
	₹20,00,000

The market price of the company's share is ₹110 and it is expected that a dividend of ₹10 per share would be declared for the year 1998. The dividend growth rate is 6%.

(i) If the company is in the 50% tax bracket, compute the WACC.

(ii) Assuming that in order to finance an expansion plan, the company intends to borrow a fund of ₹10,00,000 bearing 14% rate of interest, What will be the company's revised weighted average cost of Capital? This financing decision is expected to increase dividends from ₹10 to ₹12 per share. However, the market price of equity share is expected to decline from ₹110 to ₹105 per share.

[(10 Marks) Nov 1999]

Answer
(i) **Calculation of Weighted Average Cost of Capital**

$$\text{WACC } (K_o) = K_e W_e + K_p W_p + K_d W_d$$

$$= 15.09\% \times \frac{10}{20} + 10\% \times \frac{4}{20} + 6\% \times \frac{6}{20} \qquad = \quad \textbf{\textit{11.35\%}}$$

$$K_e = \frac{D_1}{P_0} + g \qquad = \qquad \frac{10}{110} + .06 \qquad = \quad \textbf{\textit{15.09\%}}$$

$$K_p = \text{Rate of preferential dividend} \quad [FV = NP] \qquad = \quad \textbf{\textit{10\%}}$$

$$K_d = I(1-t) \qquad = \qquad 12\%(1-0.50) \qquad = \quad \textbf{\textit{6\%}}$$

(ii) **Calculation of Revised WACC**

$$\text{Revised WACC } (K_o) = K_e W_e + K_p W_p + K_d W_d + K_{TL} W_{TL}$$

$$= 17.43\% \times \frac{10}{30} + 10\% \times \frac{4}{30} + 6\% \times \frac{6}{30} + 7\% \times \frac{10}{30} \qquad = \quad \textbf{\textit{10.68\%}}$$

$$\text{Revised } K_e = \frac{D_1}{P_0} + g \qquad = \qquad \frac{12}{105} + .06 \qquad = \quad \textbf{\textit{17.43\%}}$$

$$K_{TL} = I(1-t) \qquad = \qquad 14\%(1-0.50) \qquad = \quad \textbf{\textit{7\%}}$$

PYQ 2
XYZ Ltd. has the following book value capital structure:

Equity Share Capital (₹10 each, fully paid up at par)	₹15 crores
11% Preference Share Capital (₹100 each, fully paid up at par)	₹1 crores
Retained Earnings	₹20 crores
13.5% Debentures (of ₹100 each)	₹10 crores
15% Terms Loans	₹12.5 crores

The next expected dividend on equity shares per share is ₹3.60; the dividend per share is expected to grow at the rate of 7%. The market price per share is ₹40. Preference stock, redeemable after 10 years, is currently selling at ₹75 per share. Debentures, redeemable after six years, are selling at ₹80 per debenture. The income - tax rate for the company is 40%.

Required:

(i) Calculate the weighted average cost of capital (K$_o$) using:

    a. Book value proportions; and

    b. Market value proportions.

(ii) Define the weighted marginal cost of capital schedule for the company, if it raises ₹10 crores next year, given the following information:

    a. The amount will be raised by equity and debt in equal proportions;

    b. The company expects to retain ₹1.5 crores earnings next year;

    c. The additional issue of equity shares will result in the net price per share being fixed at ₹32;

    d. The debt capital raised by way of term loans will cost 15% for the first ₹2.5 crores and 16% for the next ₹2.5 crores.

[(12 Marks) Nov 2000]

Answer

(i) **Calculation of WACC (K$_o$)**

(a) **By Using Book Value Proportions**

Name of Source	Amount	Proportion	K	K$_o$
Equity Share Capital	15,00,00,000	0.2564	16%	4.1024%
Retained Earnings	20,00,00,000	0.3419	16%	5.4704%
Debentures	10,00,00,000	0.1709	12.70%	2.1704%
Preference Share Capital	1,00,00,000	0.0171	15.43%	0.2639%
Term Loan	12,50,00,000	0.2137	9%	1.9233%
Total	*58,50,00,000*	*1.0000*	*WACC*	*13.9304%*

(b) **By Using Market Value Proportions**

Name of Source	Amount	Proportion	K	K$_o$
*Equity & Retained Earnings	60,00,00,000	0.7385	16%	11.816%
Debentures	8,00,00,000	0.0985	12.70%	1.2510%
Preference Share Capital	75,00,000	0.0092	15.43%	0.1420%
Term Loan	12,50,00,000	0.1538	9%	1.3842%
Total	*81,25,00,000*	*1.0000*	*WACC*	*14.5931%*

* K$_e$ & K$_r$ are same, so calculated together.

(ii) **Weighted Marginal Cost of Capital Schedule and Marginal WACC:**

Marginal Cost of Capital Schedule:

Finance through Equity:

    Retained earnings = ₹1.5 crores

    New issue = ₹3.5 crores

Finance through Debt:

    15% Debt = ₹2.5 crores

    16% Debt = ₹2.5 crores

Marginal Cost of Capital

Name of Source	Amount	Proportion	K	K$_o$
Equity Share Capital (New)	3,50,00,000	0.35	18.25%	6.3875%
Retained Earnings	1,50,00,000	0.15	16%	2.4000%
15% Debt	2,50,00,000	0.25	9%	2.2500%
16% Debt	2,50,00,000	0.25	9.60%	2.4000%
Total	*10,00,00,000*	*1.00*	*WACC*	*13.4375%*

Working Notes:

Calculation of existing K$_e$, K$_r$, K$_d$, K$_p$ and K$_{TL}$:

$$K_e \quad = \quad \frac{D_1}{P_0} + g \quad = \quad \frac{3.60}{40} + 0.07 \quad = \quad \textbf{\textit{16\%}}$$

$$K_r \quad = \quad K_e \quad = \quad \textbf{\textit{16\%}}$$

$$K_d \quad = \quad \frac{I(1-t)+\left(\dfrac{RV-NP}{n}\right)}{\dfrac{RV+NP}{2}} \times 100 \quad = \quad \frac{13.50\,(1-0.40)+\left(\dfrac{100-80}{6}\right)}{\dfrac{100+80}{2}} \times 100$$

$$= \quad \textbf{\textit{12.70\%}}$$

$$K_p \quad = \quad \frac{PD+\left(\dfrac{RV-NP}{n}\right)}{\dfrac{RV+NP}{2}} \times 100 \quad = \quad \frac{11+\left(\dfrac{100-75}{10}\right)}{\dfrac{100+75}{2}} \times 100 \quad = \quad \textbf{\textit{15.43\%}}$$

$$K_{TL} \quad = \quad I(1-t) \quad = \quad 15\%\,(1-0.40) \quad = \quad \textbf{\textit{9\%}}$$

Calculation of revised K_e, K_r, K_{d1} and K_{d2}

$$K_e \quad = \quad \frac{D_1}{P_0} + g \quad = \quad \frac{3.60}{32} + 0.07 \quad = \quad \textbf{\textit{18.25\%}}$$

$$K_r \quad = \quad K_e \text{ (existing)} \quad = \quad \textbf{\textit{16\%}}$$

$$K_{d1} \quad = \quad I(1-t) \quad = \quad 15\%\,(1-0.40) \quad = \quad \textbf{\textit{9\%}}$$

$$K_{d2} \quad = \quad I(1-t) \quad = \quad 16\%\,(1-0.40) \quad = \quad \textbf{\textit{9.60\%}}$$

PYQ 3
JKL Ltd. has the following book value capital structure as on March 31, 2003:

Equity share capital (2,00,000 shares)	₹40,00,000
11.5% Preference share capital	₹10,00,000
10% Debentures	₹30,00,000
	₹80,00,000

The equity share of the company sells for ₹20. It is expected that the company will pay next year a dividend of ₹2 per equity share, which is expected to grow at 5% p.a. forever. Assume a 35% corporate tax rate.

Required:
(i) Compute weighted average cost of capital (WACC) of the company based on the existing capital structure.
(ii) Compute the new WACC, if the company raises an additional ₹20 lakhs debt by issuing 12% debentures. This would result in increasing the expected equity divided to ₹2.40 and leave the growth rate unchanged, but the price of equity shares will fall to ₹16 per share.
(iii) Comment on the use of weights in the computation of weighted average cost of capital.

[(3+3+2 = 8 Marks) May 2003]

Answer
(i) Weighted Average Cost of Capital (Based on Existing Capital Structure)

Name of Source	Amount	Weight	After tax cost	Weighted cost
Equity Share Capital	40,00,000	0.50	15%	7.50%
11.5% Preference Share Capital	10,00,000	0.125	11.50%	1.4375%
10% Debenture	30,00,000	0.375	6.50%	2.4375%
Total	*80,00,000*	*1.00*	*WACC*	*11.375%*

(ii) New Weighted Average Cost of Capital

Name of Source	Amount	Weight	After tax cost	Weighted cost
Equity Share Capital	40,00,000	0.40	20%	8%

11.5% Preference Share Capital	10,00,000	0.10	11.50%	1.15%
10% Debenture	30,00,000	0.30	6.50%	1.95%
12% Debt	20,00,000	0.20	7.80%	1.56%
Total	*1,00,00,000*	*1.00*	*WACC*	*12.66%*

Working Notes:

Calculation of existing K_e, K_p and K_d

K_e	=	$\dfrac{D_1}{P_0} + g$	=	$\dfrac{2}{20} + 0.05$	=	*15%*
K_p	=	Rate of Preference Dividend			=	*11.50%*
K_d	=	I (1 - t)	=	10% (1 – 0.35)	=	*6.50%*

Calculation of new K_e, K_p, K_{d1} and K_{d2}:

K_e	=	$\dfrac{D_1}{P_0} + g$	=	$\dfrac{2.40}{16} + 0.05$	=	*20%*
K_p	=	Rate of Preference Dividend			=	*11.50%*
K_{d1}	=	I (1 - t)	=	10% (1 – 0.35)	=	*6.50%*
K_{d2}	=	I (1 - t)	=	12% (1 – 0.35)	=	*7.80%*

Comment: On the computation of weighted average cost of capital weights are preferred to Book value. For example, weights representing the capital structure under a corporate financing situation, its cash flows are preferred to earnings & market. Balance sheet is preferred to book value balance sheet.

PYQ 4
ABC Limited has the following book value capital structure:

Equity Share Capital (150 million shares, ₹10 par)	₹1,500 million
Reserves and Surplus	₹2,250 million
10.5% Preference Share Capital (1 million shares, ₹100 par)	₹100 million
9.5% Debentures (1.5 million debentures, ₹1,000 par)	₹1,500 million
8.5% Term Loans from Financial Institutions	₹500 million

The debentures of ABC Limited are redeemable after three years and are quoting at ₹981.05 per debenture. The applicable income tax rate for the company is 35%. The current market price per equity share is ₹60. The prevailing default-risk free interest rate on 10-year GOI Treasury Bonds is 5.5%. The average market risk premium is 8%. The beta of the company is 1.1875.

The preferred stock of the company is redeemable after 5 years is currently selling at ₹98.15 per preference share.

Required:
(i) Calculate weighted average cost of capital of the company using market value weights.

(ii) Define the marginal cost of capital schedule for the firm if it raises ₹750 million for a new project. The firm plans to have a target debt to value ratio of 20%. The beta of new project is 1.4375. The debt capital will be raised through term loan will carry interest rate of 9.5% for the first 100 million and 10% for the next ₹50 million.

[(6+3 = 9 Marks) May 2004]

Answer
(i) *Weighted Average Cost of capital (Using market value weights):*

$$\text{WACC} = K_eW_e + K_pW_p + K_dW_d + K_{TL}W_{TL}$$

$$= 15\% \times \frac{81.30}{100} + 10.9715\% \times \frac{.89}{100} + 6.8718\% \times \frac{13.29}{100} + 5.525\% \times \frac{4.52}{100} = \textbf{13.46\%}$$

(K_e & K_r are same, so calculated together)

(ii)   Marginal cost of capital (MCC) schedule:

Equity share capital   =   600 million (80% of total requirement)

Debt   =   150 million (20% of total requirement; 100 million through 9.5% debt and next 50 million through 10% debt)

MCC   = $K_eW_e + K_{d1}W_{d1} + K_{d2}W_{d2}$

          = $17\% \times \dfrac{600}{750} + 6.175\% \times \dfrac{100}{750} + 6.50\% \times \dfrac{50}{750}$ =   ***14.86%***

Working Notes:

K_e = $R_f + \beta\,(R_m - R_f)$ = $5.5\% + 1.1875\,(8\%)$ =   ***15%***

K_p = $\dfrac{PD + \left(\dfrac{RV - NP}{n}\right)}{\dfrac{RV + NP}{2}} \times 100$ = $\dfrac{10.50 + \left(\dfrac{100 - 98.15}{5}\right)}{\dfrac{100 + 98.15}{2}} \times 100$ =   ***10.97%***

K_d = $\dfrac{I\,(1 - t) + \left(\dfrac{RV - NP}{n}\right)}{\dfrac{RV + NP}{2}} \times 100$ = $\dfrac{95.00\,(1 - 0.35) + \left(\dfrac{1{,}000 - 981.05}{3}\right)}{\dfrac{1{,}000 + 981.05}{2}} \times 100$

          =   ***6.8718%***

K_{TL} = $I\,(1 - t)$ = $8.50\%\,(1 - 0.35)$ =   ***5.525%***

Computation of proportion of equity capital, preference share debenture & term loans in the market value of capital structure:

[₹ in million]

Name of source	Market value	Proportions
Equity share capital & Reserve and Surplus (150 million share × 60)	9,000	81.30
10.5% Preferential share capital (1 million share × 98.15)	98.15	0.89
9.5% Debentures (1.5 million debentures × 981.05)	1,471.575	13.29
8.5% term loans	500	4.52
	11,069.725	100.00

K_e (New project)   = $5.5\% + 8\% \times 1.4375$ =   ***17%***

K_{d1} (New project)   = $9.50\% \times (1 - 0.35)$ =   ***6.175%***

K_{d2} (New project)   = $10\% \times (1 - 0.35)$ =   ***6.50%***

PYQ 5

The R & G Company has following capital structure at 31st March, 2004, which is considered to be optimum:

13% debenture   ₹3,60,000
11% preference share capital   ₹1,20,000
Equity share capital (2,00,000 shares)   ₹19,20,000

The company's share has a current market price of ₹27.75 per share. The expected dividend per share in next year is 50 percent of the 2004 EPS. The EPS of last 10 years is as follows. The past trends are expected to continue:

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
EPS (₹)	1.00	1.120	1.254	1.405	1.574	1.762	1.974	2.211	2.476	2.773

The company can issue 14 percent new debenture. The company's debenture is currently selling at ₹98. The new preference issue can be sold at a net price of ₹9.80, paying a dividend of ₹1.20 per share. The company's marginal tax rate is 50%.

(i) Calculate the after tax cost *(a)* of a new debts and new preference share capital, *(b)* of ordinary equity, assuming new equity comes from retained earnings.

(ii) Calculate the marginal cost of capital.

(iii) How much can be spent for capital investment before new ordinary share must be sold? Assuming that retained earning available for next year's investment are 50% of 2004 earnings.

(iv) What will be marginal cost of capital [cost of fund raised in excess of the amount calculated in part *(iii)*] if the company can sell new ordinary shares to net ₹20 per share? The cost of debt and of preference capital is constant.

[(2+1+2+2 = 7 Marks) May 2005]

Answer

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

$$K_d \quad = \quad \frac{I(1-t)}{NP} \times 100 \quad = \quad \frac{14(1-.50)}{98} \times 100 \quad = \quad \textbf{7.143\%}$$

After tax cost of new preference shares

$$K_p \quad = \quad \frac{PD}{NP} \times 100 \quad = \quad \frac{2.773 \times 50\%}{9.80} \times 100 \quad = \quad \textbf{12.25\%}$$

(b) *Cost of new equity (comes from retained earnings)*

$$K_e \quad = \quad \frac{D_1}{P_0(old)} + g \quad = \quad \frac{1.3865}{27.75} + 0.12 \quad = \quad \textbf{17\%}$$

(ii) *MCC (K_o)*

$$= \quad K_d W_d + K_p W_p + K_e W_e$$
$$= \quad 7.143\% \times .15 + 12.245\% \times .05 + 17\% \times .80 \quad = \quad \textbf{15.28\%}$$

(iii) *The company can pay the following amount without selling the new shares:*

Equity (retained earnings in this case) = 80% of the total capital

Therefore, investment before new issue $= \quad \dfrac{2,77,300}{80\%} \qquad = \textbf{₹3,46,625}$

Retained earnings $= \quad ₹1.3865 \times 2,00,000 \qquad = \textbf{₹2,77,300}$

(iv) *MCC (K_o)*

$$= \quad K_d W_d + K_p W_p + K_e W_e$$
$$= \quad 7.143\% \times .15 + 12.245\% \times .05 + 18.93\% \times .80 \quad = \quad \textbf{16.83\%}$$

If the company pay more than ₹3,46,625, it will have to issue new shares. The cost of new issue of ordinary share is:

$$K_e \quad = \quad \frac{D_1}{P_0(new)} + g \quad = \quad \frac{1.3865}{20} + 0.12 \quad = \quad \textbf{18.93\%}$$

PYQ 6

A Company issues ₹10,00,000 12% debentures of ₹100 each. The debentures are redeemable after the expiry of fixed period of 7 years. The Company is in 35% tax bracket.

Required:

A. Calculate the cost of debt after tax, if debentures are issued at
  a. Par,
  b. 10% Discount,
  c. 10% Premium.

B. If brokerage is paid at 2%, what will be the cost of debentures, if issue is at par?

[(5+1 = 6 Marks) May 2006]

Answer

A. *Calculation of cost of debt, when debentures are issued at:*

a. *Par*

$$K_d = \frac{I(1-t)+\left(\frac{RV-NP}{n}\right)}{\frac{RV+NP}{2}} \times 100 \qquad = \qquad \frac{12(1-0.35)+\left(\frac{100-100}{7}\right)}{\frac{100+100}{2}} \times 100$$

$$= \quad \textbf{\textit{7.80\%}}$$

b. *10% Discount*

$$K_d = \frac{12(1-0.35)+\left(\frac{100-90}{7}\right)}{\frac{100+90}{2}} \times 100 \qquad = \qquad \textbf{\textit{9.71\%}}$$

c. *10% Premium*

$$K_d = \frac{12(1-0.35)+\left(\frac{100-110}{7}\right)}{\frac{100+110}{2}} \times 100 \qquad = \qquad \textbf{\textit{6.07\%}}$$

B. *Cost of debentures, if brokerage is paid at 2% and debentures are issued at par:*

$$K_d = \frac{I(1-t)+\left(\frac{RV-NP}{n}\right)}{\frac{RV+NP}{2}} \times 100 \qquad = \qquad \frac{12(1-0.35)+\left(\frac{100-98}{7}\right)}{\frac{98+100}{2}} \times 100$$

$$= \quad \textbf{\textit{8.17\%}}$$

PYQ 7

ABC Ltd. wishes to raise additional finance of ₹20 lakhs for meeting its investment purpose. The company has ₹4,00,000 in the form of retained earnings available for investment purposes. The following are the further details:

Debt equity ratio	:	25 : 75
Cost of debt:		
Upto ₹2,00,000	:	10% (before tax) and
Beyond ₹2,00,000	:	13% (before tax)
Earning per share	:	₹12 per share
Dividend payout	:	50% of earnings
Expected growth rate	:	10%
Current market price	:	₹60 per share
Company's tax rate	:	30%
Shareholder's personal tax rate	:	20%.

Required:

(i) Calculate the post tax average cost of additional debt.
(ii) Calculate the cost of retained earnings and cost of equity.
(iii) Calculate the overall weighted average (after tax) cost of additional finance.

[(2+3+3 = 8 Marks) May 2008]

Answer

Total capital required is ₹20 lakhs. With a debt-equity ratio of 1:3. It means ₹5 lakhs is to be raised through debt and ₹15 lakhs through equity. Out of ₹15 lakhs, ₹4 lakhs are available in the form of retained earnings hence ₹11 lakhs will have to raise by issuing equity shares.

(i) *Post tax average cost of additional debt:*

K_{d1}	=	I (1 - t)	=	10% (1 – 0.30)	=	**7%**
K_{d2}	=	I (1 - t)	=	13% (1 – 0.30)	=	**9.10%**
Average K_d	=	$K_{d1}W_{d1} + K_{d2}W_{d2}$	=	$7\% \times \frac{2}{5} + 9.10\% \times \frac{3}{5}$	=	**8.26%**

(ii) Cost of retained earning & cost of equity:

K_e	=	$\dfrac{D_1}{P_0} + g$	=	$\dfrac{6+10\%}{60} + 0.10$	=	**21%**
K_r	=	$K_e (1-PT)$	=	21% (1 - .20)	=	**16.80%**
D_0	=	₹12 × 50%	=	**₹6**

(iii) Overall cost of additional finance:

$$K_o = K_eW_e + K_rW_r + K_dW_d$$
$$= 21\% \times \frac{11}{20} + 16.80\% \times \frac{4}{20} + 8.26\% \times \frac{5}{20} \qquad = \qquad \textbf{16.98\%}$$

Assumption: DPS is treated at D_o.

PYQ 8
The capital structure of MNP Ltd. is as under:

9% Debentures	₹2,75,000
11% Preference shares	₹2,25,000
Equity shares (face value ₹10 per share)	₹5,00,000

Additional information:

(i) ₹100 per debenture redeemable at par has 2% floatation cost and 10 years of maturity. The market price per debenture is ₹105.

(ii) ₹100 per preference share redeemable at par has 3% floatation cost and 10 years of maturity. The market price per preference share is ₹106.

(iii) Equity share has ₹4 floatation cost and market price per share of ₹24. The next year expected dividend is ₹2 per share will annual growth of 5%. The firm has a practice of paying all earnings in the form of dividends.

(iv) Corporate Income-tax rate is 35%.

Calculate Weighted Average Cost of Capital (WACC) using market value weights.

[(9 Marks) May 2009]

Answer

Calculation of Weighted Average Cost of Capital by Using Market Value Weight

Particular	Market value	Weight	Cost	Weighted cost
9% Debenture	2,88,750	0.1672	6.11%	1.020%
11% Preference share	2,38,500	0.1381	11.47%	1.583%
Equity Share Capital	12,00,000	0.6947	15.00%	10.425%
Total	**17,27,250**	**1.0000**	**WACC**	**13.028%**

Working notes:

$$K_e = \frac{D_1}{P_0} + g = \frac{2}{24-4} + 0.05 = \textbf{15\%}$$

$$K_d = \frac{I(1-t)+\left(\dfrac{RV-NP}{n}\right)}{\dfrac{RV+NP}{2}} \times 100 = \frac{9(1-0.35)+\left(\dfrac{100-98}{10}\right)}{\dfrac{100+98}{2}} \times 100$$

$$= \quad \textbf{6.11\%}$$

$$K_p \quad = \quad \frac{PD + \left(\dfrac{RV - NP}{n}\right)}{\dfrac{RV + NP}{2}} \times 100 \quad = \quad \frac{11 + \left(\dfrac{100 - 97}{10}\right)}{\dfrac{100 + 97}{2}} \times 100 \quad = \quad \textbf{11.47\%}$$

PYQ 9

Y Ltd. retains ₹7,50,000 out of its current earning. The expected rate of return to the shareholders, if they had invested the funds elsewhere is 10%. The brokerage is 3% and the shareholders came in 30% tax bracket.

Calculate the cost of retained earnings.

[(2 Marks) Nov 2009]

Answer

$$K_r \quad = \quad K (1 - B) (1 - PT) \quad = \quad 0.10 (1 - 0.03) (1 - 0.30) \quad = \quad \textbf{6.79\%}$$

PYQ 10

SK Limited has obtained funds from the following sources, the specific cost are also given against them:

Source of funds	Amount (₹)	Cost of Capital
Equity shares	30,00,000	15 percent
Preference shares	8,00,000	8 percent
Retained earnings	12,00,000	11 percent
Debentures	10,00,000	9 percent (before tax)

You are required to calculate weighted average cost of capital. Assume that Corporate tax rate is 30%.

[(3 Marks) May 2010]

Answer

$$K_o \quad = \quad K_eW_e + K_rW_r + K_pW_p + K_dW_d$$

$$= \quad 15\% \times \frac{30}{60} + 11\% \times \frac{12}{60} + 8\% \times \frac{8}{60} + 6.30\% \times \frac{10}{60} \quad = \quad \textbf{11.82\%}$$

$$K_d \quad = \quad I (1 - t) \quad = \quad 9\% (1 - .30) \quad = \quad \textbf{6.30\%}$$

PYQ 11

PQR Ltd. has the following capital structure on October 31, 2010:

Name of Source	Amount (₹)
Equity Share Capital (2,00,000 shares of ₹10 each)	20,00,000
Reserves & Surplus	20,00,000
12% Preference Shares	10,00,000
9% Debentures	30,00,000
Total	*80,00,000*

The market price of equity share is ₹30. It is expected that the company will pay next year a dividend of ₹3 per share, which will grow at 7% forever. Assume 40% income tax rate.

You are required to compute weighted average cost of capital using market value weights.

[(5 Marks) Nov 2010]

Answer

$$K_o \quad = \quad K_eW_e + K_pW_p + K_dW_d$$

$$= \quad 17\% \times \frac{60}{100} + 12\% \times \frac{10}{100} + 5.40\% \times \frac{30}{100} \quad = \quad \textbf{13.02\%}$$

(Kₑ & Kᵣ are same, so calculated together)

Working notes:

$$K_e = \frac{D_1}{P_0} + g = \frac{3}{30} + 0.07 = \mathit{17\%}$$

$$K_p = \text{Rate of preferential dividend} = \mathit{12\%}$$

$$K_d = I(1-t) = 9\%\,(1-0.40 = \mathit{5.40\%}$$

Calculation of market value:

Equity Shares & Reserve and Surplus =	2,00,000 shares of ₹30 each	=	₹60,00,000
Preference Shares		=	₹10,00,000
Debentures		=	₹30,00,000

PYQ 12
Beeta Ltd. has furnished the following information:

Earning per share (EPS)	:	₹4.00
Dividend payout ratio	:	25%
Market price per share	:	₹40.00
Rate of tax	:	30%
Growth rate of dividend	:	8%

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.

[(4 Marks) Nov 2011]

Answer

$$K_o = K_eW_e + K_{d1}W_{d1} + K_{d2}W_{d2}$$
$$= 10.7\% \times \frac{6}{10} + 7\% \times \frac{2}{10} + 10.50\% \times \frac{2}{10} = \mathit{9.92\%}$$

$$K_e = \frac{D_1}{P_0} + g = \frac{4.00 \times 25\% \times 108\%}{40} + 0.08 = \mathit{10.70\%}$$

$$K_{d1} = I(1-t) = 10\%\,(1-0.30) = \mathit{7\%}$$

$$K_{d2} = I(1-t) = 15\%\,(1-0.30) = \mathit{10.50\%}$$

Assumption: DPS ₹1.00 is treated at D_o.

PYQ 13
A company issued 40,000, 12% Redeemable Preference Shares of ₹100 each at a premium of ₹5 each, redeemable after 10 year at a premium of ₹10 each. The floatation cost of each share is ₹2.

You are required to calculate cost of preference share capital ignoring dividend tax.

[(5 Marks) May 2013]

Answer

$$K_p = \frac{PD + \left(\dfrac{RV - NP}{n}\right)}{\dfrac{RV + NP}{2}} \times 100 = \frac{12 + \left(\dfrac{110 - 103}{10}\right)}{\dfrac{110 + 103}{2}} \times 100 = \mathit{11.92\%}$$

PYQ 14
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

$$\text{WACC} = K_e W_e + K_p W_p + K_{rd} W_{rd} + K_{cd} W_{cd}$$

$$= 16.30\% \times \frac{65}{105} + 12\% \times \frac{12}{105} + 10.50\% \times \frac{20}{105} + 7\% \times \frac{8}{105} = \textbf{\textit{13.9952\%}}$$

Working Notes:

(i)   Calculation of cost of Preference Share Capital (K_p):

$$K_p = \text{Rate of Preference Dividend} = \textbf{\textit{12\%}}$$

(ii)   Calculation of cost of Redeemable Debentures (K_{rd}):

$$K_{rd} = I(1-t) = 15\%(1-0.30) = \textbf{\textit{10.50\%}}$$

(iii) Calculation of cost Convertible Debentures (K_{cd}):

$$K_{cd} = I(1-t) = 10\%(1-0.30) = \textbf{\textit{7\%}}$$

PYQ 15

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:

K_{d1}	=	$I(1-t)$	=	11% (1 – 0.30)	=	**_7.70%_**
K_{d2}	=	$I(1-t)$	=	14% (1 – 0.30)	=	**_9.80%_**
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%_**

2. **Cost of retained earning & cost of equity:**

$$K_e = \frac{D_1}{P_0} + g = \frac{10.50 + 10\%}{90} + 0.10 = \textit{22.83\%}$$

$$K_r = K_e(1 - PT) = 22.83\%(1 - .20) = \textit{18.27\%}$$

$$D_0 = ₹15 \times 70\% = \textit{₹10.50}$$

3. **Overall cost of additional finance:**

$$K_o = K_eW_e + K_rW_r + K_dW_d$$
$$= 22.83\% \times \frac{15}{30} + 18.27\% \times \frac{6}{30} + 9.10\% \times \frac{9}{30} = \textit{17.80\%}$$

Assumption: DPS ₹10.50 is treated at D_0.

PYQ 16
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

$$K_d = \frac{I(1-t) + \left(\frac{RV - NP}{n}\right)}{\frac{RV + NP}{2}} \times 100 = \frac{140(1 - 0.35) + \left(\frac{1000 - 930}{5}\right)}{\frac{1000 + 930}{2}} \times 100$$

$$= \textit{10.88\%}$$

Net Proceeds = 1,000 – 5% Discount – 2% Flotation cost = 930

Note: Floatation cost has been calculated on the basis of face value (i.e. 2% of ₹1,000 or ₹950 whichever is higher).

PYQ 17
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**

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

(b) After tax cost of new preference shares

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

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

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

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

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

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

Equity (retained earnings in this case)	=	80% of the total capital
Therefore, investment before new issue	=	$\dfrac{1,18,000}{80\%}$ = **₹1,47,500**
Retained earnings	=	₹2.36 × 50% × 1,00,000 = **₹1,18,000**

(iv) **MCC (K_o) when funds exceeds ₹1,47,500**

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

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:

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

WN: Calculation of growth:

Growth from year 2006 to 2007   =   (1.10 – 1.00) ÷ 1.00   =   **10%**

[Same rate of growth is found in future years]

PYQ 18

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

(i) $K_e \quad = \quad \dfrac{D_1}{P_0} + g \quad\quad = \quad \dfrac{2}{25} + 0.06 \quad = \quad \boldsymbol{14\%}$

Note: The cost of equity can be calculated with taking the effect of growth on dividend (i.e. $D_1 = 2.12$).

(ii) $\quad$ P_o $\qquad = \qquad \dfrac{D_1}{Ke - g} \qquad = \qquad \dfrac{2}{14\% - 8\%} \qquad = \qquad$ **₹33.33**

(iii) $\quad$ K_d $\qquad = \qquad \dfrac{I(1-t) + \left(\dfrac{RV - NP}{n}\right)}{\dfrac{RV + NP}{2}} \times 100 \qquad = \qquad \dfrac{10(1-0.50) + \left(\dfrac{112 - 96}{12}\right)}{\dfrac{112 + 96}{2}} \times 100$

$\qquad\qquad\qquad = \qquad$ **6.089%**

PYQ 19

Following is the capital structure of RBT Ltd. As on 31st March 2016:

Sources of Fund	Book Value	Market Value
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) $\quad$ Cost of capital for each source of capital,
(ii) $\quad$ Weighted average cost of capital on the basis of book value weights,
(iii) $\quad$ Weighted average cost of capital on the basis of market value weights.

[(8 Marks) Nov 2016]

Answer

(i) $\quad$ *Calculation of cost of capital for each source of capital:*

K_e $\qquad = \qquad \dfrac{D_1}{P_0} + g \qquad = \qquad \dfrac{4}{40} + 0.08 \qquad = \qquad$ **18%**

K_r $\qquad = \qquad K_e(1 - PT) \qquad = \qquad 18\%(1 - 0.20) \qquad = \qquad$ **14.40%**

K_d $\qquad = \qquad I(1 - t) \qquad = \qquad 14\%(1 - 0.40) \qquad = \qquad$ **8.40%**

K_p $\qquad = \qquad$ Rate of PD $\qquad = \qquad$ **11%**

(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 $\qquad = \qquad$ ₹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 20

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 (MPS/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)	=	$\dfrac{D_1}{P_0} + g$	=	$\dfrac{60\% \text{ of } 20}{125} + 6.40\%$	=	**16%**
K_e (after issue)	=	$\dfrac{D_1}{NP} + g$	=	$\dfrac{60\% \text{ of } 20}{120} + 6.40\%$	=	**16.40%**

PYQ 21
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	=	$\dfrac{D_1}{P_0} + g$	=	$\dfrac{4.00 \times 25\% \times 110\%}{50} + 0.10$	=	**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	=	$K_e W_e + K_{d1} W_{d1} + K_{d2} W_{d2}$				
	=	$12.20\% \times \dfrac{6}{10} + 7\% \times \dfrac{2}{10} + 10.50\% \times \dfrac{2}{10}$			=	**10.82%**

PYQ 22
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:**

K_{d1}	=	I (1 - t)	=	10% (1 – 0.25)	=	**7.5%**
K_{d2}	=	I (1 - t)	=	12% (1 – 0.25)	=	**9%**
Average K_d	=	$K_{d1}W_{d1} + K_{d2}W_{d2}$	=	$7.5\% \times \frac{75}{125} + 9\% \times \frac{50}{125}$	=	**8.10%**

(c) **Cost of retained earning & cost of equity:**

K_e	=	$\dfrac{D_1}{P_0} + g$	=	$\dfrac{2}{25} + 0.05$	=	**13%**
K_r	=	K_e			=	**13%**

(d) **Overall cost of additional finance:**

$$K_o = K_eW_e + K_rW_r + K_dW_d$$
$$= 13\% \times \frac{275}{500} + 13\% \times \frac{100}{500} + 8.10\% \times \frac{125}{500} = \textbf{11.78\%}$$

PYQ 23

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:

Year	1	2	3	4	5
PV Factor @ 10%	0.909	0.826	0.751	0.683	0.621
PV Factor @ 15%	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:

$$K_d = \frac{I(1-t) + \frac{CV-NP}{n}}{\frac{CV+NP}{2}} \times 100 = \frac{10(1-0.25) + \frac{121.67-100}{5}}{\frac{121.67+100}{2}} \times 100$$

$$= \textit{10.68\%}$$

(b) Calculation of Cost of Convertible debenture using IRR Method

Calculation of NPV at two discount rates:

Year	Cash Flow	Present Value		Present Value	
		10%	DCF	15%	DCF
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
NPV			+3.99		-14.38

$$\text{IRR/}K_d = LR + \frac{NPV_L}{NPV_L - NPV_H} \times (H - L) = 10\% + \frac{3.99}{3.99-(-14.38)} \times (15\% - 10\%)$$

$$= \textit{11.09\%}$$

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 24
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:*

$$K_e = \frac{D_1}{P_0 - F} + g = \frac{2}{25-4} + .05 = \mathbf{\textit{14.52\%}}$$

$$K_d = \frac{I(1-t) + \left(\frac{RV - NP}{n}\right)}{\frac{RV + NP}{2}} \times 100 = \frac{10(1-0.30) + \left(\frac{100-98}{10}\right)}{\frac{100+98}{2}} \times 100 = \mathbf{\textit{7.27\%}}$$

$$K_p = \frac{PD + \left(\frac{RV - NP}{n}\right)}{\frac{RV + NP}{2}} \times 100 = \frac{12 + \left(\frac{100-97}{10}\right)}{\frac{100+97}{2}} \times 100 = \mathbf{\textit{12.49\%}}$$

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 25

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:*

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%**

Average K_d		=	$K_{d1}W_{d1} + K_{d2}W_{d2} + K_{d3}W_{d3}$			
		=	7% × 5/20 + 6.30% × 5/20 + 5.60% × 10/20			=	**6.125%**

(c) Cost of Equity:

$$K_e \quad = \quad \frac{D_1}{P_0} + g \quad = \quad \frac{6\,(1+0.06)}{120} + 0.06 \quad = \quad \mathbf{11.30\%}$$

(d) Overall WACC after tax of additional finance:

$$K_o \quad = \quad K_eW_e + K_dW_d \quad = \quad 11.30\% \times \frac{10}{30} + 6.125\% \times \frac{20}{30}$$

$$= \quad \mathbf{7.85\%}$$

Assumption: DPS is treated at D_0.

PYQ 26
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	=	(₹6,00,000 ÷ ₹100) × ₹110	=	₹6,60,000

Market value of Equity and Retained earnings:

	=	(₹4,50,000 ÷ ₹100) × ₹180	=	₹8,10,000

(2) Calculation of K_e:

$$K_e \quad = \quad \frac{D_1}{P_0} \times 100 \quad = \quad \frac{24\% \text{ of } 100}{180} \quad = \quad \mathbf{13.33\%}$$

(3) Calculation of K_d:

$$K_d \quad = \quad \frac{I\,(1-t)}{NP} \times 100 \quad = \quad \frac{12\% \text{ of } 100\,(1-0.3)}{110} \times 100 \quad = \quad \mathbf{7.64\%}$$

PYQ 27

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.

Year	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

Interest rate	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:

$$P_0 = \frac{D_1}{K_e - g} = \frac{12.76(1 + 0.05)}{32.50\% - 5\%} = ₹48.72$$

$$K_e = R_f + \beta(R_m - R_f) = 10\% + 1.25 \times 18\% = 32.50\%$$

$$g = \sqrt[5]{\frac{12.76}{10.00}} = 5\% \quad \text{or}$$

$$g = 12.76 \div 10.00 = 1.276 \text{ (5\% for 5 year; given in interest rate table)}$$

(b) **Calculation of Cost of Preference shares using YTM method::**

Calculation of NPV at two discount rates:

Year	Cash Flow	Present Value		Present Value	
		3%	DCF	5%	DCF
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

$$\text{IRR/K}_d \quad = \quad \text{LR} + \frac{\text{NPV}_L}{\text{NPV}_L - \text{NPV}_H} \times (H - L) \quad = \quad 3\% + \frac{13.65}{13.65 - (-3.39)} \times (5\% - 3\%)$$

$$= \quad \textit{4.60\%}$$

Working Note:

Net Proceeds	=	Issue Price – Flotation Cost		
	=	(100 + 10% Premium) – 6%	=	₹103.40

PYQ 28

The following is the extract of the Balance Sheet of M/s KD Ltd.:

Particulars	Amount (₹)
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)

Capital Structure	Amount	Weight	Specific Cost	Cost of Capital
Ordinary Shares	8,12,500	0.278	0.190	0.0528
Share Premium & 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**

WACC (K_o) = **0.1548 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:

$$K_r \quad = \quad K_e \quad = \quad \textbf{19\%}$$

(3) Calculation of K_d:

$$K_d \quad = \quad \frac{I\,(1-t)}{NP} \times 100 \quad = \quad \frac{12\% \text{ of } 100\,(1-0.3)}{120} \times 100 \quad = \quad \textbf{7\%}$$

(4) Calculation of K_p:

$$K_p \quad = \quad \frac{PD}{NP} \times 100 \quad = \quad \frac{8\% \text{ of } 25}{16} \times 100 \quad = \quad \textbf{12.5\%}$$

PYQ 29

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**

$$K_d \quad = \quad \frac{I(1-t)}{NP} \times 100 \quad = \quad \frac{15\,(1-0.30)}{96} \times 100 \quad = \quad \textbf{10.94\%}$$

(b) After tax cost of new preference shares

$$K_p \quad = \quad \frac{PD}{NP} \times 100 \quad = \quad \frac{12}{91.50} \times 100 \quad = \quad \textbf{13.11\%}$$

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

$$K_r \quad = \quad \frac{D_1}{P_0} + g \quad = \quad \frac{2.50 \times 50\%}{25} + 0.10 \quad = \quad \textbf{\textit{15\%}}$$

(ii) *Marginal cost of capital:*

$K_d W_d + K_p W_p + K_r W_r \quad = \quad 10.94\% \times .15 + 13.11\% \times .05 + 15\% \times .80 \quad = \quad \textbf{\textit{14.30\%}}$

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

Equity (retained earnings in this case)	=	80% of the total capital
Therefore, investment before new issue	=	$\frac{62,500}{80\%}$ = ₹78,125
Retained earnings	=	₹2.50 × 50% × 50,000 shares = ₹62,500

PYQ 30

Capital structure of D Ltd. as on 31st March, 2023 is given below.

Particular	₹
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.

Interest Rate	1%	2%	3%	4%	5%	6%	7%
$FVIF_{i,5}$	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

Particulars	Book Value	Weight (W)	Cost (K)	Weighted cost
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

Particulars	Book Value	Weight (W)	Cost (K)	Weighted cost
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 = $\dfrac{D_1}{P_0} + g$ = $\dfrac{16}{80} + 5\%$ =   **25%**

g = $\sqrt[7]{\dfrac{14.07}{10}} - 1$ =   5%

or

$g\ (FVIF_{i,7})$ = $14.07 \div 10$ =   1.407 (g = 5% in table)

K_p = $\dfrac{PD + \left(\dfrac{RV - NP}{n}\right)}{\dfrac{RV + NP}{2}} \times 100$ = $\dfrac{8 + \left(\dfrac{106 - 104}{5}\right)}{\dfrac{106 + 104}{2}} \times 100$ =   **8%**

K_d = $\dfrac{I(1-t) + \left(\dfrac{RV - NP}{n}\right)}{\dfrac{RV + NP}{2}} \times 100$ = $\dfrac{12(1 - 0.40) + \left(\dfrac{120 - 95}{10}\right)}{\dfrac{120 + 95}{2}} \times 100$

    =   **9.02%**

K_e (Revised)   = $\dfrac{D_1}{P_0} + g$ = $\dfrac{18}{72} + 5\%$ =   **30%**

K_{TL} = $I(1-t)$ =   15% (1 – 0.4)   =   **9%**

SUGGESTED REVISION

Ques. No.	Observations or KEY Points (Note down during revisions)	Page No. of Practical Register	1st & 2nd Revision	3rd, 4th & 5th Revision	Revision during Exams
BQ (Book Questions covering Study Module of ICAI, PM, RTP's, MTP's and Important Questions)					
1			Y	Y	-
2			Y	Y	-
3			Y	Y	-
4			Y	Y	-
5			Y	Y	-
6			Y	Y	-
7			Y	Y	-
8			Y	-	-
9			Y	-	-
10			Y	Y	-
11			Y	Y	Y
12			Y	Y	-
13			Y	Y	Y
14			Y	Y	Y
15			Y	Y	-
16			Y	Y	-
17			Y	Y	-
18			Y	Y	-
19			Y	Y	-
20			Y	Y	-
21			Y	Y	Y
22			Y	-	-
23			Y	Y	-
24			Y	Y	-
25			Y	Y	-
26			Y	Y	Y
27			Y	Y	Y
28			Y	Y	-
29			Y	Y	Y
30			Y	Y	Y
31			Y	Y	-
32			Y	Y	-
33			Y	Y	Y
34			Y	Y	Y
35			Y	Y	Y
36			Y	Y	-
37			Y	Y	-
38			Y	-	-
39			Y	-	-
40			Y	Y	Y
41			Y	Y	Y
42			Y	Y	Y
43			Y	Y	Y
44			Y	Y	Y
45			Y	Y	Y
46			Y	Y	Y
47			Y	Y	-
48			Y	Y	-

49			Y	Y	-
50			Y	Y	Y
51			Y	Y	Y
52			Y	-	-
53			Y	Y	-
54			Y	Y	Y
55			Y	Y	Y
56			Y	Y	Y
57			Y	-	-
58			Y	Y	Y
59			Y	Y	Y
60			Y	-	-
61			Y	-	-
62			Y	Y	Y
63			Y	Y	Y
PYQ (Past Year Questions)					
1			Y	Y	Y
2			Y	Y	Y
3			Y	Y	Y
4			Y	Y	Y
5			Y	Y	Y
6			Y	-	-
7			Y	Y	-
8			Y	Y	Y
9			Y	Y	-
10			Y	Y	-
11			Y	Y	-
12			Y	Y	-
13			Y	Y	-
14			Y	Y	-
15			Y	Y	Y
16			Y	Y	Y
17			Y	-	-
18			Y	Y	Y
29			Y	Y	Y
20			Y	Y	Y
21			Y	-	-
22			Y	Y	Y
23			Y	Y	Y
24			Y	Y	Y
25			Y	-	-
26			Y	-	-
27			Y	Y	Y
28			Y	Y	Y
29			Y	Y	-
30			Y	Y	-

CHAPTER – 9

CAPITAL STRUCTURE

LEARNING OBJECTIVES

After studying this chapter you will be able to:
- *Discuss in details features of appropriate capital structure.*
- *Understand the various capital structure approaches.*
- *Understand the relationship between WACC of any company and valuation of the company.*
- *Understand the meaning of over valuation of any firm and its results.*
- *Understand the arbitrage process.*

NET INCOME AND NET OPERATING INCOME APPROACHES

BQ 1

Aparna Steel Ltd. has employed 15% Debt of ₹12,00,000 in its capital structure. The net operating income of the firm is ₹5,00,000 and has an equity capitalization rate of 16%. Assuming that there is no tax.

> *Find out the value of the firm.*

Answer

Statement Showing Value of Firm

Particulars	₹
Net Operating income	5,00,000
Less: Interest on Debt	1,80,000
Earnings for Equity Investors	3,20,000
Equity Capitalization rate	16%
Market Value of Equity (3,20,000 ÷ 0.16)	20,00,000
Value of debt	12,00,000
Total Value of the Firm	*32,00,000*

BQ 2

Rupa Ltd.'s EBIT is ₹5,00,000. The company has 10%, ₹20 lakh debentures. The equity capitalization rate i.e. Ke 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

Particulars	₹
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:

$$K_o \quad = \quad \frac{EBIT}{V} \times 100 \quad = \quad \frac{5,00,000}{38,75,000} \times 100 \quad = \quad \mathbf{\textit{12.90\%}}$$

BQ 3

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

Particulars	₹
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:

$$K_o \quad = \quad \frac{EBIT}{V} \times 100 \quad = \quad \frac{1,00,000}{8,33,333} \times 100 \quad = \quad \textbf{12\%}$$

BQ 4
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) Market Value of Firm $= \quad \dfrac{EBIT}{K_0} \quad = \quad \dfrac{5,00,000}{15\%} \quad = \quad$ **₹33,33,333**

(2) Cost of Equity $= \quad \dfrac{EBIT - I}{\text{Market value of Equity}} \times 100$

$= \quad \dfrac{5,00,000 - 1,50,000}{18,33,333} \times 100 \quad = \quad$ **19.09%**

Working note:

Market value of Equity $=$ Market value of Firm - Market value of Debt
$=$ 33,33,333 – 15,00,000 $=$ 18,33,333

BQ 5
The net operating profit of a firm is ₹2,10,000 and the total market value of its 12% Debt is ₹3,00,000. The equity capitalization rate of an unlevered firm of the same risk class is 16%.

   Find out the value of the levered firm as per NOI Approach given that the tax rate is 30% for both the firms.

Answer

Value of unlevered firm $= \quad \dfrac{EBIT(1-t)}{K_o} \quad = \quad \dfrac{2,10,000(1-0.30)}{0.16} \quad = \textbf{₹9,18,750}$

Value of levered firm $=$ Value of unlevered firm + Debt × tax
$=$ ₹9,18,750 + 3,00,000 × 30% $= \textbf{₹10,08,750}$

BQ 6
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:

Value of unlevered firm (Y Ltd) $\quad = \quad \dfrac{\text{EBIT}(1-t)}{K_o} \quad = \quad \dfrac{3,00,000\ (1-0.30)}{0.15}$

$\quad = \quad$ ***₹10,00,000***

Value of levered firm (X Ltd) $\quad =\quad$ Value of unlevered firm + Debt × tax

$\quad =\quad$ ₹10,00,000 + 9,00,000 × 50% $\quad = $ ***₹14,50,000***

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 Ltd (K_o) $\quad = \quad K_e \quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad = \quad$ ***15%***

X Ltd (K_o) $\quad = \quad K_e W_e + K_d W_d$

$\quad = \quad 19.1\% \times \dfrac{5,50,000}{14,50,000} + 5\% \times \dfrac{9,00,000}{14,50,000} \quad = \quad$ ***10.34%***

Or

X Ltd (K_o) $\quad = \quad \dfrac{\text{EBIT}(1-t)}{V} \times 100$

$\quad = \quad \dfrac{3,00,000(1-0.50)}{14,50,000} \times 100 \quad\quad = \quad$ ***10.34%***

Working Notes:

Calculation of K_e of X Ltd:

$K_e \quad = \quad \dfrac{\text{Earning for Equity}}{\text{Market value of Equity}} \times 100$

$\quad = \quad \dfrac{(3,00,000-90,000)\ (1-0.50)}{5,50,000} \times 100 \quad = \quad$ ***19.10%***

BQ 7

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:

Value of unlevered firm (Q Ltd)   = $\dfrac{EBIT(1-t)}{K_o}$ =   *₹20,00,000*

Value of levered firm (P Ltd)   =   Value of unlevered firm + Debt × tax
    =   ₹20,00,000 + 18,00,000 × 50%
    =   *₹29,00,000*

MODIGLANI AND MILLER HYPOTHESIS

BQ 8
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

K_o Sanghmani Limited   = K_o Samsui Limited   =   16%

K_o Sanghmani Limited   = $K_e W_e + K_d W_d$

16%   = $K_e × 2/3 + 10\% × 1/3$

K_e Sanghmani Limited   =   *19%*

BQ 9
ABC Ltd. has financed its project with 100% Equity with a cost of 21%. This also the weighted average cost of capital of the Company. XYZ Ltd. another Company identical to ABC Ltd. has financed its capital structure with 2:1 Debt -Equity ratio. The cost of debt is 14%. It is a risk free investment in debt.

Calculate the cost of Equity of XYZ Ltd.

Answer

K_o XYZ   = K_o ABC   =   21%

K_o XYZ   = $K_e W_e + K_d W_d$

21%   = $K_e × 1/3 + 14\% × 2/3$

K_e XYZ   =   *35%*

BQ 10

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

Value of unlevered firm	=	$\dfrac{EBIT\ (1-t)}{K_o}$	=	$\dfrac{2,00,000\ (1-0.50)}{0.20}$	=	**₹5,00,000**
Value of levered firm	=	Value of unlevered firm + Debt × tax				
	=	₹5,00,000 + 6,00,000 × 50%			=	**₹8,00,000**
K_o of unlevered firm	=	K_e			=	**20%**
K_o of levered firm	=	$\dfrac{EBIT(1-t)}{V}$	=	$\dfrac{2,00,000\ (1-0.50)}{8,00,000}$	=	**₹12.50%**

BQ 11

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:***

MV before repurchase (V_{UL})	=	1,750 Lakhs		
MV after repurchase (V_L)	=	V_{UL} + Debt × Tax		
	=	1,750 L + 275 L × 30%	=	1,832.50 Lakhs
Impact on MV of firm	=	1,832.50 L – 1,750 L		
	=	***Increase by 82.50 Lakhs***		

(2) ***Overall cost of capital:***

WACC before repurchase	=	20%		
WACC after repurchase	=	$\dfrac{EBIT\ (1-t)}{Value\ of\ firm} \times 100$		
	=	$\dfrac{500\ L\ (1-0.30)}{1,832.50\ L} \times 100$	=	19.10%
Impact on Cost of capital	=	20% – 19.10%		
	=	***Decrease by 0.90%***		

(3) *Cost of Equity:*

K_e before repurchase	=	20%	

$$K_e \text{ after repurchase} = \frac{(EBIT - I)(1 - t)}{MV \text{ of Equity}} \times 100$$

$$= \frac{(500 \text{ L} - 15\% \text{ of } 275 \text{ L})(1 - 0.30)}{1,557.50 \text{ L}} \times 100 = \boldsymbol{20.62\%}$$

Impact on K_e = 20.62% – 20%

= ***Increase by 0.62%***

Workings notes:

$$MV \text{ of Equity (before repurchase)} = \frac{EAT}{K_e}$$

$$1,750 \text{ Lakhs} = \frac{EAT}{0.20}$$

EAT = 1,750 Lakhs × 20% = 350 L

EBIT = EAT ÷ (1 – t)

= 350 L ÷ (1 – 0.3) = 500 L

MV of Equity (after repurchase) = Value of firm – Value of Debt

= 1,832.50 L – 275 L = 1,557.5 L

TRADITIONAL APPROACH AND MISCELLANEOUS

BQ 12

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 13

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 14

XYZ Ltd. has EBIT of ₹4,00,000. The firm currently has outstanding debts of ₹15,00,000 at an average cost of 10%. Its cost of equity capital K_e is estimated 16%.

(i) Determine the current value of the firm using the Traditional valuation approach.
(ii) Determine the firm's overall capitalization rate K_o.
(iii) The firm is considering to issue capital of ₹5,00,000 in order to redeem ₹5,00,000 debt. The cost of debt is expected to be unaffected. However, the firm's cost of equity capital is to be reduced to 14% as a result of decrease in leverage. Would you recommend the proposed action?

Answer

(i) **Value of the firm as per Traditional approach:**

EBIT	₹4,00,000
Less: Interest @10% on ₹15,00,000	₹1,50,000
Net Income for equity holders	₹2,50,000
K_e (equity capitalization rate)	0.16
Market value of equity	₹15,62,500
Market value of debt	₹15,00,000
Total market value	**₹30,62,500**

(ii) **Overall capitalization rate** = EBIT ÷ V = 4,00,000 ÷ 30,62,500 = **13.06 %**

(iii) **Effect of proposed redemption of debt:**

EBIT	₹4,00,000
Less: Interest @10% on ₹10,00,000	₹1,00,000
Net Income for equity holders	₹3,00,000
K_e (equity capitalization rate)	0.14
Market value of equity	₹21,42,857
Market value of debt	₹10,00,000
Total market value	**₹31,42,857**

The proposal should be accepted as it would increase the value of the firm from ₹30,62,500 to ₹31,42,857.

BQ 15

A Company's current operating income is ₹4 lakhs. The firm has ₹10 lakhs of 10% debt outstanding. Its cost of equity capital is estimated to be 15%.

(a)   Determine the current value of the firm, using traditional valuation approach.
(b)   Calculate the firm's overall capitalization rate.
(c)   The firm is considering to increase its leverage by raising an additional ₹5,00,000 debt and using the proceeds to retire that amount of equity. As a result of increased financial risk, the K_d is likely to go up to 12% and K_e to 18%. Would you recommend the plan?

Answer
(a)   *Value of the firm as per Traditional approach:*

EBIT	₹4,00,000
Less: Interest @10% on ₹10,00,000	₹1,00,000
Net Income for equity holders	₹3,00,000
K_e (equity capitalization rate)	0.15
Market value of equity	₹20,00,000
Market value of debt	₹10,00,000
Total market value	*₹30,00,000*

(b)   *Overall capitalization rate*   =   EBIT ÷ V   =   4,00,000 ÷ 30,00,000   = *13.33%*

(c)   *Effect of proposed redemption of debt:*

EBIT	₹4,00,000
Less: Interest @12% on ₹15,00,000	₹1,80,000
Net Income for equity holders	₹2,20,000
K_e (equity capitalization rate)	0.18
Market value of equity	₹12,22,222
Market value of debt	₹15,00,000
Total market value	*₹27,22,222*

The proposal should be rejected as it would decrease the value of the firm from ₹30,00,000 to ₹27,22,222.

BQ 16

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.*   = $\dfrac{NOI}{K_o}$ = $\dfrac{3,60,000}{18\%}$ =   *₹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
	80,000

Less: Interest on Debt @ 8% on ₹10,00,0,00 (50% of ₹20,00,000)	2,80,000
Earnings for Equity Investors	
Return on 2% Shares (2% of ₹2,80,000)	**5,600**

(ii) *Implied required rate of return on Equity* $= \dfrac{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 ₹4,00,0,00 (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 $= \dfrac{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.

BQ 17
XYZ Ltd. is expecting an EBIT of ₹3,00,000. The company presently raised its entire fund requirement of ₹20 lakhs by Issue of equity with equity capitalisation rate of 16%.

The firm is now contemplating to redeem a part of capital by introducing debt financing. The firm has two options to raise debt to the extent of 30% or 50% of total funds.

It is expected that for debt financing up to 30% the rate of interest will be 10% and equity capitalisation rate is expected to increases to 17%. However, if firm opts for 50% debt then interest rate will be 12% and equity capitalisation rate will be 20%.

You are required to compute value of firm and its overall cost of capital under different options if the traditional approach is held valid.

Answer
Statement of K_o and Value of Firm

Particulars	All equity	30% Debt	50% Debt
Earnings before interest and tax	3,00,000	3,00,000	3,00,000
Less: Interest	-	60,000	1,20,000
PBT	3,00,000	2,40,000	1,80,000
÷ K_e	16%	17%	20%
Value of Equity (E)	18,75,000	14,11,765	9,00,000
Value of Debt (D)	-	6,00,000	1,00,000
Value of Firm (V)	**18,75,000**	**20,11,765**	**19,00,000**
K_o (PBIT ÷ V)	**16%**	**14.91%**	**15.79%**

Decision: Company should opt for 30% debt finance

ARBITRAGE PROCESS ($V_L > V_{UL}$)

BQ 18
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

$$\text{Value of Equity (S)} = \frac{\text{NOI}-\text{Interest}}{\text{Cost of Equity}}$$

$$S_N = \frac{20{,}000}{10\%} = \text{₹2,00,000}$$

$$S_M = \frac{20{,}000-7{,}000}{11.50\%} = \text{₹1,13,043}$$

$$V_N = \text{₹2,00,000}$$

$$V_M = S_M + D$$
$$= \text{₹1,13,043 + ₹1,00,000} = \text{₹2,13,043}$$

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 investnent):

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 19

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%)	15,000
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%)	1,500
Net Income from unlevered firm	3,375
Income from Levered firm (24000 × 12.5%)	3,000
Incremental Income due to arbitrage	**375**

ARBITRAGE PROCESS ($V_{UL} > V_L$)

BQ 20
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:

Particulars	U Ltd. (₹)	L Ltd. (₹)
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
Value of the Firm	*2,00,000*	*1,72,222*

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 21
Following data is available in respect of two companies having same business risk:

Capital employed	=	₹2,00,000
EBIT	=	₹30,000

Sources	*Levered Company (₹)*	*Unlevered Company (₹)*
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:

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	20%	12.5%
Market Value of Equity (Earning for Equity ÷ K_e)	1,00,000	2,40,000
Value of Debt	1,00,000	-
Value of the Firm	*2,00,000*	*2,40,000*

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%)	36,000
Lend money (36,000 × 50%)	18,000
Buy shares in Levered company	18,000
Total investment	*36,000*

3. Change in Return:

Income from shares in Levered company (18,000 × 20%)	3,600
Add: Interest on money lent (18,000 × 10%)	1,800
Total income after switch over	5,400
Income from Unlevered firm (36,000 × 12.5%)	4,500
Incremental Income due to arbitrage	*900*

PAST YEAR QUESTIONS

PYQ 1

Z Ltd's operating income (before interest and tax) is ₹9,00,000. The firm's cost of debt is 10% and currently firm employs ₹30,00,000 of debt. The overall cost of capital 12%.

> *Calculate cost of Equity.*
>
> *[(4 Marks) Nov 2007]*

Answer

Market value of firm	=	$\dfrac{\text{EBIT}}{K_o}$	=	$\dfrac{9,00,000}{0.12}$
	=	*₹75,00,000*		
Market value of Equity	=	MV of firm – MV of debt		
	=	75,0000 – 30,00,000	=	*₹45,00,000*
K_e	=	$\dfrac{\text{PAT}}{\text{MV of Equity}}$	=	$\dfrac{\text{PAT}}{\text{MV of Equity}}$
	=	$\dfrac{9,00,000 - 3,00,000}{45,00,000}$	=	*13.33%*

PYQ 2

There are two firms P and Q which are identical except P does not use any debt in its capital structure while Q has ₹8,00,000, 9% debenture in its capital structure. Both the firms have earnings before interest and tax ₹2,60,000 p.a. and the capitalization rate is 10%. Assuming the corporate tax is 30%.

> *Calculate the value of these firms according to MM Hypothesis.*
>
> *[(4 Marks) Nov 2009]*

Answer

Market value of firms P and Q:

Market value of P (Unlevered)	=	$\dfrac{\text{EBIT }(1-t)}{K_e}$	=	$\dfrac{2,60,000\ (1-.30)}{.10}$
	=	*18,20,000*		
Market value of Q (Levered)	=	Market value of P + Debt × Tax		
	=	18,20,000 + 8,00,000 × 30%		
	=	*20,60,000*		

PYQ 3

RES Ltd. is an all equity financed company with a market value of ₹25,00,000 and cost of equity K_e 21%. The company wants to buyback equity shares worth ₹5,00,000 by issuing and raising 15% perpetual amount (Debt). Rate of tax may be taken as 30%. After the capital restructuring and applying MM model with taxes.

You are required to calculate:

(a) Market value of RES Ltd.
(b) Cost of Equity K_e.
(c) Weighted average cost of capital and comment on it.

> *[(4 Marks) May 2012]*

Answer

(a) **Market Value (MV) of RES Ltd:**

MV before restructuring (V_{UL})	=	25,00,000
MV after restructuring (V_L)	=	V_{UL} + Debt × Tax
	=	25,00,000 + 5,00,000 × 30% = **26,50,000**

(b) **Cost of Equity:**

$$K_e = \frac{(EBIT - I)(1 - t)}{MV \ of \ Equity} \times 100$$

$$= \frac{(7,50,000 - 15\% \ of \ 5,00,000)(1 - 0.30)}{21,50,000} \times 100$$

$$= \textbf{21.98\%}$$

(c) **Weighted average cost of capital:**

$$WACC = \frac{EBIT \ (1 - t)}{Value \ of \ firm} \times 100$$

$$= \frac{7,50,000 \ (1 - 0.30)}{26,50,000} \times 100 \qquad = \qquad \textbf{19.81 \%}$$

Comment: WACC after restructuring is lower than before restructuring. Hence, company should restructure the firm.

Workings notes:

MV of Equity (before restructuring)	=	$\dfrac{EAT}{K_e}$
25,00,000	=	$\dfrac{EAT}{0.21}$
EAT	=	25,00,000 × 21% = 5,25,000
EBIT	=	EAT ÷ (1 – t)
	=	5,25,000 ÷ (1 – 0.3) = 7,50,000
MV of Equity (after restructuring)	=	Value of firm – Value of Debt
	=	26,50,000 – 5,00,000 = 21,50,000

PYQ 4

'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. Assumung 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:

Value of 'A' Ltd. (Unlevered)	=	$\dfrac{EBIT \ (1 - t)}{K_e}$ = $\dfrac{2,50,000 \ (1 - .30)}{.20}$
	=	**8,75,000**
Value of 'B' Ltd. (Levered)	=	Market value of 'A' Ltd + Debt × Tax

$$= \quad 8,75,000 + 10,00,000 \times 30\% \quad = \quad \textbf{11,75,000}$$

Calculation of WACC of 'A' Ltd and 'B' Ltd:

K_0 of 'A' Ltd. $\quad = \quad K_e$ of 'A' Ltd

$\quad = \quad$ **20%** $\quad$ [In case of All equity company $K_o = K_e$]

K_0 of 'B' Ltd. $\quad = \quad \dfrac{\text{EBIT } (1-t)}{V} \times 100 \quad = \quad \dfrac{2,50,000 \ (1-.30)}{11,75,000} \times 100$

$\quad = \quad$ **14.89%**

PYQ 5

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	-	60,000	-
@ 12% of ₹10,00,000	-	-	1,20,000
Earning available for Equity	4,00,000	3,40,000	2,80,000
÷ K_e	16%	17%	20%
Value of Equity (E) [PBT ÷ K_e]	25,00,000	20,00,000	14,00,000
Value of Debt (D)	-	6,00,000	10,00,000
Value of Firm (V)	*25,00,000*	*26,00,000*	*24,00,000*
K_o (EBIT ÷ V)	*16%*	*15.38%*	*16.67%*

Decision: Company should opt for 30% debt finance having higher Value of firm and lower K_o.

PYQ 6

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:

Value of 'PNR' Ltd. (Unlevered)	=	$\dfrac{\text{EBIT }(1-t)}{K_e}$	=	$\dfrac{5,00,000\,(1-.30)}{.20}$
	=	**17,50,000**		

Value of 'PXR' Ltd. (Levered)	=	Market value of 'PNR' Ltd + Debt × Tax
	=	17,50,000 + 20,00,000 × 30%
	=	**23,50,000**

Calculation of WACC of 'PNR' Ltd and 'PXR' Ltd:

K_0 of 'PNR' Ltd.	=	K_e of 'PNR' Ltd		
	=	**20%**	[In case of All equity company $K_o = K_e$]	

K_0 of 'PXR' Ltd.	=	$\dfrac{\text{EBIT }(1-t)}{V} \times 100$	=	$\dfrac{5,00,000\,(1-.30)}{23,50,000} \times 100$
	=	**14.89%**		

PYQ 7

Stopgo Ltd. an all equity financed company is considering the repurchase of ₹200 Lakhs euity and to replace it with 15% debentures of the same amount. Current market value of the company is ₹1140 Lakhs and it's cost of capital is 20%. It's earning before interest and tax (EBIT) are expected to remain constant in future. It's 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) It's cost of capital, and
(3) It's 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} + Debt × Tax		
	=	1,140 L + 200 L × 30%	=	1,200 Lakhs
Impact on MV of firm	=	1,200 L – 1,140 L		
	=	***Increase by 60 Lakhs***		

(2) ***Weighted average cost of capital:***

WACC before repurchase	=	20%		
WACC after repurchase	=	$\dfrac{\text{EBIT }(1-t)}{\text{Value of firm}} \times 100$		
	=	$\dfrac{325.71\text{ L }(1-0.30)}{1,200\text{ L}} \times 100$	=	19%
Impact on Cost of capital	=	20% – 19%		
	=	***Decrease by 1%***		

(3) ***Cost of Equity:***

K_e before repurchase	=	20%

K_e after repurchase	=	$\dfrac{(EBIT - I)(1 - t)}{MV\ of\ Equity} \times 100$		
	=	$\dfrac{(325.71\ L - 15\%\ of\ 200\ L)(1 - 0.30)}{1{,}000\ L} \times 100 =$		*20.70%*

Impact on K_e	=	20.70% – 20%	
	=	*Increase by 0.70%*	

Workings notes:

MV of Equity (before repurchase)	=	$\dfrac{EAT}{K_e}$		
1,140 Lakhs	=	$\dfrac{EAT}{0.20}$		
EAT	=	1,140 Lakhs × 20%	=	228 L
EBIT	=	EAT ÷ (1 – t)		
	=	228 L ÷ (1 – 0.3)	=	325.71 L
MV of Equity (after repurchase)	=	Value of firm – Value of Debt		
	=	1,200 L – 200 L	=	1,000 L

PYQ 8

The following data relate to two companies belonging to the same risk class:

	A Ltd.	B Ltd.
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:

Market Value of B Ltd. (V_{UL})	=	EBIT ÷ K_e		
	=	₹18,00,000 ÷ 18%	=	*₹1,00,00,000*
Market Value of A Ltd. (V_L)	=	Value of unlevered	=	*₹1,00,00,000*

Equity Capitalization Rate:

Equity Capitalization Rate (B Ltd.)	=	*18% (given in the question)*	
Equity Capitalization Rate (A Ltd.)	=	(EBIT – I) ÷ *E (Value of Equity)	
	=	(₹18,00,000 – 12% × ₹54,00,000) ÷ ₹46,00,000	
	=	*25.04%*	
*Value of Equity (E) of A Ltd.	=	Value of Firm – Debt	
	=	₹1,00,00,000 - ₹54,00,000	=	₹46,00,000

Weighted Average Cost of Capital:

Weighted Average Cost of Capital (B Ltd.)	=	K_e	=	K_o	=	*18%*

Weighted Average Cost of Capital (A Ltd.)	=	EBIT ÷ V (Value of Firm)	
	=	₹18,00,000 ÷ ₹1,00,00,000	=	*18%*

(b) Various calculation with tax:

Market Value of firms:

Market Value of B Ltd. (V_{UL})	=	EBIT (1 - t) ÷ K_e or K_o	
	=	₹18,00,000 (1 – 0.40) ÷ 18%	=	*₹60,00,000*

Market Value of A Ltd. (V_L)	=	Value of unlevered + Debt × Tax	
	=	₹60,00,000 + ₹54,00,000 × .4	=	*₹81,60,000*

Equity Capitalization Rate:

Equity Capitalization Rate (B Ltd.)	=	*18% (given in the question)*

Equity Capitalization Rate (A Ltd.)	=	(EBIT – I) (1 - t) ÷ *E (Value of Equity)
	=	(₹18,00,000 – 12% × ₹54,00,000) (1 – .4) ÷ ₹27,60,000
	=	*25.04%*

*Value of Equity (E) of A Ltd.	=	Value of Firm – Debt		
	=	₹81,60,000 - ₹54,00,000	=	₹27,60,000

Weighted Average Cost of Capital:

Weighted Average Cost of Capital (B Ltd.)	=	K_e	=	K_o	=	*18%*

Weighted Average Cost of Capital (A Ltd.)	=	EBIT (1 - t) ÷ V (Value of Firm)
	=	₹18,00,000 (1 – 0.4) ÷ ₹81,60,000
	=	*13.24%*

PYQ 9

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

(a) Value of the A Ltd.	=	$\dfrac{\text{NOI}}{K_o}$		
	=	$\dfrac{4{,}50{,}000}{18\%}$	=	*₹25,00,000*
Value of Shares of A Ltd.	=	40% of ₹25,00,000	=	*₹10,00,000*

(i)   Return of X on Shares on A Ltd

Particulars	₹
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 $= \dfrac{3,30,000}{10,00,000} \times 100 =$ *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 $= \dfrac{4,10,000}{20,00,000} \times 100 =$ *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 10

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* $= \dfrac{\text{EBIT} - \text{I}}{\text{Ke}}$

R Ltd. $= \dfrac{\text{EBIT} - \text{I}}{\text{Ke}} = \dfrac{10,00,000 - 10\% \text{ of } 33,00,000}{18\%} =$ *37,22,222*

S Ltd. $= \dfrac{\text{EBIT} - \text{I}}{\text{Ke}} = \dfrac{10,00,000 - 0}{15\%} =$ *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 11

The following are the costs and values for the firms A and B according to the traditional approach.

Particulars	Firm A	Firm B
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, Ke = 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 Ke 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

Ques. No.	Observations or KEY Points (Note down during revisions)	Page No. of Practical Register	1st & 2nd Revision	3rd, 4th & 5th Revision	Revision during Exams
BQ (Book Questions covering Study Module of ICAI, PM, RTP's, MTP's and Important Questions)					
1			Y	Y	-
2			Y	Y	-
3			Y	Y	-
4			Y	Y	-
5			Y	Y	-
6			Y	Y	Y
7			Y	Y	-
8			Y	Y	Y
9			Y	Y	-
10			Y	Y	-
11			Y	Y	Y
12			Y	Y	Y
13			Y	Y	Y
14			Y	Y	Y
15			Y	Y	-
16			Y	Y	Y
17			Y	Y	-
18			Y	Y	Y
19			Y	Y	Y
20			Y	Y	Y
21			Y	Y	Y
PYQ (Past Year Questions)					
1			Y	Y	-
2			Y	Y	-
3			Y	Y	-
4			Y	Y	Y
5			Y	Y	Y
6			Y	Y	Y
7			Y	Y	Y
8			Y	Y	Y
9			Y	Y	Y
10			Y	-	-
11			Y	Y	Y

CHAPTER – 10

DIVIDEND DECISIONS

LEARNING OBJECTIVE

After studying this chapter you will be able to:
- *Understand the Meaning of Dividend Decision.*
- *Understand the importance of Dividend Decision.*
- *Discuss various Forms of Dividend.*
- *Discuss various Determinants of Dividend.*
- *Explain various theories of Dividend Decisions.*

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:

K_e = 10%, P_0 = ₹100, D_1 = 0

$$P_o = \frac{P_1 + D_1}{1 + K_e}$$

₹100 = $\frac{P_1 + 0}{1 + 0.10}$ or P_1 = ***₹110***

Step 2: No. of shares required to be issued:

No. of shares Δn = $\frac{\text{Funds requied} - (E - D)}{\text{Price at end}(P_1)}$ = $\frac{2,00,000 - (1,00,000 - 0)}{110}$

= ***909.09 shares***

Step 3: Calculation of value of firm:

$$nP_o = \frac{(n + \Delta n)P_1 - I + E}{1 + K_e}$$

nP_o = $\frac{(10,000 + 909.09)110 - 2,00,000 + 1,00,000}{(1 + .10)}$ = ***₹10,00,000***

2. *Value of the firm when dividends are paid:*

Step 1: Calculate price at the end of the period:

K_e = 10%, P_0 = ₹100, D_1 = ₹5

$$P_o = \frac{P_1 + D_1}{1 + K_e}$$

₹100 = $\frac{P_1 + 5}{1 + 0.10}$ or P_1 = ***₹105***

Step 2: No. of shares required to be issued:

No. of shares Δn = $\frac{\text{Funds requied} - (E - D)}{\text{Price at end}(P_1)}$ = $\frac{2,00,000 - (1,00,000 - 50,000)}{105}$

= ***1,428.57 shares***

Step 3: Calculation of value of firm:

$$nP_o = \frac{(n + \Delta n)P_1 - I + E}{1 + K_e}$$

$$nP_o = \frac{(10,000+1,428.57)105-2,00,000+1,00,000}{(1+.10)} = ₹10,00,000$$

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. $P_o = \dfrac{P_1+D_1}{1+K_e}$

    $₹100 = \dfrac{P_1+0}{1+0.12}$ or $P_1 = ₹112 – 0 = ₹112$

2. $P_o = \dfrac{P_1+D_1}{1+K_e}$

    $₹100 = \dfrac{P_1+10}{1+0.12}$ or $P_1 = ₹112 – 10 = ₹102$

3. No. of shares $= \dfrac{\text{Funds required}-(E-D)}{\text{Price at end}(P_1)}$

    $\Delta n = \dfrac{10,00,000-(5,00,000-1,00,000)}{102} = $ ***5882.35 or 5883 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%, P_0 = ₹100, D_1 = 0

$$P_o = \frac{P_1 + D_1}{1 + K_e}$$

$$₹100 = \frac{P_1 + 0}{1 + 0.10} \quad \text{or} \quad P_1 = \textbf{₹110}$$

Step 2: No. of shares required to be issued:

$$\text{No. of shares } \Delta n = \frac{\text{Funds requied} - (E-D)}{\text{Price at end}(P_1)} = \frac{5,00,000 - (2,50,000 - 0)}{110}$$

$$= \textbf{2,272.73 shares}$$

Step 3: Calculation of value of firm:

$$nP_o = \frac{(n + \Delta n)P_1 - I + E}{1 + K_e}$$

$$nP_o = \frac{(25,000 + 2,272.73)110 - 5,00,000 + 2,50,000}{(1 + .10)} = \textbf{₹25,00,000}$$

2. Value of the firm when dividends are paid:

Step 1: Calculate price at the end of the period:

Ke = 10%, P_0 = ₹100, D_1 = ₹5

$$P_o = \frac{P_1 + D_1}{1 + K_e}$$

$$₹100 = \frac{P_1 + 5}{1 + 0.10} \quad \text{or} \quad P_1 = \textbf{₹105}$$

Step 2: No. of shares required to be issued:

$$\text{No. of shares } \Delta n = \frac{\text{Funds requied} - (E-D)}{\text{Price at end}(P_1)} = \frac{5,00,000 - (2,50,000 - 1,25,000)}{105}$$

$$= \textbf{3,571.43 shares}$$

Step 3: Calculation of value of firm:

$$nP_o = \frac{(n + \Delta n)P_1 - I + E}{1 + K_e}$$

$$nP_o = \frac{(25,000 + 3,571.43)105 - 5,00,000 + 2,50,000}{(1 + .10)} = \textbf{₹25,00,000}$$

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%,	P_0	=	₹150,	D_1	=	₹8

$$P_o = \frac{P_1 + D_1}{1 + K_e}$$

₹150 $\quad = \quad \dfrac{P_1 + 8}{1 + 0.10}$ or P_1 = ***₹157***

(b) When expected dividends are not declared:

K_e	=	10%,	P_0	=	₹150,	D_1	=	₹0

$$P_o = \frac{P_1 + D_1}{1 + K_e}$$

₹150 $\quad = \quad \dfrac{P_1 + 0}{1 + 0.10}$ or P_1 = ***₹165***

2. Calculation of no. of shares required to be issued:

(a) When expected dividends are declared:

No. of shares Δn = $\dfrac{\text{Funds requied} - (E - D)}{\text{Price at end}(P_1)}$ = $\dfrac{6,00,00,000 - (3,00,00,000 - 80,00,000)}{157}$

= ***2,42,038.22 shares***

(b) When expected dividends are not declared:

No. of shares Δn = $\dfrac{\text{Funds requied} - (E - D)}{\text{Price at end}(P_1)}$ = $\dfrac{6,00,00,000 - (3,00,00,000 - 0)}{165}$

= ***1,81,818.18 shares***

3. Calculation of market value of shares at the end:

(a) When expected dividends are declared:

Market value of shares = Total shares at the end × Market value per share
= (10,00,000 + 2,42,038.22) × 157 = ***₹19,50,00,000***

(b) When expected dividends are not declared:

Market value of shares = Total shares at the end × Market value per share
= (10,00,000 + 1,81,818.18) × 165 = ***₹19,50,00,000***

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:

No. of shares Δn $= \dfrac{\text{Funds requied} - (E-D)}{\text{Price at end}(P_1)}$ $= \dfrac{I - (5,00,000 - 0)}{11.50}$

$26,089 \times ₹11.50$ $= I - ₹5,00,000$

I $=$ ***₹8,00,024***

Working Note:

When expected dividends are not declared:

$Ke = 15\%$, $\qquad P_0 = ₹10$, $\qquad D_1 = ₹0$

$P_o = \dfrac{P_1 + D_1}{1 + K_e}$

$₹10 = \dfrac{P_1 + 0}{1 + 0.15}$ $\qquad$ or $\qquad$ $P_1 = $ ***₹11.50***

2. *Calculation of Dividend:*

When dividend is paid:

$P_o = \dfrac{P_1 + D_1}{1 + K_e}$

$₹10 = \dfrac{P_1 + D_1}{1 + 0.15}$ $\qquad$ or $\qquad$ $P_1 = $ ***₹11.50 – D₁***

Now,

No. of shares Δn $= \dfrac{I - (E-D)}{P_1}$ $= \dfrac{8,00,024 - (5,00,000 - 2,00,000D_1)}{P_1}$

$47,619 \times P_1$ $= 3,00,024 + 2,00,000D_1$ $\qquad$ ***(P₁ = 11.50 – D₁)***

$47,619 \times (11.50 - D_1)$ $= 5,47,619 - 47,619D_1 = 3,00,024 + 2,00,000D_1$

$2,47,619D_1$ $= 2,47,595$

D_1 $=$ ***₹1.00 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

$$EPS = \frac{PAT - Preference\ Dividend}{No\ of\ Equity\ Shares} = \frac{30,00,000 - 12\%\ of\ 1,00,00,000}{3,00,000} = ₹6$$

$$P = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{D+(6-D) \times \frac{0.20}{0.16}}{0.16} = 42$$

$$6.72 = \frac{0.16D+1.2-0.20D}{0.16}$$

$$1.0752 = 1.2 - 0.04D \qquad or \qquad D = 3.12$$

Dividend Payout ratio:

$$= \frac{DPS}{EPS} \times 100 = \frac{3.12}{6} \times 100 = 52\%$$

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:

$$P = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{3+(5-3) \times \frac{0.15}{0.12}}{0.12} = ₹45.83$$

$$EPS = \frac{PAT}{No\ of\ Equity\ Shares} = \frac{5,00,000}{1,00,000} = ₹5$$

$$DPS \quad = \quad EPS \times \text{Dividend payout ratio} \quad = \quad ₹5 \times 60\% \quad = \quad ₹3$$

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.

$$P \text{ (at 0 Payout)} \quad = \quad \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} \quad = \quad \frac{0 + (5-0) \times \frac{0.15}{0.12}}{0.12} \quad = \quad ₹52.08$$

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

$$\text{Market value of share (P)} \quad = \quad \frac{D + (E-D) \times \frac{r}{K_e}}{K_e}$$

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%	$\dfrac{5 + (10 - 5) \times \frac{.15}{.10}}{.10}$ $= ₹125$	$\dfrac{7.5 + (10 - 7.5) \times \frac{.15}{.10}}{.10}$ $= ₹112.50$	$\dfrac{10 + (10 - 10) \times \frac{.15}{.10}}{.10}$ $= ₹100$
(b) 10%	$\dfrac{5 + (10 - 5) \times \frac{.10}{.10}}{.10}$ $= ₹100$	$\dfrac{7.5 + (10 - 7.5) \times \frac{.10}{.10}}{.10}$ $= ₹100$	$\dfrac{10 + (10 - 10) \times \frac{.10}{.10}}{.10}$ $= ₹100$
(c) 5%	$\dfrac{5 + (10 - 5) \times \frac{.05}{.10}}{.10}$ $= ₹75$	$\dfrac{7.5 + (10 - 7.5) \times \frac{.05}{.10}}{.10}$ $= ₹87.50$	$\dfrac{10 + (10 - 10) \times \frac{.05}{.10}}{.10}$ $= ₹100$

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. $K_e \quad = \quad \dfrac{1}{PE} \quad = \quad \dfrac{1}{12.5} \quad = \quad 8\%$

$$r \quad = \quad \frac{\text{Total Earnings}}{\text{Total Funds}} \times 100 = \frac{2,00,000}{20,000 \text{ Shares} \times 100 \text{ per share}} \times 100 = \quad 10\%$$

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.

$$K_e \quad = \quad r \quad = \quad 10\%$$

$$PE \quad = \quad \frac{1}{K_e} \quad = \quad \frac{1}{.10} \quad = \quad \textit{10 times}$$

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:

$$K_e \quad = \quad \frac{1}{PE} \quad = \quad \frac{1}{8} \quad = \quad 12.5\%$$

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

$$P_o \quad = \quad \frac{D}{K_e} \quad = \quad \frac{5}{0.10} \quad = \quad \textit{₹50}$$

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

$$P_o \quad = \quad \frac{D_0(1+g)}{K_e-g} = \quad \frac{2(1+.02)}{0.15-0.02} \quad = \quad \textit{₹15.69}$$

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

$$P_o \quad = \quad \frac{D_0(1+g)}{K_e-g} = \quad \frac{2(1+.05)}{0.15-0.05} \quad = \quad \textit{₹21}$$

1. MPS with 8% growth rate:

$$P_o \quad = \quad \frac{D_0(1+g)}{K_e-g} = \quad \frac{2(1+.08)}{0.15-0.08} \quad = \quad \textit{₹30.86}$$

2. MPS with 3% growth rate:

$$P_o \quad = \quad \frac{D_0(1+g)}{K_e-g} = \quad \frac{2(1+.03)}{0.15-0.03} \quad = \quad \textit{₹17.17}$$

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.

Factors	Growth Firm $r > K_e$	Normal Firm $r = K_e$	Declining Firm $r < K_e$
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_o $\quad = \quad \dfrac{D_1}{K_e - g}$

Growth $\quad = \quad \dfrac{10 \times 0.4}{0.10 - 0.09}$ $\qquad = \quad$ **₹400**

Normal $\quad = \quad \dfrac{10 \times 0.4}{0.10 - 0.06}$ $\qquad = \quad$ **₹100**

Declining $\quad = \quad \dfrac{10 \times 0.4}{0.10 - 0.048}$ $\qquad = \quad$ **₹76.92**

Working note:

G	=	b × r		
Growth	=	15% × .6	=	9%
Normal	=	10% × .6	=	6%
Declining	=	8% × .6	=	4.8%

Calculation of revised price of share as per Gordon model when b is 0.4 and payout is 0.6:

Growth $\quad = \quad \dfrac{10 \times 0.6}{0.10 - 0.06}$ $\qquad = \quad$ **₹150**

Normal $\quad = \quad \dfrac{10 \times 0.6}{0.10 - 0.04}$ $\qquad = \quad$ **₹100**

Declining $\quad = \quad \dfrac{10 \times 0.6}{0.10 - 0.032}$ $\qquad = \quad$ **₹88.23**

Working note:

G	=	b × r		
Growth	=	15% × .4	=	6%
Normal	=	10% × .4	=	4%
Declining	=	8% × .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 $= \dfrac{6 \times 0.25}{0.16 - 0.15}$ $=$ **₹150**

(2) When 50% payout $= \dfrac{6 \times 0.50}{0.16 - 0.10}$ $=$ **₹50**

(3) When 100% payout $= \dfrac{6 \times 1.00}{0.16 - 0.00}$ $=$ **₹37.50**

Working note:

(a) **Growth** $=$ b × r

When 25% payout	=	20% × .75	=	15%
When 50% payout	=	20% × .50	=	10%
When 100% payout	=	20% × .00	=	0%

(b) **Earning Per Share** = (PAT – PD) ÷ Number of shares
= (30,00,000 – 12% of 1,00,00,000) ÷ 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 $= \dfrac{7 \times 0.25}{0.16 - 0.15}$ $=$ **₹175**

(2) When 50% payout $= \dfrac{7 \times 0.50}{0.16 - 0.10}$ $=$ **₹58.33**

(3) When 100% payout $= \dfrac{7 \times 1.00}{0.16 - 0.00}$ $=$ **₹43.75**

Working note:

(a)   *Growth*   = $b \times r$

       When 25% payout   =   20% × .75   =   15%

       When 50% payout   =   20% × .50   =   10%

       When 100% payout   =   20% × .00   =   0%

(b)   *Earning Per Share*   =   (PAT – PD) ÷ Number of shares

                              =   (50,00,000 – 15% of 1,00,00,000) ÷ 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**

$$P_8 \quad = \quad \frac{D_9}{K_e - g} \quad = \quad \frac{.214 + 4\%}{8\% - 4\%} \quad = \quad ₹5.55$$

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**

$$P_4 \quad = \quad \frac{D_5}{K_e - g} \quad = \quad \frac{209.88 + 5\%}{20\% - 5\%} \quad = \quad ₹1,469.16$$

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

P	=	M (D + E/3)
58.33	=	7 (5 + E/3)
E	=	*₹9.99 or ₹10 approx.*

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

Price per share (P)	=	M (D + E/3)		
P	=	2 (30 × 0.60 + 30/3)		
P	=	2 (18 + 10)	=	*₹56*

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%

$$D \quad = \quad 40\% \text{ of E i.e. } 0.4E$$

$$P \quad = \quad M (D + E/3) \quad = \quad 9 (D + E/3) \quad = \quad 9 (0.4E + E/3)$$

$$P \quad = \quad 9 (0.4E + E/3) \quad = \quad 9 \left(\frac{1.2E + E}{3}\right) \quad = \quad 3 (2.2E) \quad = \quad 6.6E$$

$$\text{P/E ratio} \quad = \quad \frac{MPS}{EPS} \quad = \quad \frac{P}{E} \quad = \quad \frac{6.6E}{E} \quad = \quad \textit{6.6 times}$$

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

D_1	=	D_0 + [(EPS × Target payout) – D_0] × Af
	=	9.80 + [(20 × 60%) – 9.80] × 0.45 = *₹10.79*

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:

$$P = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{6 + (10-6) \times \frac{0.25}{0.20}}{0.20} = ₹55$$

(b) Gordon's formula (Dividend Growth model):

$$P_o = \frac{D_1}{K_e - g} = \frac{6}{0.20 - 0.10} = ₹60$$

$$G = b \times r = 25\% \times .4 = 10\%$$

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 > Ke, 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)

$$K_e = \frac{D_1}{P_o} + g = \frac{20}{1,460} + 7.5\% = 8.87\%$$

(b) With rate of return on retained earnings (r) 10% and retention ratio (b) 60%, new growth rate will be as follows:

g (revised growth rate)=   b × r   =   0.10 × 0.60   =   0.06 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 × 0.10			
b_1	=	0.75	and	payout ratio =	0.25
EPS	=	₹20 ÷ 0.25 (.75 retention)		=	₹80
Revised D_1	=	₹80 × 0.40		=	₹32

Revised K_e = $\dfrac{D_1}{P_o} + g$ = $\dfrac{32}{1,460} + 6\%$ =   ***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:**

$$P \text{ (Market value of share)} = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{10 + (20-10) \times \frac{0.12}{0.10}}{0.10}$$

$$= ₹220.00$$

$$E \text{ (EPS)} = ₹10,00,000 \text{ (PAT)} \div 50,000 \text{ shares}$$

$$= ₹20$$

(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:

$$P \text{ (Market value of share)} = \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \frac{0 + (20-0) \times \frac{0.12}{0.10}}{0.10}$$

$$= ₹240.00$$

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 (EPS) = ₹40,00,000 (Earning) ÷ 4,00,000 shares

  = ₹10

(2) Market Price of Share (P) as per Gordon's Formula:

P_0 (Market value of share) = $\dfrac{D_1}{K_e - g}$ = $\dfrac{4.00}{0.16 - 0.12}$ = **₹100.00**

G (Growth Rate) = b × r = 20% × .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:

Current Market Price of Share = EPS × PE Ratio

  = $\dfrac{10,00,000}{2,00,000}$ × 10 = **₹50**

(2) Capitalization rate of its risk class:

Capitalization rate (K_e) = 1/PE

  = 1/10 = **0.10 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 (Market price of share) = $\dfrac{D + (E-D) \times \frac{r}{K_e}}{K_e}$ = $\dfrac{0 + (5-0) \times \frac{0.20}{0.10}}{0.10}$

  = **₹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

$$\text{EPS} = \frac{PAT - Preference\ Dividend}{No\ of\ Equity\ Shares} = \frac{50,00,000 - 13\%\ of\ 2,00,00,000}{6,00,000} = ₹4$$

$$P = \frac{D + (E - D) \times \frac{r}{K_e}}{K_e} = \frac{D + (4 - D) \times \frac{0.25}{0.15}}{0.15} = 40$$

$$6 = \frac{0.15D + 1 - 0.25D}{0.15}$$

$$0.9 = 1 - 0.10D \qquad or \qquad D = 1$$

$$\textbf{Dividend Payout ratio} = \frac{DPS}{EPS} \times 100 = \frac{1}{4} \times 100 = \textbf{\textit{25\%}}$$

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:

1. **Gordon's Model**
2. **Walter's Model**

[(5 Marks) Jan 2021]

Answer

1. Calculation of Price of share as per Gordon model:

$$P_o = \frac{D_1}{K_e - g} = \frac{3 \times 0.25}{0.18 - 0.165} = ₹50$$

2. Calculation of Price of share as per Walter model:

$$P = \frac{D + (E - D) \times \frac{r}{K_e}}{K_e} = \frac{0.75 + (3 - 0.75) \times \frac{0.22}{0.18}}{0.18} = ₹19.44$$

Working note:

(a) Growth $= b \times r = 22\% \times .75 = 16.50\%$

(b) EPS $=$ (PAT – PD) ÷ Number of shares
$=$ (30,00,000 – 12% of 1,00,00,000) ÷ 6,00,000 $= ₹3$

(c) DPS $=$ EPS × Payout ratio $= ₹3 \times 25\% = ₹0.75$

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?

Answer

1. *Calculation of market value per share as per Walter's model:*

$$P \quad = \quad \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} \quad = \quad \frac{3.60 + (6 - 3.60) \times \frac{0.15}{0.13}}{0.13} \quad = \quad ₹48.99$$

$$EPS \quad = \quad \frac{PAT}{No\ of\ Equity\ Shares} \quad = \quad \frac{30,00,000}{5,00,000} \quad = \quad ₹6$$

$$DPS \quad = \quad EPS \times Dividend\ payout\ ratio \quad = \quad ₹6 \times 60\% \quad = \quad ₹3.60$$

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.

$$P\ (at\ 0\ Payout) \quad = \quad \frac{D + (E-D) \times \frac{r}{K_e}}{K_e} \quad = \quad \frac{0 + (6 - 0) \times \frac{0.15}{0.13}}{0.13} \quad = \quad ₹53.25$$

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

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 ∞)	P₄ = ₹1,779.27	0.515	916.32
Present value of all future benefits or Intrinsic value of Share			*₹1,408.27*

$$P_4 \quad = \quad \frac{D_5}{K_e - g} \quad = \quad \frac{220.29 + 5\%}{18\% - 5\%} \quad = \quad ₹1,779.27$$

(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

(a) Market price of share (P) $= \dfrac{D + (E-D) \times \frac{r}{K_e}}{K_e}$

$130 = \dfrac{D + (10-D) \times \frac{0.12}{0.08}}{0.08}$

$10.40 = D + (10 - D) \times \dfrac{0.12}{0.08}$

$10.40 = D + 15 - 1.5\,D$

$.5D = 4.6$

$D = ₹9.20$

Dividend Payout $= \dfrac{9.20}{10.00} \times 100$ $= $ **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*

Market price of share (P) $= \dfrac{D + (E-D) \times \frac{r}{K_e}}{K_e} = \dfrac{0 + (10-0) \times \frac{0.12}{0.08}}{0.08}$ $= $ **₹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\% = $ **8.33 times**

(d) Market price of share (P) $= EPS \times PE = 10 \times 8.33 = $ **₹83.33**

(e) Market price of share using Dividend growth model:

$P_o = \dfrac{D_1}{K_e - g} = \dfrac{9.20}{0.08 - 0.0096}$ $= $ **₹130.68**

Working note:

$G = b \times r = 12\% \times .08 = 0.96\%$

SUGGESTED REVISION

Ques. No.	Observations or KEY Points (Note down during revisions)	Page No. of Practical Register	1st & 2nd Revision	3rd, 4th & 5th Revision	Revision during Exams
BQ (Book Questions covering Study Module of ICAI, PM, RTP's, MTP's and Important Questions)					
1			Y	Y	Y
2			Y	Y	-
3			Y	Y	-
4			Y	Y	Y
5			Y	Y	Y
6			Y	Y	Y
7			Y	Y	Y
8			Y	Y	Y
9			Y	Y	Y
10			Y	Y	Y
11			Y	-	-
12			Y	-	-
13			Y	Y	Y
14			Y	Y	Y
15			Y	Y	Y
16			Y	-	-
17			Y	Y	Y
18			Y	Y	-
19			Y	Y	Y
20			Y	Y	Y
21			Y	Y	Y
22			Y	Y	Y
23			Y	Y	-
24			Y	Y	-
25			Y	Y	Y
26			Y	Y	Y
27			Y	Y	Y
PYQ (Past Year Questions)					
1			Y	Y	Y
2			Y	Y	Y
3			Y	Y	Y
4			Y	Y	Y
5			Y	Y	-
6			Y	Y	-
7			Y	Y	Y
8			Y	Y	Y

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	9.9427	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