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# UNIT 14 COMMERCIAL MATHEMATICS

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## 14.1 INTRODUCTION

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“Spend within your limits”, is a common saying by elders, i.e. keep your expenditure less than your income. The meaning of this is to save something for difficult times. Also, money is required to meet our day-to-day expenses. We always try to save some money for future use. To keep your savings safe is another task. Banks and other financial institutions keep the money of their customers. For this purpose the most popular account offered by the banks is saving bank account, which encourages the people to develop the habit of saving. Keeping this in mind, if you put money in a savings account, the bank pays you interest according to what you deposit. In effect, the bank is paying you for the “borrowing” of your money. The same is true for the interest you pay on a loan you take from the bank or the money you borrow from some lending agent. There are two kinds of interest; simple interest and compound interest. we shall start the unit by discussing about the Simple interest and compound interest.

All the money related transactions are done for profit. In Section 14.3 we will discuss profit and loss. In section 14.4, we shall discuss discount. The government performs various functions like facility for education and health, defence of the country, maintaining law and order etc. To perform these functions it collects the money required, in the form of revenue, through a wide variety of sources. The most important of these is tax. In section 14.5, we shall discuss various taxes. One has to be very careful in making different types of investments. If your investment is proper it will lead you to gain which we call profit. On the other hand if you invest in buying shares of a company which is running into losses you may have to bear loss. We shall discuss about shares and debentures in Sec.14.6.

Let us clearly state the objectives of this unit.

### Objectives

After reading this unit, you should be able to

- calculate simple and compound interest
- compute interest for a savings bank account at given rate of interest.

- identify whether there is a profit or loss.
- calculate discount
- compute different kinds of taxes.
- find the annual income on shares and debentures.

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## 14.2 INTEREST

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If you invest some amount in a bank, then after some time you find that there is some amount given by the bank or other financial institutes. This amount is the fee for the use of your money, which we call interest. Now we shall discuss two kinds of interests viz. simple interest and compound interest.

### 14.2.1 Simple Interest

Suppose you borrow Rs.1000 from a lending agent and return Rs.1050 after 1 year, then a fee of Rs. 50 is charged for the money borrowed, just as rent is paid for the use of another's house. The fee is called **interest**. It is usually computed as a percentage called **the interest rate** or **rate of interest**. Suppose the rate of interest is 5% annually, i.e. per year. This means the interest of Rs.100 is Rs.5 at the end of 1 year. You have already done percentage in unit (4 ). You can also use that concept to find interest. Thus 5% of 100 i.e. Rs.5 is the interest, this means that if you deposit Rs.100, then you would get Rs.105 after 1 year. The money on which the interest is calculated is called **principal**. So in the example above Rs.1000 is the principal. The interest rate is usually charged by years. It may be charged quarterly or six monthly. In such cases it is converted to yearly, rate of interest.

Now, let us try to find a rule or a formula to compute the simple interest.

Suppose you invest Rs.1000 at 5% rate of interest for 1 year, then

If interest of Rs.100 at the end of one year = Rs.5

therefore interest of Rs.1000 at the end of one year = 5% of 1000 = Rs.50

Now suppose you invest Rs.2000 at 5% interest rate annually. How much interest will you get at the end of one year? It will be  $\frac{5}{100} \times 2000 = \text{Rs.}100$ , which is double of the interest of Rs.1000.

Again if you invest Rs.5000 for 1 year at 5% rate of interest, then the return on investment is Rs.250, which is 5 times the interest on Rs.1000.

From the above, it is clear that the amount deposited or the principal amount is one of the factors which determines the interest you would get after 1 year. Now the question arises, are there other factors affecting the interest on your investment? Let us try to find an answer to this.

Suppose you invest Rs.1000 at the rate of interest 5% annually for 2 years, then

If interest on Rs.1000 at the end of one year = Rs.50

therefore interest on Rs.1000 which we will get after 2 yrs. =  $\text{Rs.}50 \times 2 = \text{Rs.}100$

This means each year Rs.50 will get added to the principal amount which you have deposited.

Thus the interest on Rs.1000 at the end of 5 years is  $\text{Rs.}50 \times 5 = \text{Rs.}250$ .

Therefore the time or duration for which the principal is invested is another factor affecting interest.

Now, let us see, what happens if the rate of interest is changed.

Since interest on Rs.100 at 5% after one year = Rs.5  
 therefore interest on Rs.100 at 10% after one year Rs.10% of 100 = Rs.10

Also interest on Rs.100 at 20% after one year = 20% of 100 = Rs.20.

It is clear that rate of interest is another factor which determines the interest on investments.

From the discussion above , it is clear that the rate of interest, principal and time (in years) are the factors of simple interest, which can be formulated as below:

Interest I = $P \times r \times t$ where P = Principal (The amount of money borrowed or invested) r = Annual rate of interest t = Time in years	(1)
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The amount after t years is  $A = \text{Principal} + \text{Interest}$   
 $= P + I$

Now let us take up a few examples to illustrate the above formula.

**Example 1:** What is the interest on Rs.2000 for six months at  $7\frac{1}{2}\%$  annual rate of interest?

**Solution:**

Here it is given that,  $P = \text{Rs.}2000$   
 $t = 6 \text{ months} = \frac{6}{12} = \frac{1}{2} \text{ year}$   
 $r = 7\frac{1}{2}\% = 0.075$

Now applying the formula given in (1), we get

$$\begin{aligned} \text{Interest} &= P \times r \times t = 2000 \times 0.075 \times \frac{1}{2} \\ &= \text{Rs.}75. \end{aligned}$$

**Note** that the time is converted in years.

\* \* \*

**Example 2:** Find the total amount you will pay back on taking a loan of Rs.5000 at an annual rate of interest 12% at the end of 30 months.

**Solution:**

Given that,  $P = \text{Rs.}5000$   
 $r = 12\% = \frac{12}{100} = 0.12$   
 $t = 30 \text{ months} = \frac{30}{12} \text{ years} = 2.5 \text{ years}$   
 Therefore interest =  $5000 \times 0.12 \times 2.5$   
 $= \text{Rs.}1500$

Total amount due at the end of 30 months = Principal + Interest  
 $= \text{Rs.}5000 + \text{Rs.}1500$   
 $= \text{Rs.}6500$

\* \* \*

So far we considered those examples where rate of interest is annual. There are situations where the rate of interest is half-yearly or quarterly. In the next example we consider such a situation.

**Example 3:** If you borrow Rs.1000 at 12% rate of interest semi annually, how much must you repay at the end of 9 months?

**Solution:** Given is  $P = \text{Rs.}1000$

Here rate of interest is given semiannually. Since there are two half years in a year, therefore the rate of interest will be doubled and will be considered annually.

Semi-annually is half yearly and quarterly is three months interval.

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$$r = 12\% \text{ semiannually} = \frac{12}{100} \times 2 \text{ annually}$$

$$= 0.24 \text{ annually.}$$

$$t = 9 \text{ months} = \frac{9}{12} \text{ years} = 0.75 \text{ years}$$

$$\text{Therefore interest} = 1000 \times 0.24 \times 0.75$$

$$= \text{Rs.180.00}$$

$$\text{The amount for repayment} = \text{Principal} + \text{Interest}$$

$$= \text{Rs.1000} + \text{Rs.180}$$

$$= \text{Rs.1180.00}$$

In this situation you must have noted that if the rate of interest is  $r\%$  for half yearly, then the interest rate is  $2r\%$  annually and if it is quarterly, then it is  $4r\%$  annually.

\* \* \*

Try some exercises to test your understanding.

- E1) Find the simple interest paid on Rs.2000 at 7% rate of interest in 4 years.
- E2) Suppose some of your bill of Rs.1500 is due from 5 years at a simple interest 5% per annum. Then what amount will you have to deposit now?
- E3) If you borrow Rs.5000 at 4% rate of simple interest quarterly, how much must you repay at the end of 15 months?

As you have seen above, the simple interest  $I$  depends upon three factors  $P$ ,  $r$  and  $t$ . If any three out of  $I$ ,  $P$ ,  $r$ ,  $t$  are known, then the fourth can be obtained by following method.

As we know  $I = P \times r \times t$

$$\text{therefore } P = \frac{I}{r \times t}, r = \frac{I}{P \times t} \text{ and } t = \frac{I}{P \times r} .$$

Let us now consider the problems of finding  $P$ ,  $r$ , and  $I$ .

**Example 4:** If you invest Rs.10,000, after some time you get Rs.12000. Find the time for which you invested if the rate of interest is 5% annually.

**Solution:**

$$\text{Here we are given that, } P = \text{Rs.10,000}$$

$$I = \text{Amount} - \text{Principal} = \text{Rs.12,000} - \text{Rs.10000} = \text{Rs.2000}$$

$$r = 0.05$$

$$t = \frac{I}{P \times r} = \frac{2000}{0.05 \times 10000} = 4 \text{ years.}$$

\* \* \*

**Example 5:** A certain sum of money was deposited for 4 years. Simple interest at the rate of 12% was paid. Calculate the sum deposited if the simple interest received by the depositor was Rs.1200.

**Solution:** Let the sum deposited be Rs.  $P$

$$\text{Given that, } I = \text{Rs.1200}$$

$$t = 4 \text{ years}$$

$$r = 0.12$$

$$P = \frac{I}{t \times r} = \frac{1200}{0.12 \times 4} = \text{Rs.2500}$$

\* \* \*

**Example 6:** At what rate of interest will simple interest be half the principal in 5 years?

**Solution:** Here we are not given principal. So let us assume the principal  $P$ . Since the

simple interest is half the principal in 5 years, therefore the interest is P/2.

$$\text{So } r = \frac{I}{P \times t} = \frac{P/2}{P \times 5} = 0.10 = 10\%$$

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Now try some exercises:

E4) Find the missing quantity against each of the following:

- i)  $P = \text{Rs.}4500, t = 4 \text{ years}, A = \text{Rs.}6000, r = ?$
- ii)  $I = \text{Rs.}800, r = 0.08, P = \text{Rs.}1000, t = ?$
- iii)  $P = \text{Rs. } 8000, t = 8 \text{ years}, r = 6\%, A = ?$
- iv)  $A = 2P, t = 6 \text{ years}, r = ?$

E5) In how much time will simple interest be 1/4th of the principal at the rate of 10% per annum?

E6) Suppose you are offered the following two schemes by the bank. Then in which scheme you would prefer to deposit and why?

- i) Rs.10000 deposited for 5 years at 4% per annum, or
- ii) Rs.8000 deposited for 6 years at 5% per annum?

In simple interest, the interest is always calculated on the principal. Principal is a fixed quantity. Now consider another situation in which principal changes every year.

### 14.2.2 Compound Interest

Here we will discuss another form of interest. Suppose you borrows money from some landing agent for a fixed time period then simple interest is the extra money paid by you for the use of landing agent’s money for that time period. If the money is not returned in time, then the interest is added to the principal and now the sum becomes the principal for the next time period, i.e. you will pay interest on the principal money as well as on the interest accrued for the first year. Therefore, you will have to pay more interest for the second year. This way of calculating interest is called **compound interest**.

When the interest is paid on the principal only, it is called **simple interest**. But if interest is paid on the principal as well as on interest, it is called **compound interest**.

Let us try to understand it.

**Example 7:** Suppose you deposit Rs.1000 in a bank at 10% compound interest annually for 4 years. Then for the first year your principal  $P = \text{Rs.}1000$ .

$$\begin{aligned} \text{The amount after 1 year}(P_1) &= P + P \times r \times t \text{ (where } r = 0.10 \text{ and } t = 1) \\ &= P(1 + r \times t) \\ &= 1000(1 + 0.10 \times 1) \\ &= 1000(1 + 0.10) \\ &= P(1 + r) \end{aligned}$$

This amount  $P_1$  will be treated as principal for second year, therefore the amount at the end of second year is  $(P_2) = P_1(1 + rt)$

$$\begin{aligned} &= P_1(1 + 0.10 \times 1) \\ &= P_1(1 + 0.10) \\ &= P(1 + r)(1 + r) \text{ [Substituting the value of } P_1] \\ &= P(1 + r)^2 \end{aligned}$$

Again the amount  $P_2$  at the end of second year will be principal for the third year, therefore at the end of third year the amount is

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$$\begin{aligned}(P_3) = P_2(1 + r) &= P_2(1 + 0.10 \times 1) \\ &= P(1 + r)^2(1 + r) \text{ [substituting the value of } P_2\text{]} \\ &= P(1 + r)^3\end{aligned}$$

Similarly, amount, at the end of fourth year will be  $P_4 = P(1 + r)^4$ .

Now if you look at the above calculations for compound interest you would notice a pattern that leads you to a general formula for computing compound interest in general. The amount in your bank computed after one, two, three, four years is given by  $P(1 + r)$ ,  $P(1 + r)^2$ ,  $P(1 + r)^3$ ,  $P(1 + r)^4$  respectively.

These consecutive amounts form a geometric progression, whose first term is  $P(1 + r)$  and the common ratio is  $(1 + r)$  continuing this, the amount at the end of nth year is  $P(1 + r)^n$ . Therefore, we write

$$A = P(1 + r)^n, \tag{2}$$

where A : Amount at the end of nth year

P: Principal

r: rate of interest annually

n: number of years.

\* \* \*

**Note:** Later we shall be discussing the case, where n is not in years. Let us now illustrate Formula (2) through an example.

**Example 8:** Calculate the compound interest on Rs.10000 for 2 years at 8% per annum.

**Solution:**

Given that

$$P = \text{Rs.}10000$$

$$n = 2$$

$$r = 8\% = 0.08$$

Amount after 2 years

$$= P(1 + r)^n$$

$$= 10000(1 + 0.08)^2$$

$$= 10000 \times 1.08 \times 1.08 = \text{Rs.}11664$$

Therefore the compound interest after 2 years

$$= \text{Amount after 2 years} - \text{Principal}$$

$$= \text{Rs.}(11664 - 10000)$$

$$= \text{Rs.}1664.$$

\* \* \*

Now, try an exercise.

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E7) Surbhi deposited three different sums in three different schemes, which are given below. Find the compound interest in each of the following.

i)  $P = \text{Rs.}10000$ ,  $n=4$ ,  $r = 6\%$

ii)  $P = \text{Rs.}5000$ ,  $n=3$ ,  $r=10\%$

iii)  $P = \text{Rs.}4000$ ,  $n=2$ ,  $r=12\%$ .

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For the calculation of compound interest, time period is generally taken in years. The compound interest can be calculated semi-annually (after 6 months), quarterly (after 3 months), monthly or even daily. The unit of time after which interest is compounded is called the **conversion period**. If conversion period is not in years, then the compound interest is computed for the no. of conversion periods and rate of interest is compounded conversion period wise. For instance, if in a bank, interest is quarterly compounded for one year, then the number of conversion periods is four because there are four quarters in a year.

For a better understanding of the concept let us go through the following examples.

**Example 9:** Calculate the compound interest on Rs.10000 for 1 year at the annual rate of interest 12% compounded (i) quarterly (ii) semi-annually.

**Solution:**

i)

$$\begin{aligned} r &= 12\% \text{ annually} = \frac{12}{4} \text{ or } 3\% \text{ quarterly} = 0.03 \text{ quarterly} \\ \text{and } n &= 4 [\because 1 \text{ year} = 4 \text{ quarters}] \\ \therefore A &= P(1 + r)^n \\ &= 10000(1 + 0.03)^4 \\ &= 10000 \times 1.03 \times 1.03 \times 1.03 \times 1.03 \\ &= 11251.9081 \end{aligned}$$

$$\begin{aligned} \text{Compound Interest} &= \text{Rs. } (11251.9081 - 10000) \\ \text{at the end of 1 year} &= \text{Rs. } 1251.90 \end{aligned}$$

ii) If Interest is compounded semi-annually, then

$$\begin{aligned} r &= \frac{12}{2} \text{ or } 6\% \text{ semi-annually} = 0.06 \\ \text{and } n &= 2 [\because 1 \text{ year} = 2 \text{ half years}] \\ \therefore A &= P(1 + r)^n \\ &= 10000(1 + 0.06)^2 \\ &= 10000 \times 1.06 \times 1.06 \\ &= \text{Rs. } 11236 \end{aligned}$$

$$\text{Compound Interest} = \text{Rs.}(11236 - 10000) = \text{Rs.}1236.$$

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**Example 10:** Calculate the compound interest on Rs.15000 for  $1\frac{1}{2}$  years at the rate of 10% per annum when the interest is compounded annually.

**Solution:** Given that P = Rs.15000

$$\text{and } n = 1\frac{1}{2} \text{ years.} = \frac{3}{2} \text{ years.}$$

$$\text{Amount } A = 15000(1 + 0.10)^{3/2} = \text{Rs.}17325.$$

$$\text{Therefore, the required compound interest} = \text{Rs. } (17325 - 15000) = \text{Rs. } 2325$$

**In another way,** here the interest is compounded annually, therefore at the end of one year, the amount will be

$$\begin{aligned} A &= 15000(1 + 0.10) = 15000 \times 1.10 \\ &= \text{Rs.}16500. \end{aligned}$$

The amount after 1 year will be the principal for next 6 months,

$$\text{and the rate of interest for 6 months} = \frac{10}{2} \text{ or } 5\% \text{ semi-annually} = 0.05$$

$$\begin{aligned} \text{and the amount after } 1\frac{1}{2} \text{ years} &= 16500(1 + 0.05) \\ &= 16500 \times 1.05 \\ &= \text{Rs.}17325 \end{aligned}$$

$$\therefore \text{Compound interest after } 1\frac{1}{2} \text{ years} = \text{Rs.}(17325 - 15000) = \text{Rs. } 2325.$$

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**Example 11:** At what rate of interest per annum would the compound interest on Rs.12500 be Rs.9100 in  $1\frac{1}{2}$  years, interest being compounded half-yearly?

**Solution:** Let r be the rate of interest compounded half-yearly.

Given is,  $n=3$  ( $\because 1\frac{1}{2}$  years = 3 half years)

and  $A = \text{Rs.}(12500 + 9100) = \text{Rs.}21600$

Again using the formula,

$$\begin{aligned} A &= P(1+r)^n, \text{ we get} \\ \Rightarrow 21600 &= 12500(1+r)^3 \\ \Rightarrow \frac{216}{125} &= (1+r)^3 \\ \Rightarrow \left(\frac{6}{5}\right)^3 &= (1+r)^3 \Rightarrow 1+r = 6/5 \Rightarrow r = 1/5 = 0.2 \\ r &= 20\% \text{ half yearly} \\ \text{or } r &= 40\% \text{ yearly.} \end{aligned}$$

\* \* \*

Let us try some exercises.

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- E8) Find the rate of interest at which Rs.8000 amounts to Rs.9261 in 3 years, if the interest is compounded annually.
- E9) Rajni purchases National saving certificates (NSC) for Rs.10000. Find the rate of interest, if she gets double the amount after 6 years.
- E10) A sum of money becomes Rs.18522 in 3 years and Rs.19448.10 in 4 years at the same rate of interest when the interest is compounded annually. Find the sum and the rate of interest per annum.
- E11) Find the difference between simple interest and compound interest for 2 years at 10% per annum, where the interest is compounded semi-annually, on Rs.8000.
- E12) If you invest Rs.5000 at an annual rate of interest of 18% compounded (i) annually (ii) semi-annually (iii) quarterly, what amount you will get after 2 years.
- E13) How long will it take money to double itself if it is invested at the interest rate of 10% compounded annually?
- E14) How much should you invest now at 10% compounded quarterly to have Rs.1,00,000 in 5 years.
- E15) What is the better way to invest Rs.2000 for 2 years at 5% simple interest or 4.8% interest compounded quarterly or 6% interest compounded semi-annually?
- 

So far, we discussed simple and compound interest and how to apply these in different context. For our convenience, we usually invest our savings in banks to get interest for a specific time period. The most popular account used for this purpose is savings bank account. Now we will discuss saving bank account.

### **14.2.3 Saving Bank Account**

We always try to save some money for future use, for this purpose the most popular account offered by the banks is savings bank account. In a particular bank, anyone can open this account with an initial investment of Rs.1000, with the facility of Cheque-Book.

The bank pays interest for the money that an account holder keeps in the account. Money can be deposited/withdrawn in cash as well as through cheques. In a savings bank account,



- (i) Different banks offer different rate of interest. For example, a particular bank has the current rate of interest 4% per annum compounded semi-annually, and the interest is credited to the account in every six months.
- (ii) The bank pays interest for the month on the minimum closing balance from the 10th day of the month to the last day of the month. If account is opened after 10th of the month, no interest is payable for that month.
- (iii) In any month if the account is closed, no interest is payable for the month.

Let us illustrate the above with some examples.

**Example 12:** A page from the pass book of saving bank account is given below:

Date	Particulars	Amount withdrawn	Amount deposited	Balance
2004				
Jan 8	By cheque	-	10000.00	10000.00
Feb. 8	By cheque	-	20000.00	30000.00
March 15	To cheque	5000.00	-	25000.00
April 6	By cash	-	10000.00	35000.00
April 25	To cheque	10000.00	-	25000.00
May 5	By cheque	-	5000.00	30000.00
June 15	To cheque	20000.00	-	10000.00

Find the minimum balance of each month on which interest will be earned. Also, find the sum on which the interest will be earned from January 2004 to June 2004.

**Solution:** As we have already noted, the amount for the interest is the minimum balance between the 10th and the last day of the month.

Let us see how we calculate the minimum balance i.e., principal of each month from January to June and find the total of that.

Principal for January	=	Rs.10000.00
Principal for Febuary	=	Rs.30000.00
Principal for march	=	Rs.25000.00
Principal for April	=	Rs.25000.00
Principal for May	=	Rs.30000.00
Principal for June	=	Rs.10000.00
Total	=	130000.00

Thus, we got that the minimum balance is Rs.1,30,000 on which the interest will be earned from January to June.

\* \* \*

**Example 13:** Madhu's pass book has the following entries:

Date	Particulars	Amount Withdrawn	Amount deposited	Balance
2003				
Jan.1	B/F	-	-	5000.00
Jan. 15	By cheque	-	5000.00	10000.00
Jan.24	To cash	4000.00	-	6000.00
Feb.8	To Cash	4000.00	-	2000.00
March 15	By cash	-	8000.00	10000.00
April 12	By cheque	-	5000.00	15000.00
May 04	By cash	-	10000.00	25000.00
Aug. 16	To cheque	15000.00	-	10000.00
October 4	By cash	-	5000.00	15000.00
Dec.7	By cheque	-	5000.00	20000.00
Dec.28	By cheque	-	5000.00	25000.00

If the rate of interest is 4% per annum, and is credited to the account at the end of every

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June and December, then find the interest earned by madhu at the end of Dec., 2003 on her saving bank account.

**Solution:** The qualifying amount for the interest credited in the month of June is as follows:

Principal for Jan.	5000.00
Principal for Feb.	2000.00
Principal for March	2000.00
Principal for April	10000.00
Principal for May	25000.00
Principal for June	25000.00
<b>Total</b>	<b>69,000.00</b>

Since the principal is calculated for each month therefore the interest is computed per month i.e. time is one month which is  $\frac{1}{12}$  year.

$$\begin{aligned} \text{Interest credited to madhu's savings account on 30th June} &= 69,000 \times 0.04 \times \frac{1}{12} \\ &= \text{Rs.230.00} \end{aligned}$$

Let us calculate the interest credited in the month of Dec.. The interest paid in the month of June will be credited in Madhu's account on 30<sup>th</sup> June. Therefore the minimum balance at the end of June is Rs. 25230.

Now minimum balance of each month for July to Dec. is:

Minimum balance in July	=	25230.00
Minimum balance in Aug.	=	10230.00
Minimum balance in Sep.	=	10230.00
Minimum balance in Oct.	=	15230.00
Minimum balance in Nov.	=	15230.00
Minimum balance in Dec.	=	20230.00
<b>Total</b>	=	<b>96,380.00</b>

$$\text{Interest earned in the month of December is} = \frac{96380 \times 04 \times 1}{100 \times 12} = \text{Rs.321.26}$$

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**Example 14:** Ashok opened a saving bank account with a bank on 6th Jan., 2003 with a cash deposit of Rs.5000. Subsequently he deposited Rs.1000 on the 6th day of every month. He withdraw Rs.2000 on 15th March and Rs.3000 on 20th May 2003. Write all the entires of the passbook. If the interest rate is 4% per annum, calculate the interest upto the last day of 30th June and make the entry in the passbook alongwith the balance.

**Solution:** The entires in the passbook are as given below:

Date	Particulars	Amount withdrawn	Amount deposited	Balance
2003				
6th Jan.	By cash	-	5000.00	5000.00
6th Feb.	By cash	-	1000.00	6000.00
6th March	By cash	-	1000.00	7000.00
15th March	To cash	2000.00	-	5000.00
6th April	By cash	-	1000.00	6000.00
6th May	By cash	-	1000.00	7000.00
20th May	To cash	3000.00	-	4000.00
6th June	By cash	-	1000.00	5000.00

Monthwise principal for the calculation of interest is

January	5000.00
February	6000.00
March	5000.00
April	6000.00
May	4000.00
June	5000.00
<b>Total</b>	<b>31000.00</b>

Here, P = Rs. 31000

r = 0.04

t = 1 month =  $\frac{1}{12}$  years

$$\begin{aligned} \therefore \text{Interest upto 30th June} &= 31000 \times 0.04 \times \frac{1}{12} \\ &= \text{Rs.}103.33 = \text{Rs.}103.00(\text{Approx.}) \end{aligned}$$

The entry in the passbook is as given below:

Date	Particulars	Amount withdrawn	Amount deposited	Balance
1st July	By Interest	-	103.00	5103.00

\* \* \*

Now try some exercises:

E16) Ritu opens a saving bank account with a bank on 9th July, 2003 with a cash deposit of Rs.10000. Subsequently she deposited Rs.5000 on 8th day of every month. She withdrew Rs.4000 on 3rd September and Rs.6000 on 9th November 2003. If the bank pays interest at the rate of 4% per annum, payable at the end of June and December. Write all the entries, including interest, which are made upto 1st January, 2004.

E17) A page from the passbook of saving bank account is given below:

Date	Particulars	Amount withdrawn	Amount deposited	Balance
01/7/02	B/F	-	-	5000.00
08/07/02	By cheque	-	4000.00	9000.00
09/08/02	To cheque	5000.00	-	4000.00
10/09/02	By Cash	-	8000.00	12000.00
04/10/02	To cash	2000.00	-	10000.00
06/11/02	By cash	-	5000.00	15000.00
10/12/02	To cheque	4000.00	-	11000.00
22/12/02	To cash	1000.00	-	10000.00

The account is closed on 15th Jan.2003 . Find the amount received if the rate of interest is 5% per annum.

So far we have done simple interest, compound interest and saving bank account. Now, in next section we shall discuss profit and loss.

### 14.3 PROFIT AND LOSS

All financial transactions about buying and selling are done for profit. Due to greater supply of goods or sub-standard goods things are to be sold on loss. Suppose, a shopkeeper buys a product in Rs.100 and sells it for Rs.120 then the shopkeeper earns a profit of Rs.20. If the shopkeeper sells it for Rs.80 then the loss of shopkeeper is of Rs.20. The price at which a product is purchased is called its **cost price** (C.P.) and the

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price at which a product is sold is called its **selling price** (S.P.) when  $S.P. > C.P.$ , then there is a profit and when  $C.P. > S.P.$  then there is a loss. Profit and loss are calculated as follows:

$$\begin{aligned} \text{Profit} &= S.P. - C.P. \\ \text{and Profit \%} &= \left\{ \frac{\text{Profit}}{C.P.} \times 100 \right\} \% \\ \text{Loss} &= C.P. - S.P. \\ \text{and Loss \%} &= \left( \frac{\text{Loss}}{C.P.} \times 100 \right) \% \end{aligned}$$

**Remember that profit or loss is always calculated on cost price (C.P.).**

Let us try to find the profit or loss in the following situations.

**Example 15:** A retailer bought an almirah from a wholesale dealer for Rs.4000, and sold it for Rs.4500. Find her profit or loss percent.

**Solution:** C.P. of almirah = Rs.4000

S.P. of almirah = Rs.4500

Here  $S.P. > C.P.$

$$\begin{aligned} \text{That means there is a profit and this Profit} &= S.P. - C.P. \\ &= \text{Rs.}(4500 - 4000) \\ &= \text{Rs.}500 \\ \text{Profit \%} &= \left( \frac{500}{4000} \times 100 \right) \% \\ &= 12.5\% \end{aligned}$$

\* \* \*

**Example 16:** A person paid Rs.120 for a basket of 40 oranges. He found that 4 of them were bad and threw them away. He sold  $\frac{2}{3}$  of the remaining oranges at a profit of 20% and the rest at a loss of 5%. What was his profit or loss.

**Solution:** Cost of 1 orange =  $\frac{120}{40} = \text{Rs.}3$

He lost 4 immediately so he sold 36 oranges in all.

$\frac{2}{3}$  of these 36 oranges =  $\frac{2}{3} \times 36 = 24$  Oranges

Therefore, he sold 24 oranges at a profit of 20%.

$$\begin{aligned} \text{Now S.P. of one orange} &= C.P. + \text{Profit} \\ &= \text{Rs.}3 + \text{Rs.}3 \times \frac{20}{100} \\ &= \text{Rs.}3.60 \\ \text{S.P. of 24 such oranges} &= 24 \times 3.60 \\ &= \text{Rs.}86.40 \\ \text{Rest oranges (sold at a loss of 5\%)} &= 36 - 24 = 12 \text{ oranges} \\ \text{S.P. of 12 such oranges} &= 12 \times \left( 3 - 3 \times \frac{5}{100} \right) \\ &= \text{Rs.}34.20 \\ \text{Total income from sales} &= \text{Rs.}86.40 + \text{Rs.}34.20 \\ &= \text{Rs.}120.60 \\ \text{Profit} &= \text{Rs.}0.60 \\ \text{Profit \%} &= \frac{0.60}{120} \times 100 = \frac{1}{2}\%. \end{aligned}$$

\* \* \*

**Example 17:** By selling a scooter to a customer for Rs.24600 a dealer makes a profit of 20%. Find the cost price of the scooter.

**Solution:** Given that, Selling price of the article is Rs.24600 and profit % is 20%.

Suppose cost price of the article = x

Thus, profit =  $24600 - x$   
 and Profit % =  $\frac{24600 - x}{x} \times 100$ ,

Now equating this profit % with given profit %, we get

$$\Rightarrow \frac{24600 - x}{x} \times 100 = 20$$

$$\Rightarrow \frac{24600 - x}{x} = \frac{1}{5}$$

$$\Rightarrow 6x = 5 \times 24600$$

$$\Rightarrow x = 5 \times 4100$$

$$\Rightarrow x = \text{Rs.}20500.00$$

Therefore cost price of a scooter is Rs.20500.00 .

\* \* \*

**Example 18:** A shopkeeper sold two wrist watches at Rs.1500 each. On selling one wrist watch she gained 20% and on selling the other she lost 20%. Find the shopkeeper's gain or loss percent.

**Solution:** S.P. = Rs.1500

Suppose Cost price of the one wrist watch = Rs. x

Then at 20% profit, the Profit =  $\frac{20x}{100} = \frac{x}{5}$

Therefore, the S.P. =  $x + \frac{x}{5} = \text{Rs.}1500$  (given)

we get,  $x = \text{Rs.}1250$ .

Hence the cost price of each wrist watch is Rs.1250.

So shopkeeper gained Rs.250 on selling first wrist watch.

For the other wrist watch, again suppose the C.P. of the watch is Rs.y.

Then loss =  $\frac{20}{100} y = \frac{y}{5}$

S.P. =  $y - \frac{y}{5} = 1500$ (given)

$$\Rightarrow \frac{1500 \times 5}{4} = y$$

$$\Rightarrow y = \text{Rs.}1775.$$

So the loss on selling the second wrist watch is Rs.(1775-1500) = Rs.275

from the above, it is clear that the shopkeeper has a gain of Rs.250 and a loss of Rs.275.

Overall the shopkeeper's loss is Rs.(275-250) = Rs.25.

Here, though the loss and gain are of same percent yet the amounts are different.

\* \* \*

**Example 19:** A bookseller gains 20% by selling a book for Rs.360. For how much should she sell it to gain 25%.

**Solution:**

Suppose C.P. = Rs.x

Profit =  $\frac{20}{100} \times x$

S.P. =  $x + \frac{x}{5} = \text{Rs.}360$  (given)

$$\Rightarrow 360 = \frac{6x}{5}$$

therefore x = Rs.300

and required Profit =  $300 \times \frac{25}{100}$   
 = Rs.75

Therefore, the sales price to gain 25 % = Rs.(300 + 75) = 375.

\* \* \*

Now try some exercises to check your understanding of profit and loss.

---

E18) A dealer buys a wall clock for Rs.280 and sells it for Rs.320. Find his profit or loss percent.

E19) A vendor loses 20% by selling 80 pencils for Rs.160. How many pencils should he sell for Rs.121, to have a profit of 10%?

E20) A cooler was sold at a profit of 10%. Had it been sold for Rs.200 more, the profit would have been 15%. Find the cost price of the cooler.

---

When you buy some article say a dress or book, you find some price is written on the packing or sometimes the shopkeeper offers you articles on a lesser amount than whatever is printed on the tag. This difference is called discount, and the tag price is called marked price. in next subsection we shall discuss the discount.

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## 14.4 DISCOUNT

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Many times you must have seen the advertisements around you of discount like discount upto 60%. Here 60% discount means 60% of the marked price will be subtracted from the marked price. For instance, if an article costs Rs.800 and the discount is 20%. Then 20% of Rs.800 that is Rs.160 will be reduced from Rs.800. Thus the article is sold for Rs.640. The marked price after discount is called the **net sales price**. Discount is the reduction in the marked or list price.

Let us consider a few examples to illustrate.

**Example 20:** In a book fair, the study material of a course of IGNOU is sold at a discount of 10%. If the cost of the course material is Rs.225 then find its net selling price.

**Solution:** Given marked Price = Rs.225

$$10\% \text{ discount on marked price} = \text{Rs. } 225 \times \frac{10}{100} = \text{Rs.}22.50$$

$$\begin{aligned} \text{Net sales price} &= \text{Marked Price} - \text{discount} \\ &= \text{Rs. } (225 - 22.50) \\ &= \text{Rs.}202.50. \end{aligned}$$

Therefore, the Net sales price of the material is Rs.202.50.

\* \* \*

**Example 21:** An article is marked at Rs.60 and is being offered at Rs.48. Find the discount percent.

**Solution:** Given that, Marked Price = Rs.60  
and the Net sales price = Rs.48  
Discount = Marked Price – sales price  
= Rs.(60 – 48) = Rs. 12

So, on Rs.60, you get a discount of Rs.12.

$$\therefore \text{the discount \%} = \frac{12}{60} \times 100 = 20\%$$

\* \* \*

- E21) Is a 10% discount, and a 2% discount, same as a 12% discount? why?
- E22) A shirt is marked at Rs.500. If a discount of 10% is offered, find its selling price?
- E23) A person pays Rs.2800 for a cooler listed at Rs.3500. Find the discount percent offered.
- E24) A TV with marked price Rs.11500, is sold at 10% discount. Due to festival season, the shopkeeper allows a further discount of 5%. Find the net selling of the TV.

In this section, we discussed the discount. Let us discuss an important liability, which is paid to the government and is known as tax.

## 14.5 TAXES

Government provides us facilities for education and health, and performs many other functions like removal of poverty, removal of unemployment, maintaining law and order, etc. The money for this is raised through taxes. Whenever you avail some service you pay money for it, the money paid for these services is nothing but tax. If you inherit some money, purchase some property, use roads, use water you pay an additional amount to the government as tax. Sometimes an individual has to pay tax to the government directly like income tax, wealth tax, property tax, water tax, professional tax etc., these taxes are known as direct taxes. And the taxes like sales tax, entertainment tax, value added tax, central excise tax, etc., which are not paid directly to the government, are known as indirect tax. Now let us discuss few important taxes.

### Income Tax:

An important direct tax is nothing but income tax. It is also a significant source of revenue of the government. Every person, whose taxable income exceeds from the minimum taxable limit is liable to pay the income tax to the government. The income tax is always computed for a financial year. It means a period of twelve months beginning from 1<sup>st</sup> April and ending on 31<sup>st</sup> March. For example financial year 2004 - 05 means 1<sup>st</sup> April 2004 to 31<sup>st</sup> March 2005. Now let us discuss the step by step procedure to compute the income tax.

The balance left after subtracting the allowable deductions from the total gross income is taxable income.

**Step I:** Income from salaries, housing property, profits of business or profession and income from other sources are added to compute the gross total income.

**Step II:** From the gross total income computed in step I, various deductions like NSC, ULIP, GPF, PPF, etc., which are permissible under various sections like 80C, 80D, etc., are subtracted. The balance left after deducting the allowable deductions from gross total income is taxable income.

**Step III:** After computing taxable income, income tax is computed by using the following rules (These rules are amended by the government time to time):

Taxable income	Income tax
(i) Upto Rs.1,35,000/- (for woman employees)	NIL
Upto Rs.1,00,000/- (for other employees)	NIL
(ii) Rs.1,35,001 to Rs.1,50,000/- (for woman employees)	10% of the income exceeding Rs.1,35,000/-
Rs.1,00,001 to Rs.1,50,000/- (for other employees)	10% of the income exceeding Rs.1,00,000/-

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- (iii) Rs.1,50,001 to 2,50,000/- 20% of the income exceeding Rs.1,50,000/- + Rs.1,500/- (for woman employees)/Rs.5,000/- (for other employees).
- (iv) Rs.2,50,001/- and above 30% of the income exceeding Rs.2,50,000/- + Rs.21,500/- (for woman employees)/Rs.25,000/- (for other employees.)

**Step IV:** An education cess @ 2% on income tax is computed and is added to the income tax. The total of income tax and education cess is the total payable income tax.

If any advance tax paid or tax deducted or collected at source, then the net payable tax is the balance after subtracting tax paid from the total payable tax.

Let us apply these steps rules in the following situations.

**Example 22:** The annual income of vibha is Rs.1,95,000/- during the financial year 2005-06. She earned Rs.15,000/- from other sources and invested Rs.25000/- in various permissible schemes. How much tax she will have to pay throughout the year.

**Solution:** Let us apply every step one by one in this situation.

$$\begin{aligned}\text{Annual income of vibha} &= \text{Rs.1, 95, 000} \\ \text{Income from other sources} &= \text{Rs.15, 000} \\ \text{The total gross income} &= \text{Rs.(1, 95, 000 + 15, 000)} \\ &= \text{Rs.2, 10, 000}\end{aligned}$$

As she made investments of Rs.25,000/- which are allowable under various permissible schemes. Therefore vibha's taxable income

$$\begin{aligned}&= \text{Rs.(2, 10, 000 - 25, 000)} \\ &= \text{Rs.1, 85, 000}\end{aligned}$$

Therefore, the total taxable income of vibha is Rs.1,85,000/-. This taxable income falls in between Rs1,50,000/- and 2,50,000/-.

$$\begin{aligned}\text{Hence the income tax} &= \text{Rs.1, 500 + 10\%of the income exceeds by Rs.1, 50, 000} \\ &= \text{Rs.1, 500 + 10\%of Rs.(1, 85, 000 - 1, 50, 000)} \\ &= \text{Rs.1, 500 + 10\%of Rs.35, 000} \\ &= \text{Rs.1, 500 + Rs.3, 500} \\ &= \text{Rs.5, 000}\end{aligned}$$

$$\begin{aligned}\text{The education cess} &= \text{2\%of Rs.5000} \\ &= \text{Rs.100}\end{aligned}$$

$$\begin{aligned}\text{Therefore the net income tax to be paid by vibha} &= \text{Rs.(5000 + 100)} \\ &= \text{Rs.5100.}\end{aligned}$$

\* \* \*

Now try the relevant exercise.

---

E25) Vivek Mohan, furnished the undernoted particulars of his income for the year ended 31<sup>st</sup> March, 2006:

- i) Basic pay Rs.1,44,000/-
- ii) Dearness Allowance Rs.38,000/-
- iii) Contribution to GPF Rs.48,000/-
- iv) LIC premium Rs.12,000/-
- v) Profit on business Rs.1,54,000/-



Compute Vivek Mohan's taxable income and net tax for the financial year 2005-06.

**Sales Tax:**

Sometimes, you must have seen that after buying some article you pay an additional amount other than the marked price to the shopkeeper. This additional amount is called sales tax. Sales tax is the amount which is levied on the sales of the goods. Suppose, an article is to be sold for Rs.800 and the rate of sales tax is 5%, then

$$\begin{aligned} \text{Sales Tax} &= \text{Rs.}800 \times \frac{5}{100} = \text{Rs.}40. \\ \text{Price including sales tax} &= \text{Rs.}800 + \text{Rs.}40 \\ &= \text{Rs.}840. \end{aligned}$$

Therefore, the selling price with sales tax will be Rs.840. One such tax which is levied on the sale of products is called sales tax. Government levies such taxes to have earning called **revenue**. The sales tax may or may not be levied on some commodities. The sales tax is different for all commodities. This sales tax is always calculated over the net sales price i.e. after discount if any, and its rate is expressed as a percentage.

**Example 23:** The marked price of a shirt is Rs.320. If the rate of sales tax is 5%, find the amount to be paid for the purchase of the shirt by the customer.

**Solution:** Given Marked price = Rs.320

$$\therefore \text{Sales Tax} = 320 \times \frac{5}{100} = \text{Rs.}16.$$

Therefore, the customer has to pay Rs.320 + Rs.16 = Rs.336.

\*\*\*

**Example 24:** A pair of shoes is sold for Rs.1100 including sales tax. If the rate of sales tax is 10%. Find the list price for the shoes.

**Solution:** Suppose list price = Rs.x.

$$\text{Sales tax at 10\%} = \frac{10x}{100}. \text{ And also sales tax} = 1100 - x$$

$$\text{Therefore } 1100 - x = \frac{10x}{100}$$

$$\therefore x = \text{Rs.}1000.$$

Hence, the list price of a pair of shoes is Rs.1000.

\*\*\*

**Example 25:** I give you a discount of 20% on Rs.500 and charge 20% sales tax, what is the final price?

**Solution:** Given that: Cost Price is Rs.500.

$$\text{Discount} = 500 \times \frac{20}{100} = \text{Rs.}100$$

$$\begin{aligned} \text{After Discount Net amount} &= \text{Rs.}(500 - 100) \\ &= \text{Rs.}400 \end{aligned}$$

$$\begin{aligned} \text{As, I charge sales tax, therefore sales tax} &= \text{Rs.}400 \times \frac{20}{100} \\ &= 80 \end{aligned}$$

$$\text{Hence the final Net amount} = \text{Rs.}(400 + 80) = \text{Rs.}480.$$

\*\*\*

Try some related exercises.

---

E26) The marked price of a machine is Rs.4000. If the sales tax on the machine is at the rate of 4%, find how much a customer has to pay for purchasing the machine.

E27) A washing machine is available for Rs.13915 which includes sales tax. If the sales tax is at 10% rate, find the listing price of the washing machine.

E28) Radhika bought a CD player for Rs.1870, after getting 15% discount on the marked price, and then 10% sales tax on the reduced price. Find the marked price of the CD Player.

E29) You go to buy an article and find shopkeeper A offers 10% discount and 10% sales tax after discount, and shopkeeper B sells it as it is. If the cost of the article is Rs.5000, then from which shopkeeper you would like to buy and why?

---

**Service Tax:**

Service tax is an indirect tax. This tax is collected by the service provider from the user and deposited to the government. When you pay bills to the hotels, courier services, petrol pumps, telecommunication services, you must have paid some amount charged under service tax. Some percentage of the gross total is paid as service tax. For example, if your telephone bill is of Rs.1500/- and you pay 10% service tax, then the service tax paid by you is Rs.10% of 1500 = Rs.150/-.

Therefore you will pay Rs.150/- as service tax and the net amount of the bill

$$\begin{aligned} \text{including service tax} &= \text{Rs.}(1500 + 150) \\ &= \text{Rs.}1650. \end{aligned}$$

**Value Added Tax (VAT):**

This tax is also an important tax. This tax is also computed as sales tax. VAT is a modified form of multiple point tax on sales, where the burden of the tax is shared rationally by all the dealers. Tax paid on purchase of trading goods/raw material/packing material is subtracted from the tax payable on the sales of trading goods/manufactured goods. This total ultimate tax collected is evenly distributed. For example, A shopkeeper purchases any item taxable @ 4% for Rs.100 and pays Rs.4/- tax thereon to the manufacturer. Total purchase size comes to Rs.104/-. Now suppose he sales this item to its customer for Rs.120/-. On this sales tax @ 4% which comes to Rs.4.80, will be charged from the customer by the shopkeeper. Now the tax for Rs.4/- paid while purchasing good will be deducted in the sale invoice and only the balance of Rs.0.80 will be paid by the shopkeeper.

**Example 26:** Mohan buys medicines of Rs.800/- and pays 4% value added tax to the medical store. Find the amount of tax paid by mohan.

**Solution:**

$$\begin{aligned} \text{Value added tax paid by mohan} &= 4\% \text{ of Rs.}800 \\ &= \text{Rs.}32. \end{aligned}$$

Therefore mohan pays Rs.32/- to the medical store as value added tax.

\* \* \*

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E30) Ashok pays Rs.525/- to a petrol pump which includes service tax. If the service tax is at 5% rate. Find the actual price of the petrol he used.

E31) If on purchase of an article of Rs.2500/- you pay 4% value added tax, then find the total amount paid to purchase the article.

---

## 14.6 SHARES AND DEBENTURES

Whenever any company (business or industry) is started, a large sum of money is needed. In general, it may not be possible for one or more individuals to invest such a large amount. In such cases, interested individuals get together and form a company called **joint stock company**. Then the estimated money is divided into small/equal units called **shares**. Each person, who purchases the shares of the company, is called its **shareholder**. The company issues a **share-certificate** to each of its shareholder stating the number of shares. We use the following terms for sale and purchase of shares.

- The original value of a share is called the **face value**, or **nominal value**, or **printed value**.
- Shares can be sold any time as other things. The price of a share quoted in the market is called its **market value**.
- If the market value is same as the face value, then shares are called at par.
- If the market value is more than the face value, then the difference is called premium or above par. Suppose the face value of a share is Rs.100, and it is sold at Rs.150. Then, it is said to be selling at a premium of Rs.50 or at Rs.50 above par.
- If the market value is less than the face value, then the share is called at discount or below par. Suppose, a share with face value Rs.100 is sold at Rs.75. Then, it is said to be selling at a discount of Rs.25 or at Rs.25 below par.
- Whatever profit, a share holder gets for his investments from the company is called dividend. The dividend is always calculated on face value irrespective of the market value, and is expressed as some percent of the face value.
- Shares are of two types: **preferred shares** and **common (or ordinary) shares**. Preferred shares carry an advantage that dividend of a specific percent must be paid to preferred shareholder before any dividend is paid to common share holders. Sometimes, the company may not be having profit after expenses. In such cases, no dividend is given to the preferred shareholders.
- Suppose you have 1000 shares of any company of par value Rs.10 each, then you hold Rs.10000 stock of the company. If the dividend on Rs.100 stock is Rs.10, it is called 10% stock. Like shares, stocks can also be purchased and sold in the market.
- In share market, shares and stocks are sold and purchased through a **stock broker**. Stockbrokers charge some money, called **Brokerage** from both seller and purchaser.

'par' means 'level'.

To illustrate the concept of shares let us discuss some examples.

**Example 27:** A person purchases 1000 shares of a company paying 10% annual dividend of par value Rs.10 each. Find its annual dividend.

**Solution:**

$$\begin{aligned}
 \text{Given is shares} &= 1000 \\
 \text{Par value of one share} &= \text{Rs.10} \\
 \text{Annual dividend} &= 10\% \\
 \text{Total par value of 1000 shares} &= 1000 \times 10 \\
 &= \text{Rs.10,000} \\
 \text{Annual dividend} &= 10000 \times \frac{10}{100} \\
 &= \text{Rs.1000.}
 \end{aligned}$$

\* \* \*

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**Example 28:** Razia invested Rs.20000 in a company. If the total dividend declared by the company is Rs.1500, find the rate of dividend paid by the company.

**Solution:**

$$\begin{aligned} \text{Given that: Total invested amount} &= \text{Rs.20000} \\ \text{Total Dividend paid by the company} &= \text{Rs.1500} \\ \therefore \text{Rate of dividend paid by the company} &= \left( \frac{1500}{20000} \times 100 \right) \% \\ &= 7\frac{1}{2}\% \end{aligned}$$

\* \* \*

**Example 29:** Madhav buys 100 preferred shares and 150 common shares of par value Rs.50 each. If the company declares a semi-annual dividend of 10% for preferred shares and an annual dividend of 7% for common shares, find the annual dividend received by Madhav.

**Solution:**

$$\begin{aligned} \text{Given is, preferred shares} &= 100 \\ \text{Common shares} &= 150 \\ \text{Par value of each shares} &= \text{Rs.50} \\ \text{Dividend for preferred shares} &= 10\% \text{ semi annually} \\ &= 20\% \text{ annually} \\ \text{Dividend for common shares} &= 7\% \text{ annual} \\ \text{Total investment for preferred shares} &= 100 \times 50 \\ &= \text{Rs.5000} \\ \text{Investment for common shares} &= 150 \times 50 \\ &= \text{Rs.7500} \\ \text{Annual dividend for preferred shares} &= 5000 \times \frac{20}{100} \times 2 \\ &= \text{Rs.1000} \\ \text{Annual dividend for common shares} &= 7500 \times \frac{7}{100} \\ &= \text{Rs.525} \\ \text{Total dividend received by Madhav} &= \text{Rs.}(1000 + 525) \\ &= \text{Rs.1525.} \end{aligned}$$

\* \* \*

Now, try some exercises.

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E32) A company declared a semi-annual dividend of 8%. Find the annual dividend received by a person owning 2000 shares of the company having a par value of Rs.100 each.

E33) Find the cost of purchasing 200 shares of a company, each of par value Rs.100 quoted at Rs.150 each in the market, from the shareholder. Also, find the gain to the new shareholder if he sells each share at a premium of Rs.100.

E34) A person buys 100 shares of par value Rs.10 each of a company which pays annual dividend of 12% at such a price that she/he gets 10% on his investments. Find the market value of a share.

---

So far, you have read that shares can be sold and purchased by the public. Now, suppose a good running company wants to increase its business, for this purpose it requires a huge amount of money. Then, for the company, it is not necessary to float fresh shares again. Another way to borrow money from the shareholders or public is to float debentures in the market. Like shares, the total required amount is again divided into small units. Each unit is called a **debenture**. The basic difference in share and debenture is that the debenture holders do not have any right on the profits declared by

the company. Debentures are issued by giving a debenture certificate to the holder. However, the interest at fixed rate and fixed time is payable to the debentureholder, whether the company is running at a profit or a loss.

Let us discuss some examples to illustrate the concept.

**Example 30:** Find the income percent on 8% debenture of face value Rs.100 whose market value is Rs.160.

**Solution** Given; Face value = Rs.100

Market value = Rs.120

$$\text{Interest on Rs.100 debenture} = \frac{100 \times 8}{100} = \text{Rs.8}$$

The market value of a debenture is Rs.160.

$$\therefore \text{Income on Rs.160} = \text{Rs.8}$$

$$\therefore \text{Income on Rs.100} = \frac{8}{160} \times 100 = 5\%.$$

Therefore income percent is 5%.

\* \* \*

**Example 31:** Rajni has 1000 shares of par value Rs.10 each and 500 debenture of par value Rs.50 each of a company. The company declares an annual dividend of 6% on the shares and 8% on its debentures. Find the total income of Rajni. Also find the rate of return on her investments.

**Solution:**

Investment for 1000 shares	= Rs.(1000 × 10)		
	= Rs.10000		
Investment for 500 debentures	= Rs.(500 × 50)		
	= Rs.25000		
Annual Dividend on 1000 shares	= $10000 \times \frac{6}{100}$		
	= Rs.600		
Annual Dividend on 500 debentures	= $25000 \times \frac{8}{100}$		
	= Rs.2000		
Annual income on her investments	= Rs.(2000 + 600)		
	= Rs.2600		
Rate of return on her investments	= $\left( \frac{\text{Income}}{\text{Total investments}} \times 100 \right) \%$		
	= $\left( \frac{2600}{10000 + 25000} \times 100 \right) \%$		
	= $7\frac{3}{7}\%$ .		

\* \* \*

Now try some exercises

E35) Find the income percent on 10% debenture of par value Rs.80, whose market value is Rs.100.

E36) A man holds 100 shares of a company at par value Rs.600 each on which the paid dividend is 6%. When the shares rise to Rs.800, the person sells them and invests half the sale proceeds in 8% debentures of par value Rs.200 each and other half of the sale proceeds in 10% stock at Rs.250 each. Find the change in his income.

Let us sum up what we have covered in this unit.

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## 14.7 SUMMARY

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In this unit we have explained and illustrated the computation in different contexts of the following:

- 1) Simple and Compound interest
- 2) Interest for a savings bank account.
- 3) Profit and loss
- 4) Discount and sales tax.
- 5) Various taxes.
- 6) Annual income on the investments on shares and debentures.

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## 14.8 SOLUTIONS/ANSWERS

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E1)  $P = \text{Rs.}2000$

$$r = 7\% = 0.07$$

$$t = 4$$

$$I = Prt = \text{Rs.}(2000 \times 0.07 \times 4)$$

$$= \text{Rs.}560$$

E2)  $P = \text{Rs.}1500$

$$t = 5 \text{ years}$$

$$r = 5\% = 0.05$$

$$\begin{aligned} \text{Amount after 5 years} &= P(1 + rt) \\ &= 1500(1 + 0.05 \times 5) \\ &= \text{Rs.}1875. \end{aligned}$$

E3)  $P = \text{Rs.}5000$

$$r = 4\% = 0.04 \text{ quarterly} = 0.04 \times 4 \text{ annually} = 0.16 \text{ annually}$$

$$t = 15 \text{ months} = \frac{15}{12} \text{ years} = 1.25 \text{ years}$$

$$\text{Interest} = 5000 \times 0.16 \times 1.25 = \text{Rs. } 1000$$

$$\begin{aligned} \text{The amount you repay at the end of 15 months} &= \text{Rs. } (5000 + 1000) \\ &= \text{Rs.}6000. \end{aligned}$$

E4) i)

$$A = P(1 + rt)$$

$$6000 = 4500(1 + r \times 4)$$

$$\frac{4}{3} = 1 + 4r$$

$$\text{or } r = \frac{1}{12} = 0.0633$$

$$= (0.0633 \times 100)\%$$

$$= 6.33\%$$

ii)  $I = Prt$

$$800 = 1000 \times 0.08 \times t$$

$$\Rightarrow t = 10 \text{ years.}$$

iii)  $A = P(1 + rt)$

$$= \text{Rs.}8000(1 + 0.06 \times 8)$$

$$= \text{Rs.}8000 \times 1.48$$

$$= \text{Rs.}13440$$

$$\text{iv) } A = P(1 + rt)$$

$$2P = P(1 + r \times 6)$$

$$r = \frac{1}{6} = \frac{100}{6}\% = 16\frac{2}{3}\%$$

E5)  $I = P/4$

$$r = 10\% = 0.10$$

$$t = ?$$

$$I = Prt$$

$$\Rightarrow \frac{P}{4} = P \times 0.10 \times t$$

$$\Rightarrow t = 2.5 \text{ years.}$$

E6) i)  $I = \text{Rs.}(10000 \times 5 \times 0.04) = \text{Rs.}2000$

ii)  $I = \text{Rs.}(8000 \times 6 \times 0.05) = \text{Rs.}2400$

Thus, the earned interest is more in second case.

E7) i) Amount =  $10000(1 + 0.06)^4 = 12624.77$   
Interest = Amount - Principal = 2624.77

ii)  $A = 5000(1 + 0.10)^3 = 6655$   
 $I = A - P = 1655$

iii)  $A = 4000(1 + 0.12)^2 = 5016.80$   
 $I = A - P = 1016.80$

E8)  $P = \text{Rs.}8000$

$$A = \text{Rs.}9261$$

$$n = 3$$

Using formula (2), we get

$$A = P(1 + r)^n$$

$$9261 = 8000(1 + r)^3$$

$$\frac{9261}{8000} = (1 + r)^3$$

$$\left(\frac{21}{20}\right)^3 = (1 + r)^3$$

$$\left(1 + \frac{1}{20}\right)^3 = (1 + r)^3$$

$$r = \frac{1}{20} = 0.05 = 5\% \text{ per annum.}$$

E9)  $P = \text{Rs.}10000$

$$r = ?$$

$$n = 6$$

$$A = \text{Rs.}20000$$

we have,

$$20000 = 10000(1 + r)^6$$

$$2 = (1 + r)^6$$

$$1 + r = (2)^{1/6}$$

$$r = (2)^{1/6} - 1$$

E10)  $A_1 = \text{Rs.}18522$

$$n_1 = 3$$

$$A_2 = \text{Rs.} 19448.10$$

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$$n_2 = 4$$

$$r_1 = r_2 = r \text{ (let) and } P_1 = P_2 = P \text{ (let)}$$

Now, we get

$$A_1 = 18522 = P(1 + r)^3 \text{ and } A_2 = 19448.10 = P(1 + r)^4$$

Dividing both, we get

$$\frac{18522}{19448.10} = \frac{1}{(1 + r)}$$

$$1 + r = \frac{19448.10}{18522}$$

$$r = 0.05.$$

$$\begin{aligned} \text{E11) S.I} &= 8000 \times 2 \times 0.10 = \text{Rs.1600} \\ \text{and C.I.} &= \text{Rs. } [8000(1 + 0.10)^2 - 8000] = \text{Rs. } (8000 \times 1.1 \times 1.1 - 8000) \\ &= \text{Rs.}(9680 - 8000) = \text{Rs.1680.} \end{aligned}$$

It is clear from the above, that the difference between compound interest and simple interest is Rs.80.

$$\text{E12) i) } A = 5000(1 + 0.18)^2$$

$$\text{ii) } A = 5000(1 + 0.09)^4$$

$$\text{iii) } A = 5000(1 + 0.045)^8$$

$$\text{E13) } A = 2P, \text{ we get}$$

$$2P = P(1 + 0.10)^n$$

$$2 = (1.10)^n$$

$$\text{E14) } A = \text{Rs.100000}$$

$$r = 0.10$$

$$P = ?$$

$$n = 20$$

$$100000 = P(1 + 0.10)^{20}$$

$$\text{E15) Comparing interest for the three cases, we get}$$

$$\text{Case I, S.I.} = 2000 \times 2 \times 0.05 = \text{Rs.200}$$

$$\text{Case II, C.I.} = 2000(1 + 0.048)^8 - 2000 = \text{Rs.}$$

$$\text{Case III, C.I.} = 2000(1 + 0.06)^4 - 2000 = \text{Rs.}$$

$$\text{E16) Month wise qualifying amount is as follows:}$$

July	=	Rs. 10000.00
August	=	Rs. 18000.00
September	=	Rs. 22000.00
October	=	Rs. 30000.00
November	=	Rs.29000.00
December	=	Rs. 37000.00
Total	=	146000.00

Interest credited at the end of the month of

$$\begin{aligned} \text{December 2003} &= 146000 \times \frac{1}{12} \times 0.04 \\ &= \text{Rs.486.67} \end{aligned}$$



E18) C.P. = Rs.280

S.P. = Rs.320

Since S.P. > C.P. , therefore there is a profit and profit % is

$$\left(\frac{320 - 280}{280} \times 100\right)\% = 14\frac{2}{7}\%$$

E19) ∴ Selling price of 80 pencils = Rs.160

∴ Selling price of 1 pencil = Rs.  $\frac{160}{80} = 2$

Let the C.P. of one pencil is x, then we get

$$\text{Loss \%} = \frac{x - 2}{x}$$

$$0.20x = x - 2$$

$$x = \text{Rs.}2.50$$

Again, S.P. = 121 and Profit = 10% = 0.10

therefore  $0.10 = \frac{121 - 2.50 \times n}{2.50 \times n}$  (where n is number of required Pencils)

or n = 44.

E20) Profit = 10%

Let the C.P. be x and S.P. be y.

According to 10% profit, we get

$$10 = \frac{y - x}{x} \times 100$$

$$0.10x = y - x$$

$$\text{or } 1.1x = y$$

(1)

According to 15% profit, we get

$$15 = \frac{y + 200 - x}{x} \times 100$$

$$0.15x = y + 200 - x$$

$$\text{or } 1.15x = y + 200$$

(2)

Solving (1) and (2), we get

$$x = \text{Rs.}4000$$

Therefore the cost price of the cooler is Rs.4000.

E21) No.

E22) S.P. = Rs.  $\left(500 - \frac{500 \times 10}{100}\right)$  Thus net sales price is Rs.450  
 = Rs.450

E23) Discount = Rs. (3500 - 2800) = Rs.700

$$\text{Discount \%} = \frac{700}{3500} \times 100 = 20\%$$

E24) After First discount S.P. = Rs.  $\left(11500 - \frac{11500 \times 10}{100}\right)$   
 = Rs.11350.00

$$\text{Sales price after further discount} = \text{Rs.} \left(11350.00 - \frac{11350 \times 5}{100}\right)$$

$$= \text{Rs.}10,782.50$$

Therefore the net sales price is Rs.10782.50

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E25) Gross total income of vivek mohan is = Basic pay + Dearness Allowance + Profit on business = Rs. (1,44,000 + 38,000 + 1,54,000) = Rs.3,36,000/-.

Permissible deductions = Contribution to GPF + LIC premium  
= Rs. (48,000 + 12,000) = Rs. 60,000/-

Total taxable income = Rs.(3,36,000 – 60,000) = Rs.2,76,000

Income tax = 30% of Rs.(2,76,000 – 2,50,000) + Rs.25,000  
= 30% of 26,000 + Rs.25,000  
= Rs.7800 + Rs.25,000  
= Rs.32,800

Education cess = 2% of Rs.32,800/- = Rs.656

Therefore, net payable tax of vivek mohan is = Rs.(32,800 + 656) = Rs.33,456.

E26) Sales tax = Rs. 4000  $\times$   $\frac{4}{100}$  = Rs.160 Thus, the customer has to pay

Rs. (4000 + 160) = Rs.4160

E27) Let the listing price be x.

Then sales tax is  $\frac{10x}{100}$  = 0.10x

Therefore 13915 = x + 0.10x

or x = Rs.  $\frac{13915}{1.10}$   
= Rs. 12650

E28) Let the marked price be x.

then the discount =  $\frac{15x}{100}$

The price after discount =  $x - \frac{15x}{100} = \frac{85x}{100}$

Now, Radhika paid 10% sales tax on reduced price,

therefore sales tax =  $\frac{85x}{100} \times \frac{10}{100} = \frac{85x}{1000}$

and 1870 =  $\frac{85x}{100} + \frac{85x}{1000} = \frac{935x}{1000}$

or x = Rs.2000

therefore the marked price of the CD Player is Rs.2000.

E29) According to Shopkeeper A, the sales prices are as below:

After 10% discount the price = Rs.5000 –  $5000 \times \frac{10}{100}$   
= Rs.4500

The sales price after adding sales tax = Rs.  $\left(4500 + \frac{4500 \times 10}{100}\right)$   
= Rs.4950.

You should buy the article from shopkeeper A as it has less sales price than that of shopkeeper B.

E30) Let the actual amount paid for the petrol is x.

Then,

Actual amount paid for petrol + service tax paid = total amount paid i.e. x + 5% of

$$x = 525$$

$$\Rightarrow x + \frac{5}{100}x = 525$$

$$\Rightarrow \frac{105x}{100} = 525$$

$$\Rightarrow x = \frac{525 \times 100}{105}$$

$$\Rightarrow x = \text{Rs.}500$$

Therefore the actual price of the petrol used is Rs. 500.

$$\begin{aligned} \text{E31) VAT} &= 4\% \text{ of Rs.}2500 \\ &= \text{Rs.}100 \end{aligned}$$

$$\begin{aligned} \text{Therefore the total amount paid to purchase the article} &= \text{Rs.}(2500 + 100) \\ &= \text{Rs.}2600. \end{aligned}$$

$$\begin{aligned} \text{E32) Total invested amount in shares} &= \text{Rs.}2000 \times 100 \\ &= \text{Rs.}2,00,000 \\ \text{Here, dividend rate} &= 8\% \text{ semi - annually} \\ &= 16\% \text{ annually} \\ \text{therefore annual dividend} &= \text{Rs.}200000 \times \frac{16}{100} \\ &= \text{Rs.}32000 \end{aligned}$$

$$\begin{aligned} \text{E33) Market value of a share} &= \text{Rs.}150 \\ \text{Market value of 200 shares} &= \text{Rs.}150 \times 200 = \text{Rs.}30000. \end{aligned}$$

Thus, the new shareholder spent Rs.30000 for buying 200 shares. The new shareholder sold the shares at a premium of Rs.100.

$$\begin{aligned} \therefore \text{New market value of a share} &= \text{Rs.} (100 + 100) \\ &= \text{Rs.}200. \end{aligned}$$

The selling price of 150 shares at new market value = Rs.(200 × 200) = Rs.40000

∴ Gain of the new shareholder in the transaction = Rs.(40000-30000) = Rs.10000.

$$\begin{aligned} \text{E34) Per value of 100 shares} &= \text{Rs.} (100 \times 10) = \text{Rs.}1000 \\ \text{Dividend received by the man} &= \text{Rs.} \frac{1000 \times 12}{100} \\ &= \text{Rs.}120 \end{aligned}$$

Let the market value of 100 shares be Rs.x.  
We have to find x such that 10% of x = 120,

$$\begin{aligned} \text{i.e. } \frac{10}{100}x &= 120 \\ \text{or } x &= 1200 \end{aligned}$$

i.e., market value of 100 shares = Rs.1200.

Hence, the market value of one share = Rs.12

$$\text{E35) The market value of a debenture is Rs.100}$$

∴ Income on Rs.100 is Rs.10.

$$\therefore \text{Income on Rs.}80 \text{ is Rs.} \left( \frac{10}{100} \times 80 \right) = \text{Rs.}8.$$

i.e. Percent income on the debentures is 8%.

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E36) Total Par value of 100 shares = Rs.600 × 100  
= Rs. 60000  
Dividend on these shares = Rs.60000 ×  $\frac{6}{100}$   
= Rs.3600  
Total sale proceeds of 100 shares  
at the rate of Rs.800 per share = Rs.(800 × 100)  
= Rs.80000  
Half of Rs.80000 i.e. Rs.40000 is  
invested in 10% stock at Rs.250 each  
∴ Income on this half = Rs.40000 ×  $\frac{10}{100}$   
= Rs.4000

with the other half (Rs.40000) debentures are purchased.

∴ Income (in the form of interest) on debenture = Rs.  $\left(40000 \times \frac{8}{100}\right)$   
= Rs.3200  
∴ Total income = Rs.(4000 + 3200)  
= Rs.7200  
∴ Change in income = Rs.(7200 – 3600)  
= Rs.3600.