20. A machine depreciates each year by 10% of its value at the beginning of the year. At the end of 2nd year, its value is Rs. 5,536.47. Find its original value. [**Ans.** Rs. 6,000]

21. The value of a machine depreciates at the rate of 11% annually. If its present value is Rs. 38,440, find its value three years age. [**Ans.** Rs. 54,527.22]

22. A machine costing Rs. 60,000 has a useful life of 5 years. The scrap value is Rs. 20,000. Using straight line method, find the annual depreciation and construct a schedule for depreciation. [**Ans.** Rs. 8,000]

23. An asset costing Rs. 12,000 is expected to have a useful life of 6 years and a scrap value of Rs. 3,000. Find the annual depreciation charge using straight line method.

[**Ans.** Rs. 1,500]

24. A machine costing Rs. 10,000 is expected to have a useful life of 5 years. It is assumed that the scrap value is nil. Using straight line method, find the annual depreciation charge. [**Ans.** Rs. 2,000]

25. A machine costing Rs. 25,000 is expected to have a useful life of 4 years. It is assumed that the scrap value at the end of 4th year is Rs. 5,000. find the annual depreciation and prepare the depreciation schedule using sum-of the years-digit method. [**Ans.** Rs. 8,00, Rs. 6,000, Rs. 4,000 and Rs. 2,000]

26. An asset costs Rs. 3,000. The useful life of the asset is 5 years and there is no scrap value. Find the annual depreciation and prepare a depreciation schedule using sum-of-the-years-digit method. [**Ans.** Rs. 1,000, Rs. 800, Rs. 600, Rs. 400, Rs. 200]

27. A computer whose cost is Rs. 4,40,000 will depreciate to a scrap value of Rs. 24,000 in 5 years.

(*a*) If the reducing balance method of depreciation is used, find the depreciation rate.

(*b*) What is the book value of the computer at the end of the third year ?

(*c*) How much more would the book value be at the end of the third year, if straight line method of depreciation has been used ?

[**Ans.** (*a*) 44.11%, (*b*) Rs. 76,816.59, (*c*) Rs. 1,13,583]

28. A company buys a computer for Rs. 1,25,000 and houses it in a specially constructed suite at a cost of Rs. 20,000.

(*a*) If the computer depreciates at 25% (reducing balance) and the suite appreciates 5% compound, what is the book value of the suite and the computer after 5 years,

(*b*) Taking computer and suite together and using the reducing balance method, what is the overall depreciation rate ? [**Ans.** (*a*) Rs. 55,188.71, (*b*) 17.57%]

29. *ABC* Ltd. purchases a machine which cost Rs. 12,000 now. The useful life of the machine is 10 years. The rate of depreciation is 6%, depreciation being calculate on diminishing balance method. What is the scrap value of the machine at the end of its life ? If after 10 years, the existing machine has to be replaced by a new machine which cost 20% more than the cost of the old machine, what amount will be required at the end of the 10th year to replace the old machine by a new one ? [**Ans.** 7,936.62]

CHAPTER

9

Bills of Exchange

INTRODUCTION

Companies due to competition in the market sell their goods on credit and give some time to the buyer to pay the amount before the expiry of some specified time period. This period is known as credit period. To ensure that the seller or creditor will receive his amount on or before the expiry of credit period, he writes a formal instruction to purchaser or debtor to make the payment of the certain specified amount on or before the expiry of credit period to him or to any one else according to his instruction. This formal document is known as the bill of exchange. In this chapter, we discuss the method of discounting a bill of exchange.

BILL OF EXCHANGE

A bill of exchange is defined as follows :

"A bill of exchange is a written document or undertaking by the debtor to the creditor for paying a certain sum of money on a specified future date."

In otherwords, a bill of exchange is a negotiable instrument by which one person undertakes to pay another person a certain sum of money at a future date. Bill of exchange is always drawn by the creditor ordering the debtor to pay the amount specified in it at the end of a specified period.

A bill of exchange contains three parties *viz.* drawer, drawee and payee. The *drawer* is the person who writes or prepares the bill. The creditor is the drawer of the bill. The *drawee* is the person who has to pay amount specified in the bill. The debtor is the drawee of the bill. The *payee* is the person to whom the payment is to be made. In many cases, the drawer and payee are the same. The drawer or the payee who is in possession of the bill is called the holder of the bill.

Bills are generally prepared by the drawer and sent to the drawee for his acceptance. If the bill is accepted, the drawee writes the word accepted on the bill, with his signature and date. When such an acceptance is written on the bill, it becomes a bill of exchange. Cheque, bank draft and etc., are examples of bills of exchange. A cheque is a bill of exchange drawn on a banker and payable on demand. A bank draft is a bill of exchange drawn by one bank on another and payable on demand.

The place of payment should be specified o the bill of exchange. If it is not mentioned, then payment should be made at the address of the drawer written in the bill. A bill of exchange must be written on a stamped paper of the court. If it is written in an ordinary paper, it should bear stamps. Stamps are fixed according to the amount of the bill.

The fixed period after which the payment of the bill is made is called the *term* of the bill. If the payment of a bill is to be made after 3 months, we say that the term of the bill is 3 months.

DUE DATE AND LEGALLY DUE DATE

The date of writing the bill must be clearly mentioned on the bill, because due date is to be calculated on the basis of this date. The date on which the payment of the bill is due is called the date of maturity or *due date.*

It should be noted that the date of acceptance of a bill may not be the same as the date on which the bill is drawn or prepared.

There are two kinds of bill of exchange.

(*a*) Bill of exchange after date

(*b*) Bill of exchange after right.

In bill of exchange after date, the date of maturity is counted from the date of drawn of the bill. On the other hand, in case of bill of exchange after sight, the date of maturity is counted from the date of acceptance of the bill.

Three days are generally added to the due date or maturity date to get the *legally due date.* These three days are called *days of grace.*

For example, consider a bill drawn on 27th November 2001 for a term of 3 months. We have 3 months from 27th November 2001 and 3 days of grace. Therefore the maturity date is 27th February 2002. The legally due date is 2nd March, 2002.

BANKER'S DISCOUNT AND TRUE DISCOUNT

The drawer or the payee of a bill of exchange is entitled to receive the payment after a fixed period of time. In otherwords, he has to wait for the payment till the bill becomes legally due. If he needs the money immediately, he can get the bill discounted from a bank or can endorse it to the third party to settle his dues.

Discounting a bill of exchange means encashing the bill before the due date form a bank. For discounting the bill, the drawer or the holder of the bill transfers the possession and also the ownership of the bill to the bank.

If the drawer or holder of a bill presents the bill for cash payment to a banker or a bill broker, the banker will deduct some amount form the bill. In fact, the banker charges certain rate of interest on the sum due. This interest is known as *banker's discount.*

Thus Banker's Discount is defined as follows :

"The interest on the bill value or the face value (*i.e.* the amount mentioned in the bill)."

If a bill of face value of Rs. P is discounted at the rate of r per annum for t years, then the banker's discount at simple interest is the interest on Rs. P at the rate of r per annum for t years.

Thus the banker's discount is given by

$$\boxed{\text{Banker's Discount} = Prt}$$

Note : 't' is the time period between the date of discounting and the legally due date. If this time period is in months, weeks, or days it should be covered into years.

True discount is defined as follows :

"True discount is the interest on the present value of a bill of exchange."

If a bill of face value Rs. P is discounted at the rate of r per annum for t years, then the interest on its present value $V = \dfrac{P}{1+rt}$ is the true discount.

$\therefore$ True discount = Interest on V at the rate of r per annum for t years

$\therefore$ True discount $= Vrt = \dfrac{Prt}{1+rt}$

Thus the true discount is given by

$$\boxed{\text{True Discount} = \frac{Prt}{1+rt}}$$

The difference between the banker's discount and the true discount is called banker's gain. Thus the bankers gain is given by

$$\boxed{\text{Banker's gain} = Prt - \frac{Prt}{1+rt}}$$

Remark :

$$\text{Banker gain} = Pvt - \frac{Prt}{1+rt}$$

$$= Prt\left[1 - \frac{1}{1+rt}\right]$$

$$= Prt\left[\frac{rt}{1+rt}\right]$$

$$= \left(\frac{Prt}{1+rt}\right)rt$$

$\therefore$ Banker's gain = (True discount) rt

Thus Banker's gain is the interest on true discount. It is also obvious that the banker's gain is greater than the true discount.

Example 1 : *Find the banker's discount and true discount on a bill of Rs. 20,000 due 4 months at 5% per annum.*

Solution **: Present Value of Amount** P **= Rs. 20,000**

$$\text{No. of Years } t = \frac{4}{12} = 0.3333 \text{ years}$$

$$\text{Rate of Interest } r = 5\% = 0.05$$

Banker's Discount = Prt

$$= 20{,}000 \times 0.05 \times 0.3333 = 333.30$$

$\therefore$ Banker's Discount is Rs. 333.30

True Discount is given by

$$\text{True Discount} = \frac{Prt}{1 + rt}$$

$$\text{True Discount} = \frac{333.30}{1 + 0.01667} = \frac{333.30}{1.01667} = 327.83$$

$\therefore$ True Discount is Rs. 327.83.

$\therefore$ The Banker's Discount is Rs. 333.30 and The True Discount is Rs. 327.83.

Example 2 : *Mr. X received from Mr. Y acceptance for Rs. 8,000 on 1st June 2007 for 3 months. He got the acceptance discounted at 6% per annum at his bank after one month. How much amount was received by him from the bank after discounting the bill ?*

Solution **: Present Value of Amount** P **= Rs. 8,000**

$$\text{No. of Years } t = \frac{(3-1)}{12} = \frac{2}{12} = 0.167 \text{ years}$$

$$\text{Rate of interest } r = 6\% = 0.06$$

Banker's Discount is given by

Bank's Discount = Prt

$$= 8{,}000 \times 0.06 \times 0.167$$

$$= 80.16$$

$\therefore$ Banker's Discount is Rs. 80.16

Amount Received by X after discount = Rs. (8,000 – 80.16) = Rs. 7,919.84

$\therefore$ The Net Amount Received by X after discount is Rs., 7,919.84.

Example 3 : *Find the True Discount and Banker's gain on a bill for Rs. 2,550 due in 4 months hence at 7% per annum.*

Solution **: Present Value of Amount** P **= Rs. 2,550**

No. of Years $t = \frac{4}{12} = 0.3333$ years

Rate of Interest $r = 7\% = 0.07$

Banker's Discount is given by

Banker's Discount $= Prt$

$= 2{,}550 \times 0.07 \times 0.3333$

$= 59.49$

$\therefore$ Banker's Discount is Rs. 59.49

Now, True Discount is given by

$$\text{True Discount} = \frac{Prt}{1 + rt}$$

$$= \frac{2{,}550 \times 0.07 \times 0.3333}{1 + 0.07 \times 0.3333}$$

$$= \frac{59.49}{1 + 0.0233}$$

$= 58.13$

$\therefore$ True Discount is Rs. 58.13.

Now, Banker's gain is given by

Bank's gain = Banker's Discount – True Discount

= Rs. (59.49 – 58.13)

= Rs. 1.36

$\therefore$ The Banker's gain is Rs. 1.36.

Example 4: *A bill of Rs. 45,000 drawn on March 27, 2008 at 8 months was discounted on August 18, 2008 at 6% per annum. How much did the banker charge and what did the holder receive ?*

Solution : Date of Drawing the bill = March 27, 2008

Duration or term of the bill = 8 months

$\therefore$ Due Date is give by

= 27 March 2008 + 8 months + 3 days of Grace

= 27 November 2008 + 3 days of Grace

= 30 November, 2008

Date of Discounting the bill is August 18, 2008

Now, Number of days form the date of discounting to the due date is calculate as follows :

13 days + 30 days + 31 days + 30 days = 104 days

[For August Month] [For September Month] [For October Month] [For November Month] = 104 days

Present Value of Amount P = Rs. 45,000

No. of Years $t = \frac{104}{365} = 0.285$ years

Rate of Interest $r = 6\% = 0.06$

Banker's discount is given by

Banker's discount $= Prt$

$= 45{,}000 \times 0.06 \times 0.285 = 769.50$

$\therefore$ Banker's Discount is Rs. 769.50

Discounted value of the bill is given by

Discounted value of the bill = Present Value of Amount – Banker's Discount

$= P - Prt$

= Rs. (45,000 – 769.50)

= Rs. 44,230.50

$\therefore$ Discounted value of the Bill is Rs. 44,230.50.

Example 5 : *The Banker's gain on a bill due 6 months hence at 8% per annum is Rs. 50. Find the face value of the bill.*

Solution **:** Let the face value of the bill be Rs. P.

No. of Years $t = \frac{6}{12} = 0.5$ years

Rate of Interest $r = 8\% = 0.08$

Banker's gain = Rs. 50

Banker's gain is given by

Banker's gain = Banker's Discount – True Discount

Banker's gain $= Prt - \frac{Prt}{1 + rt}$

Now, substituting the values, we get

$$P \times 0.08 \times 0.5 - \frac{P \times 0.08 \times 0.5}{1 + 0.08 \times 0.5} = 50$$

$$0.04P - \frac{0.04P}{1.04} = 50$$

$$0.0416P - 0.04P = 52$$

$$0.0016P = 52$$

$$\therefore \quad P = 32{,}500$$

Hence, the face value of the bill is Rs. 32,500.

Example 6: *The difference between the True and banker's discount on a bill due after 4 months at 7% interest is Rs. 500. Find*

(i) The True Discount

(ii) The Banker's Discount

(iii) The face value of the bill.

Solution : Let Rs. P be the face value of the bill.

No. of Years $t = \frac{4}{12} = 0.3333$ years

Rate of interest $r = 7\% = 0.07$

$\therefore$ Banker's Discount is given by

Banker's Discount $= Prt$

$= P \times 0.07 \times 0.3333$

$= 0.023331\,P$ ...(1)

Now, True Discount is given by

$$\text{True Discount} = \frac{Prt}{1 + rt}$$

$$= \frac{P \times 0.07 \times 0.3333}{1 + 0.07 \times 0.3333}$$

$$= \frac{0.023331P}{1.023331} \quad \text{...(2)}$$

Now, Given that

Banker's discount – True Discount = Rs. 500

So, $0.023331P - \frac{0.023331P}{1.023331} = 500$

$\Rightarrow \quad 0.023875335P - 0.023331P = 511.67$

$\Rightarrow \quad 0.000544335P = 511.67$

$\Rightarrow \quad P = 9{,}39{,}991$

$\therefore$ The face value of the bill is Rs. 9,39,991.

Now putting P = Rs. 9,39,991 in eq. (i) and (ii)

Banker's discount is given by

Banker's discount $= Prt$

$= 9{,}39{,}991 \times 0.07 \times 0.3333$

$= 21{,}930.93$

$\therefore$ The Banker's Discount is Rs. 21,930.93

True Discount is given by

$$\text{True Discount} = \frac{Prt}{1 + rt}$$

$$= \frac{0.023331 \times 939991}{1.023331}$$

$$= 21{,}430.92$$

$\therefore$ True Discount is Rs. 21,430.92.

Example 7: *A bill of exchange drawn on February 4, 2004 at 4 months after date was discounted on March, 26, 2004 at 8% per annum. If the banker's discount is Rs. 400, find the face value of the bill .*

Solution : Let the face value of the bill be Rs. P

Rate of Interest $r = 8\% = 0.08$

Now, Date of Drawing the bill is February 4, 2004

Term of the bill = 4 months

Legally due date of the bill = 7th June, 2004

Date of Discounting the bill = March 26, 2004

$\therefore$ Number of days from date of discounting to the due date as follows :

= 5 days + 30 days + 31 days + 7 days = 73 days

[March] [April] [May] [June]

Thus, we get

$$\text{No. of years } t = \frac{73}{365} = \frac{1}{5} = 0.2 \text{ year}$$

Banker's Discount is given by

Banker's Discount $= Prt$

$= P \times 0.2 \times 0.08$

$= 0.016P$

Given that Banker's Discount is Rs. 400.

$\therefore \quad 0.016P = 400$

$$P = \frac{400}{0.016} = 2{,}500$$

Hence, the face value of the bill is Rs. 2,500.

Example 8: *The banker's discount calculated for one year is 26 times his gain. Find the rate of interest.*

Solution : Let the rate of interest be r per rupee per annum and the face value of the bill be Rs. P.

Banker's Discount is given by

Banker's Discount $= Prt$

$\therefore$ Banker's Discount for one year $= Pr$

$$\text{Banker's gain} = Prt - \frac{Prt}{1 + rt}$$

$$\therefore \text{ Banker's gain for one year} = Pr - \frac{Pr}{1 + r}$$

It is given that for one year, Banker's Discount is 26 times the banker's gain.

$$\therefore \quad Pr = 26\left(Pr - \frac{Pr}{1 + r}\right)$$

$$\Rightarrow \quad 1 = 26\left(1 - \frac{1}{1+r}\right)$$

$$\Rightarrow \quad 1 + r = 26r$$

$$\Rightarrow \quad 25r = 1$$

$$\Rightarrow \quad r = \frac{1}{25} = 0.04$$

Hence, the required rate of Interest $= \left(\frac{1}{25} \times 100\right)\% = 4\%$

$\therefore$ The required Rate of interest is 4% per annum.

Example 9: *A bill of Rs. 1,500 drawn on May 3 for 6 months was discounted on August 25 for a cash payment of Rs. 1,479, find the rate of interest charged by the bank.*

Solution : Bill discounted for a cash payment of Rs. 1,479.

Date of drawing the bill is May 3.

Term of the bill is 6 months.

$\therefore$ Due date of the bill is November 6.

Date of discounting is August 29.

$\therefore$ Number of days from the date of discounting (*i.e.* August 29) to due date (*i.e.* November 10) calculated as follows :

$$= \underset{\left[\begin{matrix}\text{For}\\ \text{August}\end{matrix}\right]}{6 \text{ days}} + \underset{\left[\begin{matrix}\text{For}\\ \text{September}\end{matrix}\right]}{30 \text{ days}} + \underset{\left[\begin{matrix}\text{For}\\ \text{October}\end{matrix}\right]}{31 \text{ days}} + \underset{\left[\begin{matrix}\text{For}\\ \text{November}\end{matrix}\right]}{6 \text{ days}} = 73 \text{ days}$$

Present value of amount P = Rs. 1,500

No. of years $t = \frac{73}{365} = 0.2$ years.

Let the interest be r per rupee per annum.

Banker's Discount is given by

$\therefore$ Banker's discount $= Prt$

$$= 1{,}500 \times r \times 0.2$$

$$= 300\,r \qquad \ldots(i)$$

It is given that the bill was discounted for a cash payment of Rs. 1,479.

$\therefore$ Banker's Discount = Rs. [1,500 – 1,479]

= Rs. 21 ...(*ii*)

From (*i*) and (*ii*), we get

$$300r = 21$$

$$r = \frac{21}{300} = 0.07$$

$$r = 7\%$$

So, the rate of Interest is charged by the Bank is 7% per annum.

Example 10 : *A bill for Rs. 21,900 drawn on 10 July, 2006 for 6 months was discounted for Rs. 21,720 at 5% per annum. On what date was the bill discounted ?*

Solution : Rate of interest $r = 5\% = 0.05$

Face value of the bill P = Rs. 21,900

Discount value of the bill = Rs. 21,720

Banker's Discount = Face value of the bill – Discount value of the bill

$$= \text{Rs. } (21{,}900 - 21{,}720) = \text{Rs. } 180 \qquad \ldots(i)$$

Date of drawings the bill is July 10, 2006

Duration of the bill = 6 months

$\therefore$ Due Date of the bill is January 13, 2007

Let the bill be discounted 't' years prior to its due date at 5% per annum.

Banker Discount is given by

Banker's Discount = Prt

Rate of Interest $r = 5\% = 0.05$

$\therefore$ Banker's Discount $= 21{,}900 \times 0.05 \times t$

$$= 1{,}095t \qquad \ldots(ii)$$

From (i) and (ii), we get

$$1{,}095t = 180$$

$$\Rightarrow \quad t = \frac{180}{1{,}095} \text{ years}$$

$$\Rightarrow \quad t = \frac{180}{1095} \times 364 \text{ days}$$

$$t = 60 \text{ days}$$

Thus, the bill was discounted 60 days prior to its legally due date *i.e.* 13 January, 2007.

Hence, the bill was discounted on 14th November 2006.

Example 11: *If the banker's gain on a bill is* $\left(\frac{1}{9}\right)^{th}$ *of the banker's discount; the rate of interest being 10% per annum (simple), find the expired period of the bill.*

Solution : Let 't' years be the expired period of the bill and Rs. P be the face value of the bill.

Rate of Interest $r = 10\% = 0.10$

Banker's discount is given by

Banker's Discount = $Prt = Pt \times 0.10$ $\qquad \ldots(i)$

Now, True Discount is given by

$$\text{True Discount} = \frac{Prt}{1 + rt}$$

$$= \frac{Pt \times 0.10}{1 + t \times 0.10} \qquad \ldots(ii)$$

Now, Banker's gain is given by

Banker's gain = Banker's Discount – True Discount

$$= Pt \times 0.10 - \frac{Pt \times 0.10}{1 + t \times 0.10}$$

$$= \frac{(Pt \times 0.10) \times (1 + t \times 0.10) - (Pt \times 0.10)}{(1 + t \times 0.10)} \quad \ldots(iii)$$

It is given that

$$\text{Banker's gain} = \frac{1}{9}(\text{Banker's discount})$$

$$\Rightarrow \quad \frac{(Pt \times 0.10) \times (1 + t \times 0.10) - (Pt \times 0.10)}{(1 + t \times 0.10)} = \frac{1}{9} \times Pt \times 0.10$$

$$\Rightarrow \quad 8(1 + 0.1t) = 9 \Rightarrow t = \frac{10}{8} = 1.25 \text{ year}$$

Hence, the expired period of the bill is 1.25 year.

Example 12: *A man holds a bill for Rs. 9,600 which is due for payment after 9 months. After 4 months, however, he sells the bill to a broker who charges 5% per annum. The man then invests the discounted value of the bill in a security where rate of Interest is such that he does not suffer any loss on discounting the bill, find the rate of interest percent per annum of the security.*

Solution **:** Since the bill is due for payment after 9 months and the bill is discounted after 4 months, the bill has 5 months to run for maturity.

Banker's discount is given by

Banker's Discount = Prt

$$= (9{,}600 \times 0.05 \times 0.4167) \qquad \left[\because \ P = \text{Rs. } 9{,}600, t = \frac{5}{12} \text{ years}, r = \frac{5}{100}\right]$$

$$= 200.02$$

$\therefore$ Banker's Discount is Rs. 200.02

Thus, the Discounted value of the bill = Rs. (9,600 – 200.02) = Rs. 9,399.98

Let this discounted value of the bill be invested in security at r per annum.

Interest earned on security for 5 months = $9{,}399.98 \times r \times 0.4167$

Since the man does not suffer any loss in discounting the bill and then investing the discounted value in the security. Therefore,

Interest on discounted value in the security = Banker's Discount

$$\Rightarrow \quad 9{,}399.98 \times r \times 0.4167 = 200.02$$

$$\Rightarrow \quad r = \frac{200.02}{0.4167 \times 9{,}399.98} = 0.0511 = 5.11\%$$

$\therefore$ The rate of interest on the security is 5.11%.

Example 13: *A Banker discounts a bill for a certain amount which has 32 days to run before it matures legally at 5%. The discounted value of the bill is Rs. 7,268. Find the face value of the bill ?*

Solution : Let the face value of the bill be Rs. P

Rate of interest $r = 5\% = 0.05$

No. of years $t = \frac{32}{365} = 0.0877$ years

Banker's Discount is given by

Banker's Discount $= Prt$

$= P \times 0.5 \times 0.0877$

$= 0.004385P$

Given that the discounted value = Rs. 7,268

$\Rightarrow \quad P - 0.004385P = 7,268$

$\Rightarrow \quad 0.995615P = 7,268$

$\Rightarrow \quad P = 7,300$

$\therefore$ The face value of the bill is Rs. 7,300.

Example 14: *The Banker's Discount and True Discount on a Certain sum of money due 3 months hence are Rs. 515 and Rs. 500 respectively. Find the sum of money and rate of interest ?*

Solution : Let the face value be Rs. P and the rte of interest be r per rupee per annum.

Given that

No. of years $t = \frac{3}{12} = \frac{1}{4}$ years = 0.25 years.

$\therefore$ Banker's discount is given by

Banker's discount $= Prt$

$= Pr \times 0.25$

Now, True Discount is given by

True Discount $= \frac{Prt}{1 + rt} = \frac{Pr \times 0.25}{1 + 0.25r}$

It is given that banker's discount = Rs. 515 and True Discount = Rs. 500.

$\therefore \quad Pr \times 0.25 = 515$ and $\frac{Pr \times 0.25}{1 + 0.25r} = 500$

$\therefore \quad \frac{515}{1 + 0.25r} = 500$

$\Rightarrow \quad 1 + 0.25\,r = \frac{515}{500} = 1.03$

$\Rightarrow \quad 0.25r = 0.03$

$\Rightarrow \quad r = 0.12 = 12\%$

$\therefore$ rate of interest is 12%

Now, $P \times 0.12 \times 0.25 = 515$

$\Rightarrow$ P = Rs. 17166.67

$\therefore$ The sum of money is Rs. 17,166.67

Example 15 : *A merchant has a 3 months bill for Rs. 4,000 which his broker discounts at 5%. Find the rate of interest, if at least he should earn on the discounted value so that he may not suffer any loss by discounting the bill.*

Solution : Let the required rate of interest be r.

Broker's Discount is given by

Banker's Discount = Prt

where Present value of amount $P = 4{,}000$

Rate of interest $r = 5\% = 0.05$

No. of year $t = \frac{3}{12} = 0.25$ years

Broker's discount = $4{,}000 \times 0.05 \times 0.25 = 50$

$\therefore$ Broker's discount is Rs. 50

$\therefore$ Discounted value = Rs. (4,000 – 50) = Rs. 3,750.

Then, The Broker's Discount = Interest on Discounted Value.

$\Rightarrow$ $50 = 3{,}750 \times 0.25 \times r$

$\Rightarrow$ $r = \frac{50}{3950 \times 0.25} = \frac{50}{987.5} = 0.0506 = 5.06\%$

Hence, the required rate of interest is 5.06%.

Example 16: *Find the rate of percent at which the true discount on a bill legally due in 9 months will be exactly the same as the banker's discount at 7% per annum ?*

Solution : Let Rs. P be the face value of the bill legally due in 9 months time and r be the interest rate of per annum.

No. of years $t = \frac{9}{12} = \frac{3}{4} = 0.75$ years

True Discount is given by

$$\text{True Discount} = \frac{Prt}{1 + rt}$$

$$= \frac{P \times r \times 0.75}{1 + 0.75 \times r}$$

$$= \frac{0.75\,Pr}{1 + 0.75r}$$

Now, we find Banker's Discount on a bill of *Rs. P* due in 9 months at 7%.

Banker's Discount is given by

$$\text{Banker's Discount} = Prt$$

$$= P \times 0.07 \times 0.75 \qquad [\because\ r = 7\% = 0.07]$$

$$= 0.0525P$$

It is given that, True Discount = Banker's Discount

$$0.0525P = \frac{075Pr}{1 + 0.75r}$$

$$0.0525P\,(1 + 0.75r) = 0.75Pr$$

$$0.0525P + 0.039375Pr = 0.75\,Pr$$

$$0.0525P = 0.75Pr - 0.039375Pr$$

$$0.0525P = 0.710625\,Pr \qquad \text{[Divide both sides by } P\text{]}$$

$$0.0525 = 0.710625r$$

$$r = \frac{0.0525}{0.710625} = 0.07387$$

$$r = 7.39\%$$

$\therefore$ The rate of percent is 7.39%.

EXERCISES

1. Find the banker's discount and true discount on a bill of Rs. 12,200 due 4 months at 5% per annum. [**Ans.** Rs. 203.33, Rs. 200]
2. Find the true discount and banker's gain on a bill for Rs. 1,550 due 3 months hence at 6% per annum. [**Ans.** Rs. 22.91, Rs. 0.34]
3. A bill of Rs. 80,000 drawn on May 27, 2008 at 6 month is discounted on August 8, 2000 at 6% per annum. How much does the banker charge and what does the holder receive ? [**Ans.** Rs. 1,499.19, Rs. 78,500.81]
4. A bill of exchange for Rs. 1,000 was drawn on the 3rd April, 2000 payable 3 months after date. It was discounted on 15th April, 2000 at $4\frac{1}{4}\%$ per annum. What was the discounted value of the bill ? [**Ans.** Rs. 990.45]
5. The banker's gain on a bill due 4 months hence at 4% per annum is Rs. 50. Find the sum. [**Ans.** Rs. 2,85,000]
6. The true discount and banker's gain on a certain bill of exchange due after a certain time are respectively Rs. 700 and Rs. 17.50. Find the face value of the bill. [**Ans.** Rs. 28,700]
7. The difference between the true and banker's discount on a bill due after 3 months at 5% interest is Rs. 100. Find (*a*) the true discount, (*b*) the banker's discount and (*c*) the face value of the bill . [**Ans.** (*a*) Rs. 8,000; (*b*) Rs. 8,100; (*c*) Rs. 6,48,000]
8. If the banker's gain on a bill due 6 months hence at 8% per annum is Rs. 600, find the true discount, banker's Discount and the amount of the bill ? [**Ans.** Rs. 15,000;Rs. 15,600; Rs. 3,90,000]
9. A bill of exchange drawn on February 4, 2007 at 6 months after date was discounted on March 27, 2000 at 10% per annum. If the banker's discount is Rs. 600, find the face value of the bill. [**Ans.** Rs. 16,466.25]
10. A bill was drawn on 25th July, 2008 at 7 months after sight and was accepted o presentation on 8th August, 2008. It was discounted on the 30th August, 2008 at 7% per annum interest to realise Rs. 7,920. Find the value of the bill. [**Ans.** Rs. 8,224.42]

11. The banker's discount calculated for 2 year is 28 times his gain. Find the rate of interest. **[Ans.** 1.82%]

12. The banker's discount and the true discount on a bill due 8 months hence are Rs. 500 and Rs. 400 respectively. Find the rate percent and the amount of the bill.
[Ans. 37.5%; Rs. 2,000]

13. A bill of Rs. 10,000 drawn on May 7 for 7 months was discounted on August 19, following, for a cash payment of Rs. 9,880. Find the rate of interest charged by the bank. **[Ans.** 3.88%]

14. A bill for Rs. 4,650 was drawn on 8 March, 2008 at 7 months. It was discounted on 18 May, 2008 and the holder of the bill received Rs. 4,497. What rate of interest did the baker charge ? **[Ans.** 5%]

15. A bill is drawn for Rs. 5,050 on June 20 at five months. It is discounted on September 11 at 5% per annum. How much does the holder of the bill received and what is the banker's gain in the transaction ? **[Ans.** Rs. 4990.50; Rs. 50]

16. A bill for Rs. 2,000 drawn on 20th Dec. 1995 at 6 moths is discounted on 11th April, 1996. If the payment made by the broker is Rs. 1,978, find the rate of interest. Find also the rate the banker gets on this money. **[Ans.** 5.5%, 5.56%]

17. A bill for Rs. 1,800 drawn on 24th September 2008 due 6 months hence was encashed in a bank at 5% for Rs. 1,782. Find out the date on which it was encashed ?
[Ans. 13 January 2009]

18. The difference between banker's discount and true discount on a certain sum for 3 years 4 months at 5% per annum is Rs. 12.50. Find the sum. **[Ans.** Rs. 525]

19. The banker's discount and True discount on a certain sum of money for 20 months are Rs. 64 and Rs. 60 respectively at the same rate. Find the sum and the rate per cent. **[Ans.** Rs. 960, 4%]

20. A bill of Rs. 2,525, drawn on January 13, 2007 at 8 months credit was discounted on 5th July at 5% per annum. Find the banker's discount and gain in this transaction.
[Ans. Rs. 25.25; Re. 0.25]

21. A bill of exchange of Rs. 2,000 drawn on January 6, 2008 at 4 months was discounted on March 28, 2008. If the banker's discount at 5% per annum is Rs. 1,008, find the face value of the bill. **[Ans.** Rs. 1,75,200]

22. A bill of exchange of Rs. 2,000 drawn on 14 March for 8 months is discounted on 2nd August at 5% per annum. How much does the banker charges ? **[Ans.** Rs. 29.32]

23. A bill of exchange of Rs. 2,000 drawn on 15th March, 2008 for 6 months is discounted on 15th May, 2008 at 5% per annum. How much does the bank charge ?
[Ans. Rs. 34.52]

24. *A* received from *B* acceptance for Rs. 30,000 on 1st March, 2007, at 4 months. A got the acceptance discounted at 6% per annum at his bank after 1 month. How much was received by *A* from the bank after discounting the acceptance ? **[Ans.** Rs. 29,550]

25. The holder of a ill for Rs. 17,850 received Rs. 357 less than the amount of the bill by having it discounted at 5% per annum. For how many more days the bill has still to run ? **[Ans.** 146 days]

26. Rajesh draws a bill on Ramesh for Rs. 6,400, payable after 5 months. Ramesh accepts it and returns it to Rajesh. The bill is discounted by Rajesh from a bank for Rs. 6,000 on the same day. Find the rate at which the bill was discounted by the bank. [**Ans.** 15% per annum]

27. A bill of exchange drawn on January 4, 2005 at 5 months was discounted on March 26, 2005. If the banker's discount at 3% be Rs. 603.60, find the face value of the bill.

[**Ans.** Rs. 1,00,600]

28. A bill of exchange for Rs. 27,335 was drawn on 7th April, 2008 payable 7 months after date. It was discounted on the 20th May, 2008 at 7% per annum. What was the discounted value of the bill ? [**Ans.** Rs. 26,422.84]

29. The true discount and banker's gain on a certain bill of exchange due after a certain time are respectively Rs. 50 and Re. 0.50. Find the face value of the bill.

[**Ans.** Rs. 5,050]

30. A bill was drawn on 15th May, 1999 at 8 months after date and was discounted on August 25, 1999 at 6% per annum. If the banker's gain on the basis of simple interest is Rs. 18, for what sum was the bill drawn. [**Ans.** Rs. 32,000]

31. What is the face value of a bill discounted at 5% per annum 73 days earlier than the date of maturity, the banker's gain being Rs. 10 only ? [**Ans.** Rs. 1,01,000]

32. One bill of Rs. 5,000 due on June 13 and another for Rs. 4,000 due on August 25 are both discounted with a banker on April 1. If the difference between the two discounts is Rs. 30, find the rate of interest at which the discount is calculated. [**Ans.** 5% p.a.]

33. The banker's discount and the true discount on a bill due 4 months hence are Rs. 210 and Rs. 200 respectively. find the rate of per cent and the amount of the bill.

[**Ans.** 15%, Rs. 4,200]

34. A bill was drawn on April 14, 2008 at 8 months after date and was discounted on July 24, 2008 at 5% per annum. If the banker's gain on the basis of simple interest is Rs. 20, for what sum was the bill drawn ? [**Ans.** Rs. 51,000]

35. Calculate the banker's gain on a bill of Rs. 18,500 due in 7 months at 9% per annum. [**Ans.** 48.45]

36. A bill for Rs. 50,000 drawn on January 18, 2002 at 9 months was discounted at a bank on January 18,2002 at 9 months was discounted at a bank on which the date of discounting is March 28, 2002, the rate of interest being 6% per annum. How much did the holder receive ? [**Ans.** Rs. 48,299]

37. If the banker's gain on a bill due 3 months hence at 5% per annum is Rs. 1,500. Find the True Discount, Banker's Discount and the amount of the bill.

[**Ans.** Rs. 40,000; Rs. 40,500; Rs. 32,40,000]