MTH302 (BUSINESS MATH AND STATISTICS

Formula 1

Percent = fraction x 100

Formula 2

Percent =base x rate

Formula 3

Average = sum / numberWhere Sum= sum of all data valuesNumber = number of all data values

Formula 4

Change = final value- initial value % change = change x 100/ initial value Or % change = (final value- initial value)x 100/ initial value

Formula 5

Stock yield = annual dividend payments / stock's current share price

Formula 6

Earnings per share= total profits of company/ number of shares

Formula 7

Price earnings ratio = market value per share (or) company's current share price/ Earnings per shareOr Price earnings ratio = market value per share (or) company's current share price/ total profits of company/ number of sharesOr Price earning ratio = market value per share (or) company's current share price x number of shares/ total profits of company

Formula 8

Net current asset value per share = (current assets – total liabilities)/ number of shares outstanding

Formula 9

Dividends = Dividends% x number of shares/ face value of the share

Formula 10

Return on investment in %= total gain x 100/ total cost

Formula 11

Net cost price = list price – discount in Rs.Where discount in Rs = discount % x list price SoNet cost price = list price- (discount % x list price)

Formula 12

Simple interest = principal x time in years x rate of interest per annum / 100Or I= PRT/100

Formula 13

Compound interest = S-PWhere S= P $(1+R/100)^{n}$So Compound interest = P $(1+R/100)^{n}$ -P

S= money accrued after n years or compound amount or accumulated value

P= principalR = rate of interest per annumN = number of periods

Formula 14

PV ordinary annuity (OR) A= r (OR) C x DISCOUNT FACTOR

DISCOUNT FACTOR = $[1-(1+i)^{-n} / i]$PV ordinary annuity (OR) A= r (OR) C x $[1-(1+i)^{-n} / i]$A= discounted or present worth of an annuity

Formula 15

$FV_{\text{ordinary annuity (OR)}}$ A=R (OR) C X ACCUMULATION FACTORAccumulation factor= $[(1+i)^{n} -1/i]$$FV_{\text{ordinary annuity (OR)}}$ S =r (OR) C x $[(1+i)^{n} -1/i]$S =accumulated valueC (OR) r = payments per periods (OR) amount of annuity (OR) cash flow per period i= rate of interest per annumn= number of payments

Formula 16

Selling price = cost price + Rs. Markup on costRs. Markup on cost = cost price x % markup on cost So Selling price = cost price + (cost price x % markup on cost)So Selling price = cost price (1+% markup on cost)

Formula 17

Selling price = cost price + (selling price x % markup on sale)

cost price = Selling price – (Selling price x % markup on sale)Cost price = Selling price (1- % markup on sale)

Formula 18

Rs. Markup = Selling price – Cost price(OR) Rs. Markup on cost= cost price x % markup on costRs. Markup on sale = Selling price x % markup on sale

Formula 19

% Markup on cost= (Selling price – Cost price) x 100/ Cost price(OR) Rs. Markup on cost= Rs. Markup x 100/ Cost price(AND) % Markup onSALE = (Selling price – Cost price) x 100/ Selling price(OR) Rs. Markup on sale = Rs. Markup x 100/ Selling price

Formula 20

New selling price= current (OR) old selling price – Rs. MarkdownWhere Rs. Markdown = % Markdown x current (OR) old selling price New selling price = current (OR) old selling

price – (% Markdown x current (OR) old selling price)New selling price = current (OR) old selling price (1- % Markdown)

Formula 21

Rs. Markdown = current (OR) old (OR) original selling price - new selling price % Markdown= Rs. Markdown x 100/ current (OR) old (OR) original selling price

Formula 22

Actual Rs. Paid = total Rs. Assumed to be paid due to discount (1-% discount)

Formula 23

Margin % = Rs markup (OR) Rs. Margin x 100/ saleAnd Rs. Margin= Margin % x selling priceWhile markup % = Rs. Markup x 100/ costMargin (OR) markup = (Selling price – Cost price) x 100/ Selling priceSelling price =cost price + Rs. Margin / Rs. Markup**Remember unless it is mentioned that markup is on sale, simple markup means markup on cost** **while margin is always on sale**

Formula 24

Markup on sale= % markup on cost / (1+ % markup on cost)

% markup on cost= % markup on sale/ (1+ % markup on sale)

Formula 25

Break even point (OR) BEP in units = fixed cost/ contribution margin per unit

Formula 26

BEP in Rs. = fixed cost x net sales / TOTAL contribution margin

BEP in Rs. = fixed cost x selling price per unit / contribution margin per unit

Formula 27

BEP as % capacity = BEP in units x 100/ production capacity

Formula 28

Total Contribution margin = Net sales- variable cost

Contribution margin per unit = selling price per unit - variable cost per unit

Formula29

Contribution rate = Total Contribution margin x 100/ net sales

Contribution rate = Contribution margin per unit x 100/ selling price per unit

Formula 30

Net income = number of units sold above BEP x Contribution margin per unit

Formula 31

Net loss = number of units sold below BEP x Contribution margin per unit

Net loss= - Net income = - number of units sold above BEP x Contribution margin per unit

BUSINESS MATH AND STATISTICS

TYPES OF EMPLOYEES

1. regular
2. part time
3. incentive base

GROSS EARNINGS/SALARY

Gross earning includes the following?

1. basic salary
2. allowances
    i. house rent
    ii. conveyance allowance
    iii. utilities allowances

TAXATION RULES ON ALLOWNCES

If allowances are 50% of basic salary, the amount is treated as tax free. Any allowance that exceed this allowance are considered taxable, both for the employee as well as the company.

PROVIDENT FUND

A company can establish a provident fund for the benefit of the employees. By law, $1/11^{th}$ of basic salary per month is deducted by the company from the gross earning of the employees. An equal amount i.e. $1/11^{th}$ of basic salary per month is contributed by the company to the provident fund to the account of the employee. Total becomes $2/11^{th}$ of the basic salary.

Example:

Basic = 10000
Allow = 5000
Provident fund= ?

Employee contribution to provident fund = 1/11 x 10000 = 909.1
Company contribution to provident fund = 1/11 x 10000=909.1
Total provident fund = 909.1+909.1 = 1818.2

GRATUITY FUND

A company can establish a gratuity trust fund for the benefit of the employees. There is a saving of $1/11^{th}$ of basic salary on behalf of the employee in gratuity fund.

LEAVES

CL = 18 days per year
EL = 18
SL = 12

Total cost of leaves as percent of gross salary = **18.2%**

SOCIAL CHARGES

Medical / group insurance = 5% of gross salary

Education, club member ship = 5.2% of gross salary
Leaves = 18.2% of gross salary
Total social charges = **29%** of gross salary

GROS REMUNERATION

It is pay or salary typically monetary payment for services rendered, as in an employment like

i. basic salary
ii. house rent allowances
iii. conveyance
iv. utilities
v. provident fund
vi. gratuity fund
vii. leaves
viii. group insurance
ix. mislaneous charges

PERCENTAGE

Percentage is formed by Xing a number called the base by a percent called the rate.

% = base x rate

AVERAGE = sum / n

WEIGHTED AVERAGE

It is one type of earthmatic mean of a asset of data in which some elements of the sets carry more importance (weight) than others.

Example:

	Unit	hours
A	6	300
B	3	200
C	1	100

First convert weight in fractions
6+3+1= 10

6/10 = .6
3/10 = .3
1/10 = .1

weighted average = sum of fractions x hours
= (.6x300) + (.3x200)+ (.1x100) = 250

PERCENTAGE CHANGE

Change = final value – initial value
Percentage change = change / initial value x 100%

STOCK

It is share in the ownership of a company

STOCK YIELD/

It can refer to the rate of income generated from a stock in the form of regular dividends.

EARNING PER SHARE (EPS)

EPS = total profits / number of shares

PRICE EARNING RATIO: = market value of shares / EPS

NET CURRENT ASSET VALUE PER SHARE

= current asset – total liabilities / number of outstanding share

CURRENT ASSETS

The value of all assets that are reasonably expected to be converted into cash with in one year

LIABILITIES

A company's legal debts or obligations that arise during the course of business operations

MARKET VALUE

The price at which investors buy or sell a share of stock at a given time

FACE VALUE

Original cost of a share of stock which is shown on the certificate

DIVIDENT

A company distributes a part of the profit it terms as dividend

DISCOUNT

It is rebate or reduction in pirce

NET COST PRICE = list price – discount

SIMPLE INTEREST I = PTR/100

P = Principal
R= rate
T = time in years
I = interest

COMPOUND INTEREST S= P(1+R/100)^N

P = Principal
R = rate
N = no of years
S = compound interest

ANNUITY

Annuity is sequence of payment/installment

Annuity = C x $[(1+i)^n - 1 / i]$

C= payment per period / amount of annuity
i = interest rate
n = number of payments

ACCUMULATED VALUE

The accumulated volves of an annuity is the total payments mode including the interest.

R = amount of annuity
N = number of payments
I = interest rates
S = accumulated vlue
A = discounted / present worth of an annuity

$S = r [(1+i)^n - 1 / i]$

Accumulation factor for n payments

$[(1+i)^n - 1 / i]$

accumulated value = payment per period x accumulation factor for n payment

DISCOUNTED FACTOR RATE

When future value is converted into present worth, the rate at which the calculations are made.

Example.
Rate of interest = 4.25% = 0.0425
No of periods = 18
Amount of annuity = 1000 Rs.
Accumulation factor = ?
Accumulated value = ?
Discounted value = ?

AF = (1+0.0425) -1 / 0.0425 = 26.24

S = 10000 X 26.24 = 260,240 Rs.
DV = first of all we find discount factor

$DF = (1-1/(1+i)^n / i)$
$= (1-1/(1+i)^n / i)$

$= (1-1/(1+0.0425)^{18} / 0.0425) = 12.4059$
DV= 10000x12.4059 = 124059 Rs.

MATRIX

A matrix is a rectangular array of numbers. The plural of matrix is matrices like

A = (-1 9
-3 4)

DIMENSION

Dimension order of a matrix = rows x columns

RATIO

A ratio is a comparison between things. If in a room there are 30 men and 15 women then the ratio of men to women is 2 to 1. this is written as 2:1 and read is "two is to one". ":" is the notation for a ratio.

PROPORTION

A proportion is an equation with the ratio on each side. It is a statement that two ratios are equal. 3:4 = 6:8 or ¾ = 6/8 is an example of proportion

MIDDLEMAN

A middle man is a person who buys a product directly from the manufacturer, and then either sells the product at retail prices to the public, or sells the product at wholesale prices to a distributor.

Trade Discount

Amount of discount = d × L
Where, d = Percentage of Discount
L = List Price
Net Price = L – Ld = L(1 – d)
Net Price = List Price – Amount of Discount

MARKUP:-

Markup is an amount added to a cost price while calculating a selling price.

Markup as Percentage of Cost (MUC:-

Here markup is some percentage of cost price. For simplicity, it is also named as %Markup on cost. The relation between %markup on cost, cost price and selling price is:

Selling Price = Cost price + (Cost price × %Markup on cost)
= Cost price (1 + %Markup on cost)

Markup as Percentage of Sale price (MUS):
Here markup is some percentage of selling price. For simplicity, it is also named as %Markup on sale. The relation between %markup on sale, cost price and selling price is:

Selling Price = Cost price + (Selling price × %Markup on sale)

Cost price = Selling price – (Selling price × %Markup on sale)
= Selling price (1 – %Markup on sale)

Rs Markup:
Markup in terms of rupees is called Rs markup. The relations between Rs markup, cost price and selling price are:

1. Selling Price = Cost price + Rs Markup
2. Rs Markup = %Markup on cost × Cost price
3. Rs Markup = %Markup on sale × Selling price

For example:
The cost price of certain item is 80Rs and its selling price is 100Rs. Then
Rs Markup = Selling price – Cost price
= 100 – 80
= 20 Rs

MARKDOWN:-

Markdown is a reduction from the list/cost price.

DISCOUNT:-

Discount is a reduction in price which the seller offers to the buyer.

SERIES TRADE DISCOUNT:-

This refers to the giving of further discounts as incentives for more sales. Usually such discount is offered for selling product in bulk.

L = List price = 100
D = discounts

Net price = L(1-D1)(1-D2)(1-D3)
Single equivalent discount rate = L – Netprice = ?%
Rs. Discount = (0.2787)(20000)
= 5,574 Rs

TRADE DISCOUNT-EXAMPLE 2

Find the single discount rate that is equivalent to the series
15%, 10% and 5%.
TradeDiscount
Apply the multiple discount to a list price of Rs. 100.
Net price = $(1-d_1)(1-d_2)(1-d_3)$
= 100(1 -15%) (1 - 10%) (1 - 5%)
=100(0.85) (0.9) (0.95)
= 100(0.7268)
= 72.68
% Discount = 100 - 72.68
= 27.62%

CASH DISCOUNT:-

Cash Discount is allowed on Invoices, Returned Goods, Freight, Sales Tax and A common business phrase for a cash discount is "3/10, net/30," meaning that a 3% discount is offered if the amount due is paid within 10 days; otherwise 100% of the amount due is payable in 30 days

CASH DISCOUNT-EXAMPLE

Invoice was dated May 1st. The terms 2/10 mean that 2% discount is offered if invoice is paid up to 10thMay.

What is the net payment for invoice value of Rs. 50,000 if paid up to 10th May?

Cash Discount

N = L(1 – d)
= 50,000(1-0.02)
= 50,000(0.98)
= 49,000 Rs.

DISCOUNT PERIODS

Discount Periods are periods for the buyer to take advantage of Discount Terms.

CREDIT PERIODS

Credit Periods are periods for the buyers to pay invoices within specified times.

PARTIAL PAYMENTS

When you buy on credit and have cash discount terms, part of the invoice may be paid within the specified time. These part payments are called **Partial Payments**.

You owe Rs. 40,000.
Your terms were 3/10 (3% discount by 10th day).
Within 10 days you sent in a payment of Rs. 10,000.
Rs. 10,000 was a part payment.
How much is your new balance?

First we will find the amount that if 3% discount is given on it, the net amount is 10000Rs.
Let that amount is t. Then
10000 = t (1 – 0.03)
This implies, $t = \frac{10000}{(1 - 0.03)}$

Thus, t = 10309Rs
This means that although you pay 10,000Rs, due to 3% cash discount 10309Rs among 40,000Rs is paid.
Hence the new balance = 40000 – 10309 = 29691Rs.

MARKETING TERMS

There are a number of marketing terms.

First of these is the **Manufacturer Cost**. This is the cost of manufacturing.
Next is the price charged to middlemen in “The Distribution Chain”.
The Distributor>Wholesaler>Retailer is a chain.
The next term is the **Selling Price**. This is the price charged to Consumers by Retailers. It may or may not be the same as list price.

Operating Expenses

Expenses the company incurs in operating the business, e.g. rent, wages and utilities is called operating Expenses

Selling Price:-

Selling Price is composed of Cost and Rs Markup.
Selling Price (S) = Cost (C) + Rs Markup (M)

MARGIN:-

While determining Sale Price, a company includes the operating expenses and profit to their own cost. This amount is called the margin of the company. It is usually calculated as percentage but can also be expressed as rupees. It is also named as **markup on sale.**

Margin or markup on sale = $\frac{\text{Selling price - Cost price}}{\text{Selling Price}} \times 100\%$

Selling price = Cost price + Rs Margin

Margin and markup confuse many. By margin, company evaluates that for every rupee generated in sales, how much is left over to cover basic operating costs and profit. Markup represents the amount added to a cost to arrive at a selling price

Markup on cost = Selling price – Cost price ×100%

Cost price

Note: Remember unless it is mentioned that markup is on sale, simple markup means markup on cost.

RS. MARKUP AND PERCENT ON COST

Tanveer's flower business sells floral arrangements for Rs. 35.
To make his desired profit, Tanveer needs a 40% Markup on cost.
What do the flower arrangements cost Tanveer?
What is the Rs. Markup?

Rs. Markup and Percent Markup on Cost

Sale price S = Cost C + {C ×Markup on cost (MUC)}
S = C + 0.40(C)
35 = 1 .40(C)
C = 35/1,4 = 25 Rs.
Rs Markup = 25 x 0.4
= 10 Rs.

Selling Price = Cost price + (Selling price × %Markup on sale)

CONVERTING MARKUPS

Convert 50% Markup **(MU) on Cost** to %**MU on Sale**
Formula for converting %Markup on Sale (mus) to %Markup on Cost Price (muc) is:
% Markup on Selling Price (mus) = %Markup on Cost / (1 + %Markup on Cost)
mus = muc/(1+muc)

Solution

% Markup on Sale (mus) = 0.5 / (1+0.5) = 0.5/1.5
mus = 0.3333 = 33.33%

Converting Markups

Converting 33.33% **MU on Sale** to %**MU on C**
Convert % Markup on Cost (muc) to % Markup on selling price (mus):
% Markup on cost = % Markup on S / (1 - % Markup on S)
muc = mus / (1-mus)

Solution

Markup on cost = 0.3333/(1 – 0.333)
= 0.3333/0.6666 = 0.5
= 50%

MARKDOWN

Reduction from original selling Price is called Markdown.

Formula

%Markdown = (Rs. Markdown / Selling Price (original)) ×100%

MARKDOWN-EXAMPLE 1

Store A marked down a Rs. 500 shirt to Rs. 360.
What is the Rs. Markdown?
What is the %markdown?

Rs. Markdown

Let S = Sale price

Rs. Markdown = Old S – New S
= Rs. 500 – Rs. 360
= Rs. 140 Markdown

% Markdown

$$\% \text{ Markdown} = \frac{\text{Markdown}}{\text{Old S}} \times 100\%$$

$$\% \text{ Markdown} = \frac{140}{500} \times 100\%$$

$$= 0.28 \times 100\%$$

$$= 28\ \%$$

PROJECT FINANCIAL ANALYSIS

Financial analysis is the analysis of the accounts and the economic prospects of a firm, which can be used to monitor and evaluate the firm's financial position, to plan future financing, and to designate the size of the firm and its rate of growth.

COST ESTIMATES

cost estimates cover calculations based on quantities and unit rates.

REVENUE ESTIMATES

Along with costs even revenues are calculated. These calculations are similar to component costs.

FORECASTS OF COSTS

Forecasting requires a technique for projections. One of such technique, Time Series Analysis, will be covered later in this course.

FORECASTS OF REVENUES

These will be done similar to the forecast of costs. Here also the method must be determined first. Once the methodology is clear, the worksheets can be prepared easily.

NET CASH FLOWS

The difference between Revenue and Cost is called the Net Cash flow. This is an important calculation as the entire Project Operation and Performance is based on its cash flows.

BENEFIT COST ANALYSIS

This is the end result of the Project Analysis. The ratio between Present Worth of Benefits and Costs is called the Benefit Cost (BC) ratio.

INTERNAL RATE OF RETURN

Internal Rate of Return or IRR is that Discount Rate at which the Present Worth of Costs is equal to the Present Worth of Benefits. IRR is the most important parameter in Financial and Economic Analysis.

BREAK-EVEN ANALYSIS

In every project where investment is made it is important to know how long it takes to recover the investment. It is also important to find the breakeven point where the Cash Inflow becomes equal to Cash Outflow. After that point the company has a positive cash flow (i.e. there is surplus cash after meeting expenses).

$$\textbf{BEP in units} = \frac{\textbf{Fixed Costs}}{\textbf{Contribution Margin per unit}}$$

BEP in Rs calculates the revenue that must be obtained to reach break even point.

$$\textbf{BEP in Rs} = \frac{\textbf{Fixed Costs}}{\textbf{Contribution Margin}} \times \textbf{Net Sales}$$

BEP in Rs = $\frac{\text{Fixed costs}}{\text{Contribution Margin per unit}}$ **× Selling Price per unit**

BEP as % of capacity = $\frac{\text{BEP in units}}{\text{Production capacity}}$ **× 100 %**

Excel Functions for Financial Analysis

AMORDEGRC(cost,date_purchased,first_period,salvage,period,rate,basis)

If an asset is purchased in the middle of the accounting period, the prorated depreciation is taken into account.

AMORLINC(cost,date_purchased,first_period,salvage,period,rate,basis)

Returns the depreciation for each accounting period. If an asset is purchased in the middle of the accounting period, the prorated depreciation is taken into account.

CUMIPMT
Returns the cumulative interest paid between two periods.
CUMPRINC
Returns the cumulative principal paid on a loan between two periods

DB(cost,salvage,life,period,month)
Returns the depreciation of an asset for a specified period using the fixed-declining balance method.
DDB(**cost**,**salvage**,**life**,**period**,**factor)**
Returns the depreciation of an asset for a specified period using the double declining balance method or some other method you specify
MIRR(**values**,**finance_rate**,**reinvest_rate**)
Returns the modified internal rate of return for a series of periodic cash flows. MIRR considers both the cost of the investment and the interest received on reinvestment of cash.
IRR(values,guess)
Returns the internal rate of return for a series of cash flows
PV(rate,nper,pmt,fv,type)
Returns the present value of an investment
NPV(rate,value1,value2, ...)
Returns the net present value of an investment based on a series of periodic cash flows and a discount rate
XNPV(rate,values,dates)
Returns the net present value for a schedule of cash flows that is not necessarily periodic.
SLN(cost,salvage,life)
Returns the straight-line depreciation of an asset for one period
SYD(**cost**,**salvage**,**life**,**per**)
Returns the sum-of-years' digits depreciation of an asset for a specified period

$$\textbf{SYD} = \frac{\textbf{(cost-salvage) x (life – per + 1) x 2}}{\textbf{(life)(life + 1)}}$$

VDB(cost,salvage,life,start_period,end_period,factor,no_switch)
Returns the depreciation of an asset for any period you specify, including partial periods, using the double-declining balance method or some other method you specify. VDB stands for variable declining balance.
XIRR(**values**,**dates**,**guess**)
Returns the internal rate of return for a schedule of cash flows that is not necessarily periodic.

LINEAR EQUATIONS

Linear equations have following applications in Merchandising Mathematics:

- Solve two linear equations with two variables
- Solve problems that require setting up linear equations with two variables
- Perform linear Cost-Volume-Profit and break-even analysis employing:
- The contribution margin approach
- The algebraic approach of solving the cost and revenue functions

Production Capacity (PC)
It is the number of units a firm can make in a given period.

Contribution Margin
Contribution Margin is the Rs. amount that is found by deducting **Variable Costs** from **Sales or revenues** and **'contributes'** to meeting **Fixed Costs** and making a **'Net Profit'**Contribution Margin = Net Sales – Variable Cost = S – VC
Contribution margin per unit =CM =Sale price per unit – Variable cost per unit
Contribution Rate (CR)

$$\text{Contribution rate} = \frac{\text{Contribution Margin}}{\text{Net sales}} \times 100\% = \frac{\text{CM}}{\text{S}} \times 100\%$$

$$\text{Contribution rate} = \frac{\text{Contribution Margin per unit}}{\text{Sale price per unit}} \times 100\% = \frac{\text{CM}}{\text{S}} \times 100\%$$