CMA STUDENTS'

E-BULLETIN

FOUNDATION

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JUNE, 2017 ISSUE

(SYLLABUS 2016)

THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

Behind every successful business decision, there is always a CMA

Message from the
President

Dear Students,
Greetings,

Education is the ability to listen to almost anything without losing your temper or your self-confidence." — Robert Frost

We all acknowledge the importance of education, knowledge and truth for promoting the world outlook. Education is a must for global citizenship and such a person always works for the benefits of humanity. I personally believe that education produces citizens who are men of intellectual and moral integrity. Education aims at producing ideal human-beings. These people are truly cultured, wise, tolerant and public-spirited.

The more we learn, the easier learning becomes. Once our mind develops that aptitude for absorbing new facts it becomes much more efficient at learning things. A good education is useful in professional course as well and an all round education will get a person off to a good start in life.

I am happy to know that you are finding E-bulletins useful in your preparation and for that I must appreciate the effort taken by the Directorate of Studies. My sincere thanks go to all the eminent academicians; contributed in this issue of the bulletin.

I am sure all of you have come to know that the **Hon'ble President of India, Shri Pranab Mukherjee** has consented to be the **Chief Guest of the Global Summit 2017** to be held on 29th and 30th June, 2017 in Kolkata. **Hon'ble Governor of West Bengal Shri Keshari Nath Tripathi** and **Hon'ble Minister of State for Finance and Corporate Affairs, Govt. of India, Shri Arjun Ram Meghwal** will be the **Guests of Honour**.

Being the true Ambassador of your Institute I am asking you to please come and join in the programme and make it remarkable. Boost up your energy and participate in the programme whole-heartedly!

Best wishes,

CMA Manas Kumar Thakur
President
The Institute of Cost Accountants of India

Be a CMA, be a Proud Indian

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Message from the
Chairman

"When an idea exclusively occupies the mind, it is transformed into an actual physical or mental state" -Swami Vivekananda

Dear Students,

Hope, those who appeared in the June term of examination have done well. A truly educated man always seeks perfection. He is not a specialist who has perfected only his body or the intellect or the mind but one who seeks the development of all his faculties.

To face with all kinds of challenges in life you need to be educated. Education is important for the personal, social and economic development of the nation. Education is important to live with happiness and prosperity. The value of education and its significance can be understood from the fact that as soon as we are born, our parents start educating us about an essential thing in life.

In today's era, it is extremely important to know about the significance of a good education. A good education does not simply consist of getting a degree. It goes beyond that. Education provides the capability to know what is important for him, what is wrong and what is right. Through this course we are trying to offer you a comprehensive knowledge so that tomorrow you may combat with the challenges efficiently. After getting professionally qualified, you will be able to fight the various social evils and feels empowered to eradicate such problems too.

Thorough preparation in the subjects will help you and I feel the issues of E-bulletin are helping you in that way. Mock Test Papers are also giving you the needed impetus.

All of you must be knowing about the Global Summit,2017 to be held in Kolkata on 29th & 30th June, 2017. Please try to attend the Summit as the **Hon'ble President of India, Hon'ble Governor of West Bengal and Hon'ble Minister of State for Finance & Corporate Affairs, Government of India** has kindly consented to grace the occasion.

"Education is the passport to the future, for tomorrow belongs to those who prepare for it today".

Have a bright future ahead,

CMA Pappa Rao Sunkara,
Chairman,
Training & Education Facilities (T& EF) Committee

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GLOBAL SUMMIT 2017

Venue

Day - 1 (29th June 2017) 11.00 a.m.
Main Auditorium of Science City
JBS Haldane Avenue, Kolkata - 700046
&
Day - 2 (30th June 2017) 09.00 a.m.
Eastern Zonal Cultural Centre (EZCC)
IB-201, Sector-III, Salt Lake City
Kolkata - 700106

ACADEMIC & ECONOMIC REFORMS
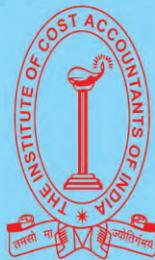
Role of Cost & Management Accountants

CHIEF GUEST

Shri Pranab Mukherjee
Hon'ble President of India

GUESTS OF HONOUR

Shri Keshari Nath Tripathi
Hon'ble Governor of West Bengal

Shri Arjun Ram Meghwal
Minister of State for Finance and Corporate Affairs, Govt. of India

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THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

Statutory Body under an Act of Parliament

Behind Every Successful Business Decision, there is always a CMA

Contents

Behind every successful business decision, there is always a CMA

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KNOWLEDGE
UPDATE

In this section of e-bulletin we shall have a series of discussion on each of these chapters to provide a meaningful assistance to the students in preparing themselves for the examination at the short end and equip them with sufficient knowledge to deal with real life complications at the long end.

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PAPER: 1, PART- I

FUNDAMENTALS OF ECONOMICS & MANAGEMENT (FEM) - ECONOMICS
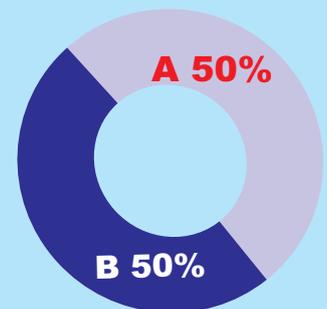
CMA Sucharita Chakraborty
Jt. Director, Studies
She can be reached at:
studies.jd1@icmai.in

CMA

Your Preparation Quick Takes

Syllabus Structure

A Fundamentals of Economics 50%
B Fundamentals of Management 50%

A 50%

B 50%

Learning Objectives:

In this issue, you will learn about Return to scale and difference between Return to scale and Economies of scale. Since you will become Cost Accountant very soon, you have to understand these concepts from the beginning. Read this very carefully.

Return to Scale and Economies of Scale

In economics, returns to scale and economies of scale are related terms that describe what happens as the scale of production increases. They are different terms and should not be used interchangeably
.
Returns to scale are concerned with changes in the level of output as a result of changes in the amount of factor inputs used. "Returns to scale" refers to the percentage change in output achieved by a particular production process when all inputs are increased by the same percent. A production process exhibits decreasing, constant, or increasing returns to scale, depending on whether the quantity of output increases less than, the same as, or more than proportionally when all the inputs are increased by the same percent. (That is, if all inputs are increased by 5%, output increases by less than 5% in the case of decreasing returns to scale; by 5% in the case of constant returns to scale; and by more than 5% in the case of increasing returns to scale.)

Economies of scale are concerned with changes in cost per unit of output. *Economies of scale are the reduction in the per unit cost of production as the volume of production increases.*
So, if you double the amount of all factors of production and output also doubles, then you have constant returns to scale. If output more than doubles, you have increasing returns to scale. If output less than doubles, you have decreasing returns to scale.
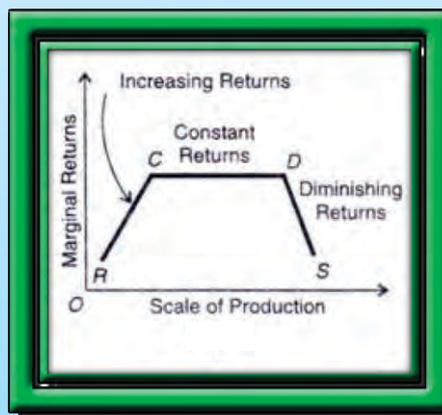If doubling output can be acheived with total cost less than doubling, you can achieve economies of scale. If doubling output can only be achieved with total costs more than doubling, you are faced with diseconomies of scale.
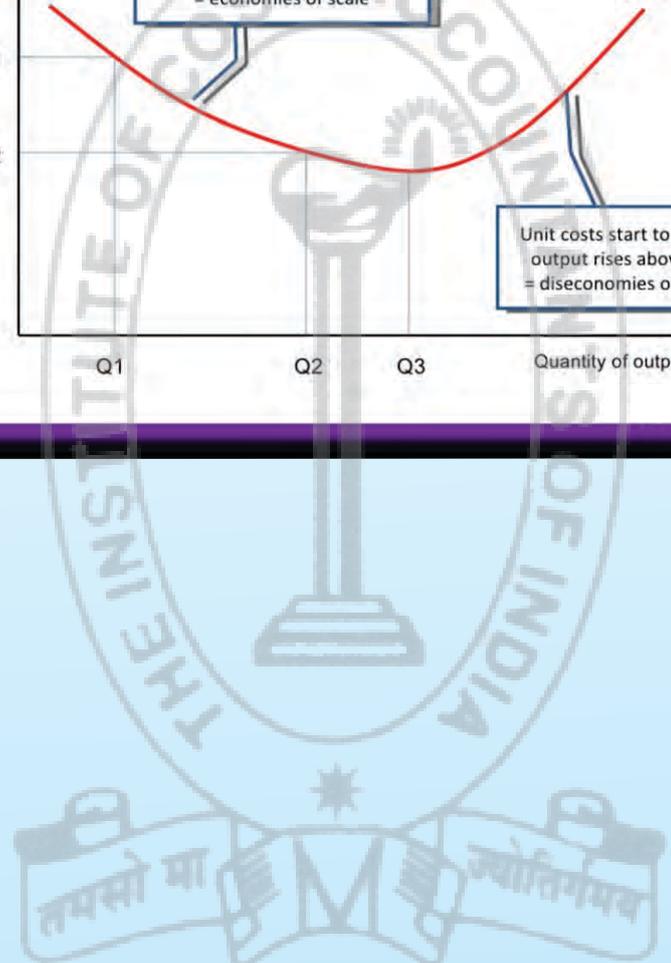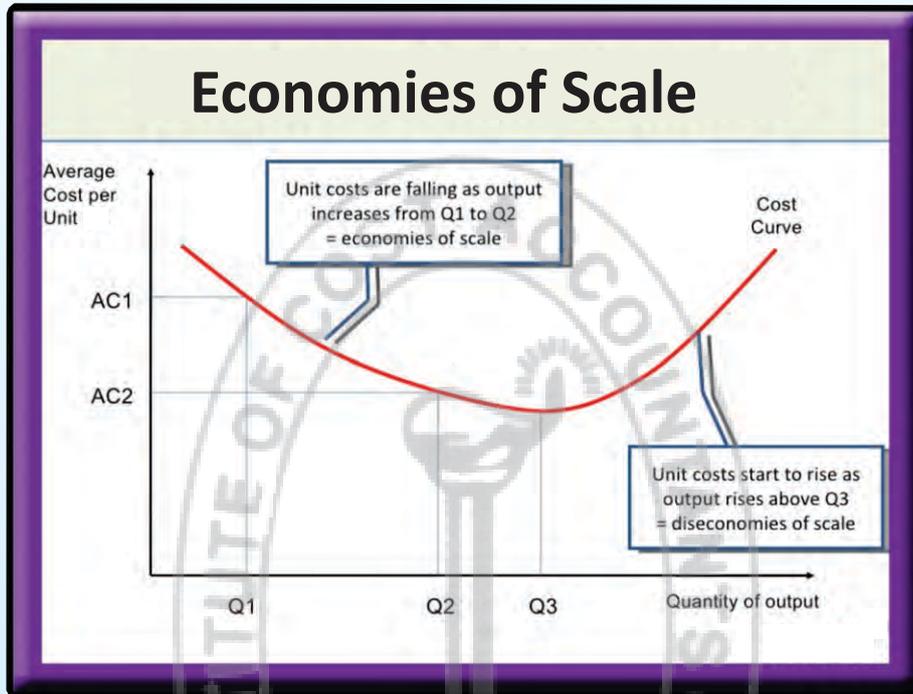
"Economies of scale" refers to a key implication of increasing returns to scale: the average cost of production declines as the scale of production increases. It is thus more "economical" to produce on a large scale.
However, increasing returns to scale do not necessarily imply economies of scale, nor do decreasing returns to scale always imply diseconomies of scale. For example, if you double all factors of production, and output increases by a factor of 2.5, you have increasing returns to scale, but if scarcity of resources meant the price you paid for the total factors of production increased by a factor of 3, then the cost per unit would increase, resulting in diseconomies of scale.

Summary:
In economics, returns to scale and economies of scale are related but different terms that describe what happens as the scale of production increases in the long run, when all input levels are variable. The term returns to scale arises in the context of a firm's production function. It explains the behavior of the rate of increase in output (production) relative to the associated increase in the inputs (the factors of production) in the long run. In the long run all factors of production are variable and subject to change due to a given increase in size (scale). While economies of scale show the effect of an increased output level on unit costs, returns to scale focus only on the relation between input and output quantities.

Return to Scale

Economies of Scale

5

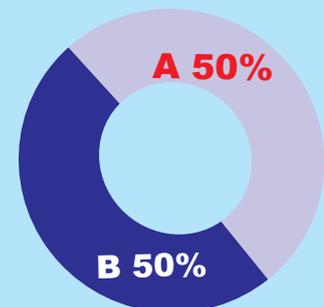# FUNDAMENTALS OF ECONOMICS & MANAGEMENT (FEM) - MANAGEMENT

CMA (Dr.) Sumita Chakraborty
Jt. Director, Studies
She can be reached at:
studies.jd2@icmail.in

CMA

Your Preparation Quick Takes

Syllabus Structure

A Fundamentals of Economics **50%**
B Fundamentals of Management **50%**

A 50%
B 50%

Learning Objectives:

- Students will demonstrate their knowledge of business and management principles
- Students will reveal effective written and oral communication
- Students will exhibit an awareness of the global environment in which businesses operate
- Students will display the ability to recognize when change is needed, adapt to change as it occurs, and lead change

Practicing regular exercise can keep your energy levels up, resulting in a more engaged mind in your preparation for examination. Assessing how you prioritize your daily activities and tasks will help determine whether you are working efficiently or against yourself.

When you've finally established a plan and developed some strategies, it's time to utilize them. Don't let your hard work go to waste; think about how much more effective and valuable you will be. Most importantly, it's you who has the opportunity to direct your life, so try to do it in the way that is most beneficial to you.

It's interesting to note that organized people are characterized by the following traits: efficient, punctual and reliable. Wouldn't we all wish to be like that? By implementing some simple strategies, someone who considers themselves disorganized will be able to become a more efficient and effective person.

By understanding how to set achievable goals, manage, prioritise and schedule different tasks and learning how to avoid distractions, we can make the most of our time to accomplish the things we want to do. *"Time is the most valuable thing a man can spend."*

Here we are discussing about '**Motivation**'. Today, virtually all people have their own concept of motivation and they include various terms like motives, needs, wants, desires, incentives etc. in defining motivation. Latin word *movere* ; which means to move can be traced back to express the term motivation.

According to McFarland 'Motivation' refers to the way in which urges, drives, desires, aspirations, strivings, or needs direct, control or explain the behaviour of human beings".

Relationship among 'motive', motivating' and 'motivation':

Fig-1

Motivation & Behaviour- Motivation causes goal-directed behaviour. Feeling of a need by an individual generates a feeling that he lacks something. This lack of something creates tension in the mind of the individual. Since the tension is not an ideal state of mind, the individual tries to overcome this by engaging himself in a behaviour through which he satisfies his needs. This is goal-directed behaviour and the following diagram can help to understand this:

Need → Tension → Goal-directed behaviour → Goal-fulfilment/ need satisfaction

Favourable environment

Fig-2

There are many needs which an individual may have and there are various ways in which these may be classified. The basic objective behind classification of needs into different categories is to find out similarity and dissimilarity in various needs so that incentives are grouped to satisfy the needs falling under one category or the other.

Thus needs may be grouped into three categories:

Primary needs

Secondary needs &

General needs.

There utilities are found in various theories of motivation as hese theories try to explain the different needs which people seek to satisfy. If the need is not satisfied even after the goal-directed behaviour, the person may feel frustration which can be defined as the accumulation of tension because of non-fulfilment of needs. As a result, there may be great variations in the behaviour, however, this can be generalised and may be presented as:

Flight (External withdrawal)

Towards source

Externalised

Person

Non-satisfaction of need → Frustration → Aggression

Towards others

Internalized

Inanimate object

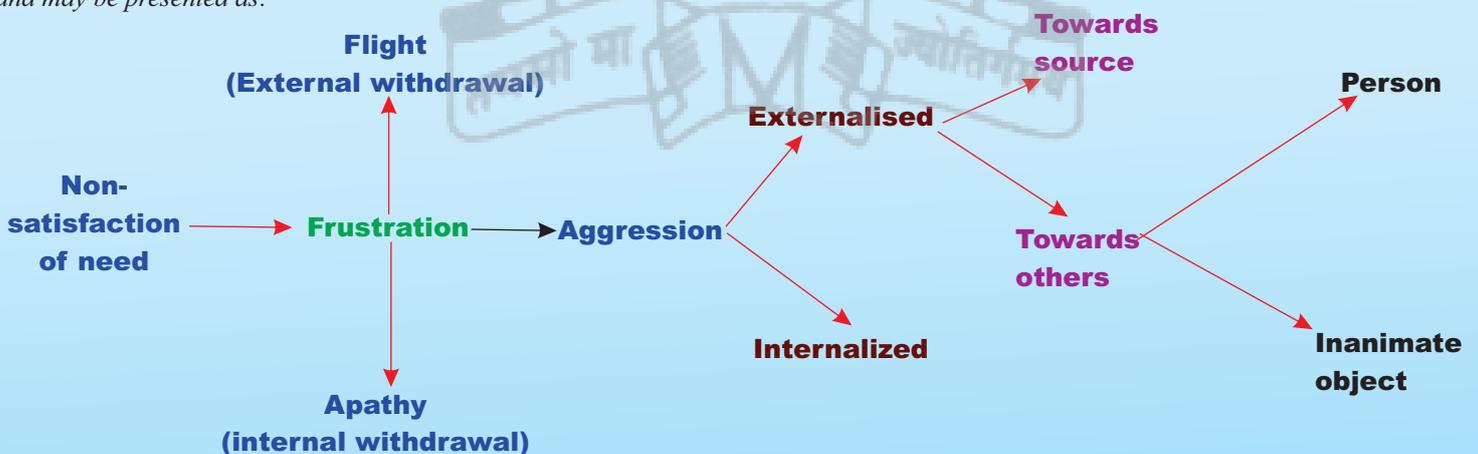Apathy (internal withdrawal)
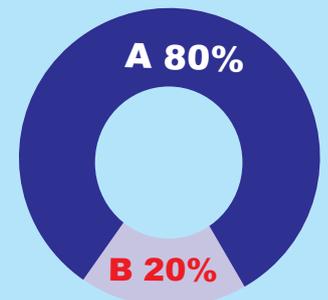
Fig-3

PAPER: 2

FUNDAMENTALS OF ACCOUNTING (FOA)

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Quick
Takes

Syllabus Structure

A Fundamentals of Financial Accounting **80%**
B Fundamental of Cost Accounting **20%**

A 80%

B 20%

Learning Objectives:
In order to internalize the concepts of subjects like accountancy one has to have an understanding of the learning objectives of the chapters. Try to go through the Statement of Objects and Reasons issued for every topics as it would give you a background to your study.

Recap : *In past issues we have discussed various topics from section A relating to Financial Accounting. Now we will concentrate on a very interesting topic from section B relating to Management accounting. Before we proceed let us have an idea about the management accounting. In simple terms it's a branch of accounting where post mortem analysis is done after the financial accounting is over. It helps the authority (management) to make decisions. How marginal costing helps in decision making is also there in the syllabus which we will discuss in the next issue. Here we will confine ourselves to the basic concepts of marginal costing*

.

Marginal costing is a technique of analyzing cost into fixed and variable and to see its impact over cost , volume and profit. It is popularly also known as cost, volume and profit analysis. (CVP Analysis). In fact marginal cost is the variable cost only. Some experts like to call fixed cost as irrelevant cost in the sense that it does not take part in the decision making. By nature it remains fixed and does not vary with the change in production. In that sense it is irrelevant only. However on the other hand marginal cost is the additional cost for producing one more unit. Therefore by nature it is variable and takes vital part in decision making. For example, in a corporate meeting a seminar hall is rented for Rs. 5000 for an evening. Hall rent will not change whether 200 or 500 people attend the programme. However, the cost of tea or food packets will increase or decrease depending on the number of attendance and hence cost of tea is a variable expense and to be handled very carefully.

Though very limited questions are set on this topic at foundation level yet for update of knowledge it is important to learn.

With this background let us see how marginal costing technique is applied in real life business decisions. Following are the cases where marginal costing technique can be used for taking business decisions:

1. Replacement of old equipment
2. Closing down or suspending activities
3. Profitable product mix under capacity constraint
4. Outsourcing and idle facilities
5. Extra order
6. Make or buy

Some important cases are explained through illustrations in the following lines.

ILLUSTARTION 1: EXTRA ORDER AT LOWER PRICE
A company which has capacity to produce 20000 units is producing at a cost of Rs. 20 per unit while utilizing 50 % of its capacity. 40% of the total cost is fixed and 60 % is variable.

If there is an offer to buy 8000 additional units at Rs. 18, can this be accepted?

SOLUTION:
Variable cost per unit: 60% of Rs.20 = Rs. 12
Existing production at 50 % capacity is 10000 units.
Idle capacity: 10000 units
Therefore the company can produce 10000 additional units without incurring any additional fixed cost.
Contribution per unit when the price offered is Rs.18/-:

Price offered	18
Variable cost	12
Contribution	6

Acceptance of offer will increase the total contribution towards fixed cost and total profit by Rs. (8000x6)= Rs. 48000. It is therefore advisable to accept the offer.

ILLUSTARTION 2: MAKE OR BUY
A radio manufacturing company finds that while it costs Rs.6.25 to make a component the same is available in the market at Rs. 5.75 each with an assurance of continued supply. The analysis of cost is as follows :

Materials	2.75
Labour	1.75
Other variables	0.50
Depreciation and other fixed cost	1.25
Total	6.25

Should you make or buy?
What would be your decision if the supplier offered the component at Rs.4.85?

SOLUTION
Variable cost per unit of the component:

Materials	2.75
Labour	1.75
Other variables	0.50
Total	5.00

a. The decision of make or buy is determined by the fact whether the capacity to be released by stopping manufacture of the component can be utilized in making some other profitable product or not. If the released capacity can be utilized otherwise profitably, buying is preferable to making.

If the released capacity cannot be profitably employed elsewhere the fixed cost of Rs.1.25 will have to be incurred and the saving in cost will be Rs. 5 only (i.e the variable cost). The net cost of buying will be Rs.5.75+Rs.1.25 = Rs. 7 which in comparison to making is high. Therefore buying from outside will not be a wise decision. In this context please note that fixed cost in this way does not take part in decision making. Some experts prefer to call fixed cost as 'irrelevant cost 'while decision making.

b.   If the price offered by the supplier is Rs.4.85 which is less than the variable cost of Rs. 5 it will be economical to buy component even if the capacity released cannot be profitably employed. This will result in saving of Rs. 5- 4.85 = Rs. 0.15 per unit. Saving will be more if the released capacity can be utilized elsewhere.

ILLUSTRATION 3 : LIMITING OR KEY FACTOR AND PROFITABLE PRODUCT MIX

A company producing products A and B using single production process has the following cost data:

	A	B
Selling price per unit (Rs.)	10.00	15.00
Variable cost per unit (Rs.)	6.00	8.00
Labour hours required per unit of production 1 hour		2 hours
Maximum demand in the market (units)	100000	200000
Total available labour hours 400000 hours		
Fixed cost per annum Rs. 1000000		

Considering the limiting factor of labour hours and market demand you are required to suggest the best combination of the products to maximize profit of the company.

SOLUTION :

	A	B
Selling price per unit	10.00	15.00
Variable cost per unit	6.00	8.00
Contribution per unit	4.00	7.00
Labouir hour per unit	1.00	2.00
Contribution per labour hour	4.00	3.50

Since labour is a limiting factor, we have to maximize the contribution to the limiting factor. Accordingly, product A enjoys the priority of production over product B. the other limiting factor is the market demand. Hence, product A must be produced upto its market demand, and then product B till the available labour hours limit id s reached.
Accordingly, the best combination of product mix and the expected profit would be as under :

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PRODUCT	UNITS	CONTRIBUTION P.U	CONTRIBUTION	LABOUR HR P.U	LABOUR HOUR
A	100000	4	400000	1	100000
B	150000	7	1050000	2	300000
			1450000		400000
Less: fixed cost			1000000		
Profit			450000		

Note :

Since labour is the limiting factor, after producing 100000 units of A, the remaining labour hours are 300000. Product b requires 2 hours of labour per unit. Hence the number of units of B that can be produced is 300000/2 = 150000 units.

Keep solving these kinds of problems and put stress on the basics and the formula as discussed above.

With best wishes
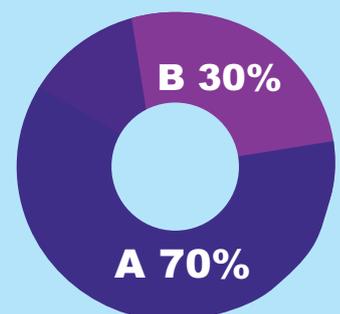
PAPER: 3

FUNDAMENTALS OF LAWS AND ETHICS (FLE)

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Syllabus Structure

A Fundamentals of Commercial Laws **70%**
B Fundamentals of Ethics **30%**

B 30%

A 70%

Learning Objectives:
- Read the Study Material minutely.
- For details or if you don't understand Study Material or the section is important to identify the topic, then refer to Bare Act, otherwise reference to Bare Act is not necessary. For Company Law, book by Avtar Singh is recommended. For other laws Institute Study Material is sufficient.
- The words used in any of the texts as mentioned above should be understood by immediate reference to the Dictionary.
- The main points coming out in any of the provisions should be either underlined or written in separate copy which has to be repeated again and again.
- Theoretical knowledge should be adequate and clear before solving practical problems.
- Don't write wrong English. It changes the meaning and therefore answer may be wrong even when the student's conception is clear. Also don't make spelling mistakes.

INDIAN CONTRACT ACT

Consideration and its presence is one of the prerequisite of a valid contract. Section 2(d) of the Indian Contract Act states " when at the desire of the promise, the promise or any other person has done or abstained from doing or does or abstains from doing, or promises to do or promises to abstain from doing something, such an act or abstinence or promise is called a consideration for the promise". In simple words consideration means 'in lieu or in return of something'. Consideration as a concept is two dimensional in nature; both the parties should get something in a contract. And when both the parties get something then only a contract becomes capable of creating a legal relationship. This "something" or consideration may be in form of cash, goods, benefit, right or may be some detriment, forbearance or responsibility upon the other party.

For e.g when A agrees to sell his horse for Rs.10,000 to B, then B's promise to pay Rs.10,000 is the consideration for A's promise to sell his horse and at the same time A's promise to sell the horse is the consideration for B's promise to pay Rs.10,000.

RULES REGARDING CONSIDERATION:

1) Consideration must move at the desire of the promisor or offeror. Any act done at the desire of the third party of a contract is no consideration. An offeree should send only such consideration as is desired by the offeror or the promisor. For e.g. In the famous Durgaprasad v/s Baldeo case, A and B are to share profits equally by running a market where A would provide all the essential requirements and B would run the market. Eventually upon C's request and for a consideration from C, B makes the market a 24 hr market. On C's refusal to pay the consideration, B claimed the same from A for the additional work for which A denied. It was held by the court that the additional work done by B was not required by A and hence B cannot claim any consideration from A.

2) Consideration may move from promisee or any other person. Although it is a necessity that the consideration must move at the desire of the promisor, it may be supplied either by the promisee or any other person. Thus though a stranger to a contract cannot sue, yet a stranger to a consideration i.e. a third party can maintain a suit.

3) Consideration, in regard to time, may be past, present or future. Consideration which is sent before the formation of the contract is called past consideration and those which gets passed at the time of formation of a contract is present consideration while consideration which is to be passed after the contract at a future date is termed as future consideration.

4) Consideration need not be adequate i.e. considerations need not be of equal magnitudes. Inadequacy of consideration generally does not affect the validity of the contract unless and until it is proved that such consent was not free. Thus it can be said inadequacy of consideration will be treated as evidence to be looked into by the court where the party pleads coercion, undue influence or fraud.

5) Consideration must be real and competent. Any illusionary or unbelievable promise makes a transaction to be void. Any agreement, which the promise is already duty bound to perform, is void being without competent consideration. Thus a consideration must be competent i.e. it must be something to which the law attaches some value.

6) Consideration must be legal. (please refer to 'legality of the object.)

IMPORTANCE OF CONSIDERATION:

Any gratuitous promise i.e. any promise without consideration cannot create a legal relationship. If we analyze the concept of contract then we will see that it consists of 2 separate parts, 1) a promise 2) consideration for the promise. A contract cannot be thought of without a proper consideration. Hence it is said that an agreement without consideration is void, i.e.'No consideration, no contract'.

However there are certain EXCEPTIONS to the above rule of NO CONSIDERATION, NO CONTRACT.

- ✓ Any agreement without consideration, registered and expressed in writing and made on account of natural love and affection between parties standing in near relation to each other is valid. In this connection it is to be borne in mind that nearness of relation itself does not necessarily mean the existence of natural love and affection. For e.g in Raihikhy Dohee v/s Bhootnath case, a Hindu husband by a registered document, after mentioning quarrels and disagreement with his wife, promised to pay his wife a sum for her maintenance and separate residence. The court held that the agreement was unenforceable.
- ✓ No consideration is necessary to create agency.
- ✓ Consideration is not necessary to effect bailment.
- ✓ The rule of no consideration, no contract does not apply between donor and done for gifts actually made.
- ✓ A promise to pay whole or part of a debt barred by the law of limitation can be enforced is it is in writing and is signed by the debtor or his authorized agent.
- ✓ A promise made without consideration is valid if it is a promise to compensate part or wholly a person who has already voluntarily done something for the promisor, which the promisor was legally compellable to do.

Tips to answer –
- ✓ *Answers in examination should be concise and in own language as far as practicable.*
- ✓ *Try to supplement answers with relevant sections and case laws where ever required.*

Best of luck students for your examination!

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FUNDAMENTALS OF BUSINESS MATHEMATICS AND STATISTICS (FBMS)

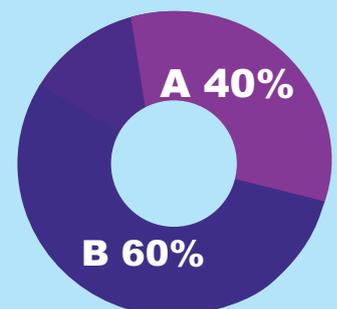**Dr. Lakshmi Kanta Roy**
Guest Lecturer
Vidyasagar Mahavidyalaya

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Syllabus Structure

A Fundamentals of Business Mathematics 40%
B Fundamentals of Business Statistics 60%

A 40%
B 60%

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VARIATION

1.1 INTRODUCTION

It is our common experience that (i) When liquid is heated, its volume expands, (ii) When demand of certain product increases, the price of the same product of increases, (iii) the deficiency in supply of essential commodities causes rise of the price of the same commodities and so on. Therefore it is realized that there are two types of happening between two quantities: (i) When one quantity varies, the other quantity also varies directly as the first one and (ii) When one quantity varies, the other quantity also varies inversely as the first one. These facts can be represented mathematically.

1.2 MATHEMATICAL REPRESENTATION

Let us take two variables x and y and supplies that y varies. Now if x varies directly as y, then it can be represented mathematically as $x \propto y$ .....(i)
This is to be implied that $x = ky$, where k is called variation constant. The relation (i) is known as Direct Variation. If x takes the values $x_1, x_2, x_3, \dots\dots$ and y the values $y_1, y_2, y_3, \dots\dots\dots$, then from (i) it

appears that $\dfrac{x_1}{y_1} = \dfrac{x_2}{y_2} = \dfrac{x_3}{y_3} = \dots\dots\dots = k$ which implies that the ratios of x and y for their different

values remain constant. Hence the Direct Variation can also be defined in other way; for different values of x and y, if their ratios remain constant then x and y are said to be in Direct Variation.

Further if the variable x varies inversely as y then it can be represented mathematically as $x \propto \dfrac{1}{y}$ i. e., $x =$

$\dfrac{k}{y}$ (k being variation constant) $\rightarrow xy = k$ ..... (2) The relation (2) is known as inverse variation.

Now from (2), for different values of x and y we have $x_1. Y_1 = x_2 y_2 = x_3 y_3 = \dots\dots\dots = k$
Hence the inverse variation can also be defined as follows: For different values of x and y if their products remain constant, then x and y are said to in inverse variation.

NOTE: (i) If $x \propto y$, then $y \propto x$

(ii) If $x \propto \dfrac{1}{y}$, then $y \propto \dfrac{1}{x}$

(iii) If x varies inversely as y, then x varies directly as $\dfrac{1}{y}$.

1.3 JOINT VARIATION

Let L, B and A are the length, breadth and area of a kectangle respectively. Then $A = LB$ Now if B is constant, then $A = LB$ implies $A \propto L$ and if L is constant, then $A = LB$ implies $A \propto B$.

Here $\dfrac{A}{LB} = 1 = $ Constant $\therefore$ $A \propto LB$
When both land B vary.
Now what we have discussed here can be summarised as follows: if $A \propto L$ when B is constant and $A \propto B$
When L is constant, then $A \propto LB$ when both L and B vary. This implies that A varies jointly as L and B

DEFINITION

If a variable x varies directly as the product of the variables y, z, w, …… etc, then x is said to vary jointly as y, z, w, ……, etc.

EXAMPLE: Simple interest varies jointly as the principal, rate of interest on Unit sum and the Time.

1.4   THEOREM ON JOINT VARIATION

The three quantities x, y and z are such that $x \propto y$ when z is constant and $x \propto z$ when y is constant, then $x \propto yz$ when both y and z vary

Proof: It is given that $x \propto y$ when z is constant.

$\therefore x = ky$ Where k is variation constant and independent of x and y

Again $x \propto z$ when y is constant.

$\therefore ky \propto z \left[\because x = ky \right]$ When y is constant

$\rightarrow k \propto z \; \because$ y is constant.

$\rightarrow k = mz$ where m is a variation constant and independent of k and z.

$\therefore x = ky = myz \left[\because k = mz \right]$

$\rightarrow x \propto yz \; \because$ m is variation constant and independent of k and z i. e. the constant m is independent of x, y and z.

 Hence $x \propto yz$ when both y and z vary.

 This completes the proof.

COROLLARY: (i) The theorem on joint variation is applicable in case of more than three variables.

Let there are more than three variables and they are m, n, p. q………..

Now, if $m \propto n$ when p. q, …….. are constants,

$\qquad m \propto p$ when n, q …….. are constant

and $\quad m \propto q$ when n, p, …… are constant,

then $m \propto npq$ …… when all n, p, q, ….. vary.

(ii) If $x \propto y$ when z is constant and $x \propto \dfrac{1}{z}$ when y is constant, then $x \propto \dfrac{y}{z}$ when both y and z vary.

1.5   SOME PROPERTIES OF VARIATION

(i)   If $x \propto y$ and $y \propto z$, then $x \propto z$

Proof: Given that $x \propto y$

$\therefore x = ky$, k is variation constant and $y \propto z$

$\therefore y = k_1 z$, k_1 is another variation

Now $x = ky = kk_1 z \quad \left[\because y = k_1 z \right]$

$\therefore x \propto z \qquad \because kk_1$ is constant

(ii)   If $x \propto y$, then $x^n \propto y^n$ Where n is any Constant

Proof: Given that $x \propto y$

$\therefore x = ky$, k is variation Constant

$\rightarrow x^n = (ky)^n = k^n y^n$

$\therefore x^n \propto y^n \qquad \because k^n$ is Constant.

(iii)   If $x \propto y$ and $y \propto z$, then $(x \pm y) \propto z$ and $xy \propto z^2$

Proof: Given that $x \propto y$

$\therefore$ x = ky, k is variation Constant   and y $\propto$ z

$\therefore$ y = k_1z , k_1 is variation Constant

Now x $\pm$ y = ky $\pm$ k_1z

$\rightarrow$ x $\pm$ y = kk_1z $\pm$ k_1z $\left[\because y = k_1 z\right]$

$\qquad$ = ($kk_1 \pm k_1$) z

$\therefore$ x $\pm$ y $\propto$ z $\left[\because kk_1 \pm k_1 \text{ is constant}\right]$

Again xy = ky. k_1z = kk_1z - k_1z $\left[\because y = k_1 z\right]$

$\rightarrow$ xy = $kk_1^2 z^2$

$\therefore$ xy $\propto z^2$ $\qquad \because kk_1^2$ is constant

(iv) If x $\propto$ yz, then y $\propto \dfrac{x}{z}$ and z $\propto \dfrac{x}{y}$

Proof: Given that x $\propto$ yz

$\therefore$ x = kyz, k is variation Constant .... (i)

$\Rightarrow y = \dfrac{x}{kz} = \dfrac{1}{k} \cdot \dfrac{x}{z}$

$\therefore y \propto \dfrac{x}{2}$ $\because \dfrac{1}{k}$ is constant.

Again from (i) ,

$z = \dfrac{x}{ky} = \dfrac{1}{k} \cdot \dfrac{x}{y}$

$\therefore z \propto \dfrac{x}{y}$ $\because \dfrac{1}{k}$ is Cons tan t.

(v) If x $\propto$ y and z $\propto$ w, then xz $\propto$ yw and $\dfrac{x}{z} \propto \dfrac{y}{w}$

Proof: Given that x $\propto$ y

$\therefore$ x = ky, k is variation Constant

And z $\propto$ w

$\therefore$ z = k_1w, k_1 is variation constant

Now xz = ky. K_1w = kk_1 yw

$\therefore$ xz $\propto$ yw $\because kk_1$ is constant.

Again, $\dfrac{x}{z} = \dfrac{ky}{k_1 w} = \dfrac{k}{k_1} \cdot \dfrac{y}{w}$

$\therefore \dfrac{x}{z} \propto \dfrac{y}{w}$ $\qquad \because \dfrac{k}{k_1}$ is Constant

1.6 SUMMARI - SATION

(i) If a variable x varies directly as a variable y then x $\propto$ y i.e., x = ky where k $\neq$ o is a variable constant.

(ii) If a variable x varies inversely as a variable y, then $x \propto \dfrac{1}{y}$ i. e., $x = \dfrac{k}{y} \Rightarrow k$

    (K ≠ 0 is a variable constant)

(iii) If a variable x varies jointly as the variables y and z, then $x \propto yz$ when both y and z vary and x = kyz (k ≠ 0 is a variation constant)

(iv) If $x \propto y$ when z is constant and $x \propto z$. when y is constant, then $x \propto yz$ when both y and z vary (Theorem on joint variation)

(v) If $x \propto y$, then $y \propto x$

(vi) If $x \propto y$, then $x^n \propto y^n$

(vii) If $x \propto y$ and $y \propto z$, then $x \propto z$

(viii) If $x \propto y$ and $y \propto z$, then $(x \pm y) \propto z$ and $xy \propto z^2$

(ix) If $x \propto y$ and $z \propto w$, then $xz \propto yw$ and $\dfrac{x}{z} \propto \dfrac{y}{w}$

(x) If $x \propto yz$, then $y \propto \dfrac{x}{z}$ and $z \propto \dfrac{x}{y}$

1.7 ILLUSTRATIVE EXAMPLES

1. If $A^2 + B^2 \propto A^2 - B^2$, then prove that $A \propto B$

Solution: Given that $A^2 + B^2 \propto A^2 - B^2$

$$\therefore A^2 + B^2 = K\left(A^2 - B^2\right) \text{ Where k is a variation Constant.}$$

$$\Rightarrow A^2 + B^2 = KA^2 - KB^2$$

$$\Rightarrow KB^2 + B^2 = KA^2 - A^2$$

$$\Rightarrow B^2(K+1) = A^2(k-1)$$

$$\Rightarrow \dfrac{A^2}{B^2} = \dfrac{K+1}{K-1}$$

$$\Rightarrow \dfrac{A}{B} = \sqrt{\dfrac{K+1}{K-1}}$$

$$\Rightarrow A = \sqrt{\dfrac{K+1}{K-1}}.B$$

$$\therefore A \propto B \qquad \because \sqrt{\dfrac{K+1}{K-1}} \text{ is constant}$$

2. If $x + y \propto z + \dfrac{1}{z}$ and $x - y \propto z - \dfrac{1}{z}$ and x = 3 and y = 1 for z = 2, then find x and y in terms of z.

SOLUTION:

Given that $x + y \propto z + \dfrac{1}{z}$

$\therefore x + y = k\left(z + \dfrac{1}{z}\right)$ where k is variation constant...........(1)

and $x - y \propto z - \dfrac{1}{z}$

$\therefore x - y = m\left(z - \dfrac{1}{z}\right)$, Where m is variation constant.........(2)

Putting x = 3 and y = 1 when z = 2 in (1) and (2)

We have respectively

$3+1 = k (2 + \frac{1}{2}) \rightarrow 4 = k. \ 5/2 \rightarrow k. = \frac{8}{5}$

and $3 - 1 = m (2 - \frac{1}{2}) \rightarrow 2 = m. \frac{3}{2} \rightarrow m = \frac{4}{3}$

Again putting $k = \frac{8}{5}$ and $m = \frac{4}{3}$ in (1) and (2) we get from

(1) $x + y = \frac{8}{5} (z + \frac{1}{z})$ ....(3) and from (2), $x - y = \frac{4}{3} (z + \frac{1}{z})$ .....(4)

Now (3) + (4) yields: $2x = (\frac{8}{5} + \frac{4}{3})z + (\frac{8}{5} - \frac{4}{3}) \ 1/z$

$= \frac{44}{15} z + \frac{4}{15} . \frac{1}{z}$

$\Rightarrow x = \frac{22}{15} z + \frac{2}{15} . \frac{1}{z}$

$= \frac{2}{15} \left(11z + \frac{1}{z} \right)$

Again (3) – (4) yields: $2y = (\frac{8}{5} - \frac{4}{3})z + (\frac{8}{5} + \frac{4}{3}) \ 1/z$

$= \frac{4}{15} z + \frac{44}{15} . \frac{1}{z}$

$\Rightarrow y = \frac{2}{15} z + \frac{22}{15} . \frac{1}{z}$

$= \frac{2}{15} \left(z + \frac{11}{z} \right)$

Hence x and y in terms of z : $x = \frac{2}{15} (11z + \frac{1}{z})$

$and \quad y = \frac{2}{15} \left(z + \frac{11}{z} \right)$

3. Apply the principle of variation to find how long 25 men will take to prepare 30 machines, if 5 men take 9 days to prepare 10 machines.

SOLUTION: Let M denotes the numbers of men, D the numbers of days and N the number of machines.

Also let M men take D days to prepare N machines. Hence, $M \propto N$ when D is constant and $M \propto 1/D$ When N is constant.

Now according to the theorem on joint variation $M \propto N. \ 1/D$ When both N and D vary

$\therefore$ M = k. N/D Where K is a variation Constant........(1)

Given that when M = 5 and D = 9, then N = 10

$\therefore$ *From* (1) 5 $K. \frac{10}{9} \Rightarrow K = \frac{45}{10} = \frac{9}{2}$

$\therefore M = \frac{9}{2} \frac{N}{D}$...........(2)

Putting M = 25, N = 30 in (2)

We have $25 = \frac{9}{2} . \frac{30}{D}$

$\Rightarrow D = \frac{9 \times 30}{2 \times 25} = \frac{27}{5} = 5\frac{2}{5}$

$\therefore$ The number of days required $= 5\frac{2}{5}$ days

4. The weight of a right circular cone varies as the square of the radius of the base and also as the height. If the radios of the base is 5 cms., height 30 cms, and the weight is 5.5 kgs. What will be the radius of the cone which weights 2.464 kgs and has a height 21 cms?

SOLUTION: Let the weight of the right circular cone is w kgs, radius of the base r cms, and height cms.

Now according to the problem $w \propto r^2h$

$\therefore$ W = kr^2h……..(1) Where K is a variation constant

Given that W = 5.5kgs When r = 5 cms and h = 30 cms

$\therefore$ From (1) 5.500 = k. 5^2.30 = k.25.30 = k.25.30 [$\because$ w = 5.5kg = 5.500 grms.]

$$\Rightarrow K = \frac{5500}{25 \times 30} = \frac{22}{3}$$

Hence W = kr^2h = $\frac{22}{3}r^2h$ .... (2)

Now putting W = 2.464 kgs = 2464 grms and h = 21 ….in (2), we have

$$2464 = \frac{22}{3}. r^2. 21 \qquad \Rightarrow r^2 = \frac{2464 \times 3}{22 \times 21} = 16$$

$$\Rightarrow r = \sqrt{16} = 4\ cms.$$

$\therefore$ The radius of the base = 4 cms.

5. Remuneration of a Private Bus Conductor partly fixed the balance varies as total price of the tickets sold by him in the month. By selling tickets of total prices ₹2000 and ₹2500 in two consecutive months, he received remunerations as ₹420 and ₹445 respectively. If he wants to get ₹500 as his remuneration in a month, what would be the total price of the tickets to be sold in that month?

SOLUTION:

Let F stands for the fixed part of the remuneration of the Bus Conductor and B, the balance part of the same and R, the total price of the tickets sold.

$\therefore$ As per problem B $\propto$ R $\rightarrow$ B = KR where K is a variation constant.

If S stands for his total monthly remuneration, then S = F + B = F + KR …………(1)

Given that S = 420 When R = 2000 and S = 445 When R = 2500

Now putting the values of S and R in (1)

We have   420 = F + 2000k ……….. (2)

and 445 = F + 2500K…….(3)

Now (3) – (2) $\rightarrow$ 500k= 25 i. e. K = $\frac{25}{500} = \frac{1}{20}$

Substituting K = $\frac{1}{20}$ in (2) , we get F + 2000 × 1/20 = 420

$\rightarrow$ F = 420 – 100 = 320

Again Substituting F = 320 and K = 1/20 in (1) , we have S = 320 + 1/20 R…….. (4)

Now putting S = 500 in (4), we get 500 = 320 + 1/20 R

$\rightarrow$ 10000 = 6400 + R

$\rightarrow$ R = 10000 – 6400 = 3600

$\therefore$ Price of the tickets sold = ₹3600

6. If y be the sum of three quantities of which is the first varies as the square of x, the second varies as x and the third is a constant, find the relation between y and x if y = 3,11,38 and x = 2,4,7 respectively.

SOLUTION: Let the three quantities are p, q and r respectively.

According to problem y = p + q + r …………(1) and P $\propto x^2$, q $\propto$ x

$\therefore$ P = Kx^2 and q = lx where k and l are variation constant.

∴ From (1) we get $y = kx^2 + lx + r$ ....(2)

Given that y = 3 When x = z, y = 11 when x = 4 and = 38 when x = 7

Substituting these values of x and y in (2)

We have

$3 = 4K + 2l + r$.......(3)

$11 = 16k + 4l + r$ .....(4)

and $38 = 49K + 7l + r$.....(5)

Now subtracting (3) from (4) and (4) from (5)

We have

$12K + 2l = 8 \rightarrow 6K + l = 4$ ......(6)

and $33k + 3l = 27 \rightarrow 11k + l = 9$.......(7)

Again subtracting (6) from (7), we get $5k = 5 \rightarrow K = 1$

Now substituting k = 1 in (6) we have

$6.1 + l = 4 \rightarrow l = -2$
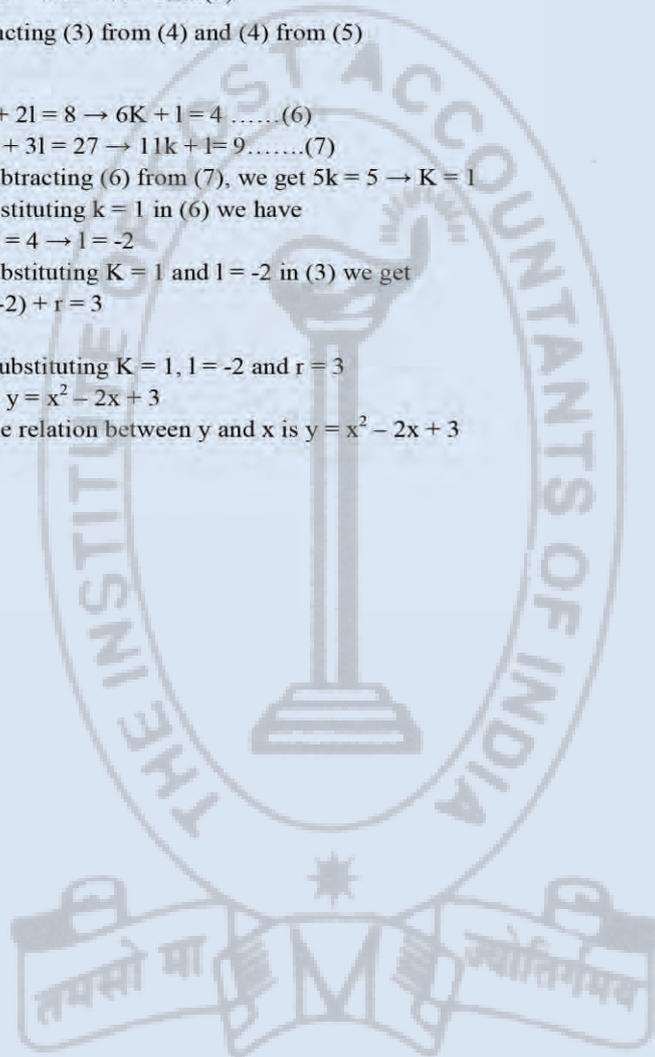
Again substituting K = 1 and l = -2 in (3) we get

$4.1 + 2.(-2) + r = 3$

$\rightarrow r = 3$

Finally substituting K = 1, l = -2 and r = 3

We have $y = x^2 - 2x + 3$

Hence the relation between y and x is $y = x^2 - 2x + 3$

SUBMISSIONS

Dear Students,

We are very much delighted to receive responses from all of you; for whom our effort is!
We have noted your queries and your requests will definitely be carried out. Further, requesting you to go through the current edition of the bulletin. All the areas will be covered gradually. Expecting your responses further to serve you better as we believe that there is no end of excellence! One of the mails received is acknowledged below.

Absolutely great learning from the e-bulletin provided by all of you!! Concepts became very clear after solving e- bulletin! The kind of questions contained by this bulletin is can be solved by the students acquainted with basic knowledge!!   I hope that this service of providing bulletin to the students is great, it must continued in future!! Thanks

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Updation of E-Mail Address/Mobile:

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Please put your opinions so that we can make your e-bulletin everything that you want it to be.

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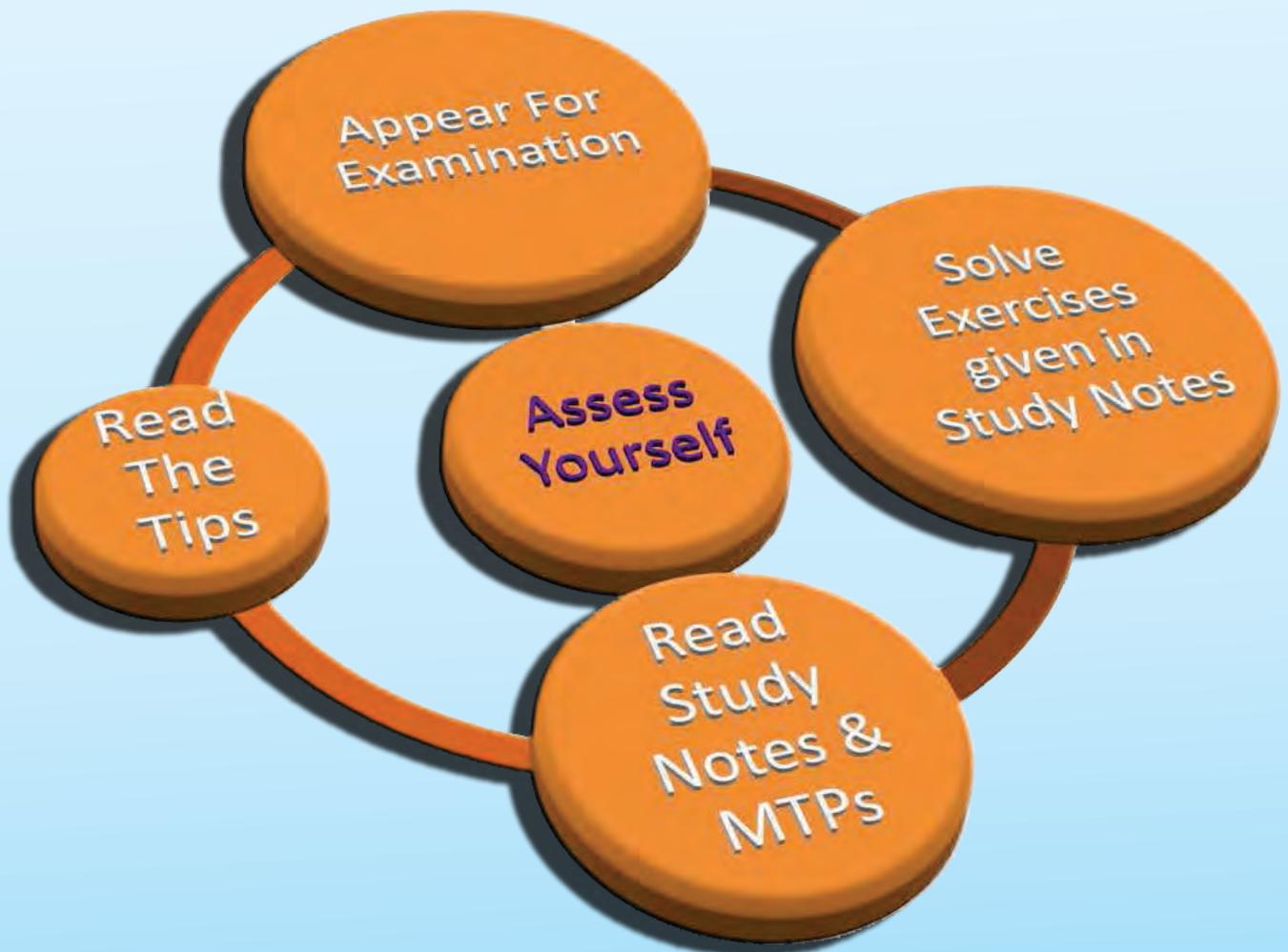**e-mail: studies.ebulletin@icmai.in**
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Message from the
Directorate of Studies

Dear Students,

For the smooth and flawless preparation. Directorate of studies have provided meaningful tips which will help you to gain sufficient knowledge about each subject.

"Tips" are given in this E-bulletin by the knowledge experts for the smooth encouragement in you preparation. We are sure that all students will definitely be benefitted by those tips and that will help them to brush up their knowledge and also to swim across.

Take the course seriously from the very beginning but don't be panicky. Please try to follow the general guidelines, mentioned below; which may help you in your preparation.

Essentials for Preparation:

▸▸ Conceptual understanding & Overall understanding of the subject both should be clear.

▸▸ Candidates are advised to go through the study material provided by the institute in an analytical manner.

▸▸ Student should improve basic understanding of the subject with focus on concepts.

▸▸ Students Should improve basic understanding of the subject with focus on core concepts.

▸▸ The Candidates are expected to give to the point answer, which is a basic pre-requisite for any professional examination.

▸▸ To strengthen the answers candidates are advised to give answer precisely and in a structured manner.

▸▸ In-depth knowledge about specific terms required.

▸▸ Write question numbers correctly and prominently.

▸▸ Proper time management is also important while answering.

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