

ESE 2022 Prelims

Paper-1

ME | CE | EE | EC

Question & Answer Key



- 1.** Which of the following are the elements of TQM?

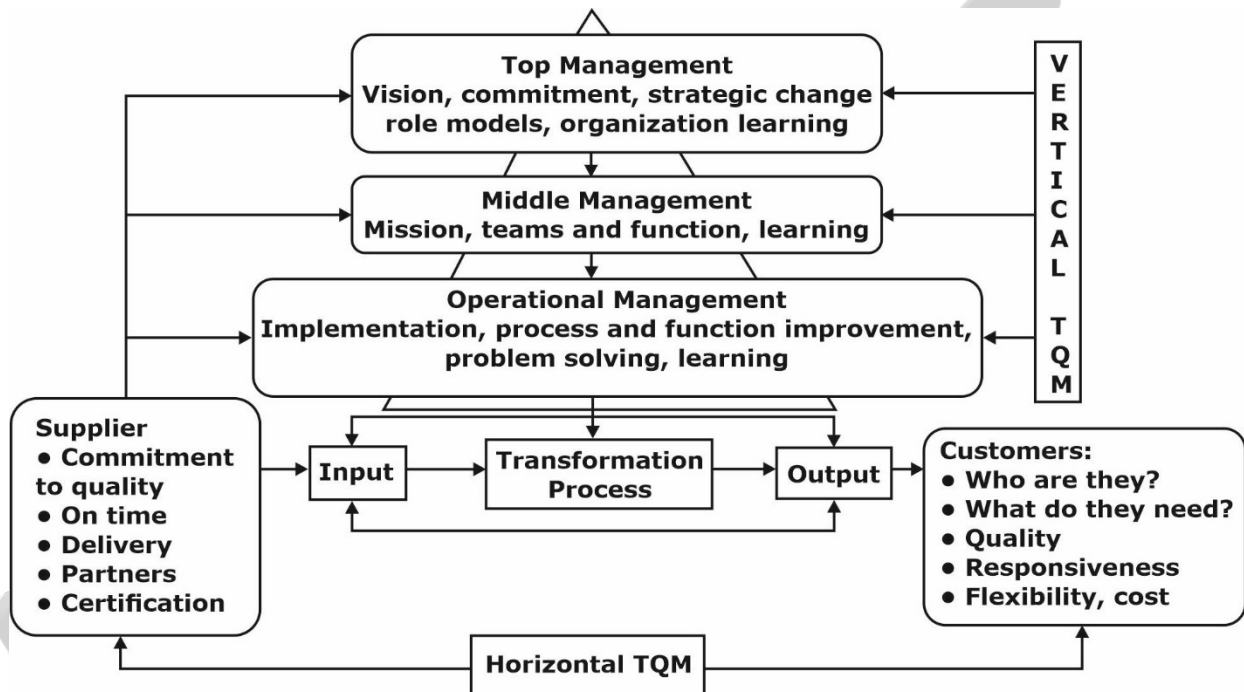
1. Teamwork and Employee empowerment
2. Feedback mechanisms
3. Strong division of labour
4. Result oriented management

Select the correct answer using the code given below :

- A. 1 and 2 only
B. 3 and 4 only
C. 2,3 and 4 only
D. 1,2,3 and 4

Ans. D

Sol. Total quality management can be summarized as a management system for a customer-focused organization that involves all employees in continual improvement.



So, elements of Total quality management (TQM)

- (i) Team work and employee empowerment.
- (ii) Feedback mechanisms.
- (iii) Strong division of labour.
- (iv) Result oriented management.

- 2.** The quality characteristics can be categorized in which of the following groupings ?

1. Sensory characteristics
2. Structural characteristics
3. Statistical characteristics

- #### 4. Time oriented characteristics

Select the correct answer using the code given below:

- A. 1,2,3 and 4 B. 1 and 4 only
C. 2 and 3 only D. 1,2 and 4 only

Ans. D

Sol. Quality Characteristics:-

1. Physical characteristics → Length, weight voltage, viscosity etc.
2. Sensory characteristics → Taste, Appearance, colour.
3. Time based characteristics → Reliability serviceability, Durability.

And, Statistical characteristics is quantitative in nature.

3. What are the major categories for quality costs ?

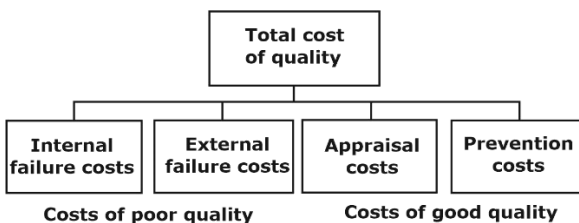
1. Prevention costs
2. Appraisal costs
3. Production costs
4. Internal failure costs

Select the correct answer using the code given below :

- A. 1,2 and 3 only B. 1,2 and 4 only
C. 3 and 4 only D. 1,2,3 and 4

Ans. B

Sol. Cost of Quality (COQ) is defined as a methodology that allows an organization to determine the extent to which its resources are used for activities that prevent poor quality, that appraise the quality of the organization's products or services, and that result from internal and external failures.



So, production cost is not considered in quality cost.

4. Consider the following statements regarding evaluating sampling plans :

1. If rectifying inspection is conducted for lots rejected by the sampling plan is the average total inspection.
2. The average number of items inspected for a series of lots in order to make a decision is the average sample number.
3. The average quality level of a series of batches that leave the inspection station after coming in for inspection at a certain quality level is the average outgoing quality limit.

Which of the above statements are correct ?

- A. 1 and 2 only B. 2 and 3 only
C. 1 and 3 only D. 1,2 and 3

Ans. D

Sol. (i) Average total inspection:

The average total inspection (ATI) for a rectifying sampling plan is defined as follows:

The average number of units inspected per lot under the rectifying sampling plan is called the average total inspection (ATI).

In other words,

The average total inspection (ATI) is the number of units inspected per lot to take the decision for acceptance or rejection of the lot under rectifying sampling plan calling for 100 % inspection of the rejected lots.

(ii) Average sample number:

The number of observations or sample size is not pre-determined, but depends on the observations themselves. The Average (expected) value of the sample size of such a procedure is called the average sample number.

(iii) Average outgoing quality limit (AOQL):

- It represents the maximum percentage defective in outgoing product.
- Depends upon incoming quality.

We know that, Average outgoing quality is given by :

We know that, Average outgoing quality is given by :

$$AOQ = P_a \times P_d \left(\frac{N-n}{N} \right)$$

Where P_a = Probability of accepting a lot,

P_d = Fraction defective,

N = lot size

n = sample size

5. Consider the following statements with reference to principal quality objectives :

1. The organization should achieve and sustain the quantity of the product so as to continually meet the purchaser's stated or implied needs.
2. The organization should provide confidence to its own management that the intended quality is being achieved and sustained.
3. The organization should provide confidence to the purchaser that the intended quality is being, or will be, achieved in the delivered product.

Which of the above statements are correct ?

- A. 1 and 2 only B. 2 and 3 only
C. 1 and 3 only D. 1,2 and 3

Ans. B

Sol.

- (i). The organization should achieve and sustain the **quality** not quantity of the

product so as to continually meet the purchaser's stated or implied needs.

- (ii). The organization should provide confidence to its own management that the intended quality is being achieved and sustained.

- (iii). The organization should provide confidence to the purchaser that the intended quality is being, or will be, achieved in the delivered product.

So, statement 1 is not correct regarding the principle of quality.

6. Trial runs are recommended for which of the following reasons ?

1. Trial runs provide an opportunity to remedy the situation during the experiment.
2. Trial runs provide a final chance to fine-tune levels of a factor.
3. Trial runs provide a chance to make any needed changes in the experimental plan during the experiment.
4. Trial runs can help considerably in estimating the time to complete a run, the logistical support required for level changes, and total time needed to complete an experiment.

Select the correct answer using the code given below:

- A. 1,2,3 and 4 B. 1 and 3 only
C. 2 and 4 only D. 2,3 and 4 only

Ans. C

Sol. Background

Trial runs are recommended for a number of reasons. Some of these are:

1. They afford an opportunity to evaluate potential problem treatment combinations before proceeding with an experiment.

2. They provide a final chance to fine-tune levels of a factor.
3. As the word suggests, a trial is a test of the system that will be engaged during the course of an experiment. This is important in a production environment where the experimenter may only have one chance to obtain the needed data. Trial runs provide a chance to make any needed changes in the experimental plan before an experiment begins.
4. Trial runs can help considerably in estimating: the time to complete a run, the logistical support required for level changes, and the total time needed to complete an experiment.
5. Finally, a trial run is also an excellent communications test. Any breakdown in communications will likely be apparent during trial runs. Trial runs also provide an opportunity to remedy the situation before proceeding with the experiment.

- 7.** Which one of the following is NOT a source of variation present in every process of construction ?

- A. The equipment B. The material
C. The environment D. The specifications

Ans. D

Sol. The equipment, labour, environment and the material all presents the variation in every process of construction. But the specifications of a project are fixed at the time of designing stage, hence cannot be varied.

- 8.** The international dispute about modern environmental movement began with the publication of Silent Spring by

- A. Mary Daly B. Rachel Carson
C. Carolyn Merchant D. Maria Mies

Ans. B

Sol. The international dispute about modern environment movement began with the publication of Silent Spring by Rachel Carson.

- 9.** Which one of the following is NOT a principle of CERES ?

- A. Controlled production
B. Energy conservation
C. Informing the public
D. Protection of the biosphere

Ans. A

Sol. Principal of CERES:-

1. Protection of Biosphere.
2. Sustainable use of natural resources.
3. Reduction and disposal of wastes.
4. Energy conservation.
5. Risk reduction.
6. Safe products and services.
7. Environmental restoration.
8. Informing the public.
9. management commitment.
10. Audits and reports.

- 10.** The largest tidal range in the world is

- A. Bay of Fundy
B. Ungava Bay
C. Bristol Channel
D. Turnagain Arm of Cook Inlet

Ans. A

Sol. The world's largest tidal range of 16.3 m occurs in Bay of Fundy (Canada).

- 11.** Kyoto Protocol operationalizes the UN framework convention on

- A. sustainable development
B. renewable energy
C. climate change
D. soil erosion

Ans. C

Sol. Kyoto protocol was adopted on 11 December 1997. It operationalizes the united nations framework convention on Climate change by committing industrialized countries and economics in transition to limit and decrease the greenhouse gases emission.

12. According to Carson, which one of the following approaches argues that nature has intrinsic value and we should protect it because of this value ?

- A. Instrumental approach
- B. Axiological approach
- C. Eco-critical approach
- D. Anthropological approach

Ans. A

Sol. According to Carson, Instrumental approaches argues that nature has intrinsic value and we should protect it because of this values.

13. The Gaia hypothesis, which suggested that the earth should be seen as a single organism, was devised by

- A. James Lovelock
- B. Francoise d' Eaubonne
- C. Earnest Haeckel
- D. Paul Ehrlich

Ans. A

Sol. The Gaia hypothesis, Jamel Lovelock. suggested that the earth should be seen as a single organism.

14. Energy used by man does NOT originate from which one of the following sources ?

- A. Radiant energy
- B. Geothermal power
- C. Frictional energy
- D. Gravitational energy

Ans. D

Sol. Energy used by man does not original from gravitational energy source.

15. The term "Sacred Cow" is often used to denote a project that

- A. a powerful, high-ranking official is advocating
- B. facts are advocating
- C. sound reasoning is advocating
- D. less weaknesses are advocating

Ans. A

Sol. A sacred cow is a firmly held belief that is rarely questioned and is largely exempt from criticism or opposition. As such, tenets that are considered sacred cows are often held on to, even in the face of contradictory evidence. A sacred cow is a closely held belief that is not to be questioned. In terms of Project, it is a powerful, high ranking official that cannot be Questioned.

16. Which one of the following is NOT a condition for preferring Top-Down Time and Cost Estimates?

- A. Strategic decision making
- B. Cost and time important
- C. High uncertainty
- D. Internal, small project

Ans. B

Sol. Conditions for Preferring Top-Down or Bottom-up Time and Cost Estimates

Condition	Top-down Estimates	Bottom-up Estimates
Strategic decision making	×	
Cost and time important		×
High uncertainty	×	

Internal, small project	×	
Fixed-price contract		×
Customer wants details		×
Unstable scope	×	

17. In Network Computation Process, which one of the following is correct for forward pass?

- A. It starts with the first project activity (ies) and traces each path (chain of sequential activities) through the network to the last project activity(ies)
- B. This is the longest path in the T network, which will delay the project
- C. It starts with the last project activity(ies) on the network
- D. It starts with the last project activity(ies) and traces each path (chain of sequential activities) through the network to the first project activity(ies)

Ans. A

Sol. The forward pass starts with the first project activity(ies) and traces each path (chain of sequential activities) through the network to the last project activity(ies). As you trace along the path, you add the activity times. The longest path denotes the project completion time for the plan and is called the critical path (CP). Table lists the activity times in workdays for the Koll Business, hence option(a).

18. Consider the following statements regarding production:

The major aspects of production that may lead to sickness are

1. increase in the cost of production.
2. decrease in the quantity of production.
3. quality of product not meeting the standards/customer expectation.
4. Producing more quantity than can be sold, leading to accumulation of stock.

Which of the above statements are correct ?

- A. 1 and 2 only
- B. 1,2,3 and 4
- C. 2 and 3 only
- D. 1,3 and 4 only

Ans. B

Sol. The major aspects of production that may lead to sickness are

- Increase in the cost of production.
- Decrease in the quantity of production.
- Quality of product not meeting the standards/customer expectation.
- Producing more quantity than can be sold, leading to accumulation of stock.

19. Which one of the following projects are those which are to be completed within a stipulated time, even at the cost of ending up with a higher project cost ?

- A. Normal projects
- B. Business. projects
- C. Crash projects
- D. search projects

Ans. C

Sol. Based on the constraints on project completion time, projects can be classified into two types, that are normal projects and crash projects.

Normal projects are those for which there is no constraint on time.

Crash projects are those which are to be completed within a stipulated time, even at the cost of ending up with a higher project

cost. For example, construction of canal lining with the condition that the work should be completed before the monsoon starts is a crash project.

- 20.** Which one of the following policies is concerned with changing the supply of money stock and the rate of interest, for the purpose of stabilizing the economy at full potential output level ?

A. Commercial policy B. Fiscal policy
C. Monetary policy D. Social policy

Ans. C

Sol.

- Both monetary and fiscal policy are macroeconomic tools used to manage or stimulate the economy.
- Monetary policy addresses interest rates and the supply of money in circulation, and it is generally managed by a central bank.
- Fiscal policy addresses taxation and government spending, and it is generally determined by government legislation.
- Monetary policy and fiscal policy together have great influence over a nation's economy, its businesses, and its consumers.

- 21.** Which one of the following is NOT a classification of microscopic diffusion?

A. Inter-diffusion B. Vacancy diffusion
C. Surface diffusion D. Lattice diffusion

Ans. A

Sol. Classification of microscopic diffusion

- Vacancy diffusion
- Surface diffusion
- Lattice diffusion

Inter diffusion is observed in nano composites. So, it cannot be microscopic diffusion.

- 22.** Many bulk polymers that are crystallized from a melt, are semi crystalline and from which one of the following structures?

A. Spherolite structure
B. Spherelite structure
C. Spherulite structure
D. Spherilite structure

Ans. C

Sol. Many bulk polymers that are crystallized for a melt, are semi crystallize and form spherulite structure. It is composed of chain-folded lamellar crystals.

- 23.** 'Positive and negative ions by virtue of their net electrical charge, attract one another', these attractive bonding forces are

A. Coulombic B. Magnetic
C. Electromagnetic D. Non-magnetic

Ans. A

Sol. According to coulomb force law, different polarity charges attract each other. i.e. positive charge (+Q) and negative charge (-Q) will attracts each other.

Hence these attractive bonding forces are coulombic or electrostatic force.

- 24.** The process by which plastic deformation is produced by dislocation motion is termed as

A. Plane slit B. Seepage
C. Slip D. Twinning

Ans. C

Sol. The process by which plastic deformation is produced by the motion of dislocations through a crystal is called slip. We can see with the edge dislocation that the applied shear stress forces the extra plane of atoms forward in the direction of the applied force.

- 25.** Stereoisomerism denotes the situation in which atoms are linked together
- A. in the different order and also differ in their spatial arrangement
 - B. in the different order but same in their spatial arrangement
 - C. in the same order (head-to-tail) but differ in their spatial arrangement
 - D. in the same order (head-to-tail) and also same in their spatial arrangement

Ans. C

Sol. Stereoisomerism denotes the situation in which atoms are linked together in the same order (head to tail) but also differ in their spatial arrangement.

- 26.** Some of the complex thermoplastic chains become so stiff that they act as rigid rods, even when heated above the melting point. These materials are
- A. Solid crystalline polymers
 - B. Semi solid crystalline polymers
 - C. Liquid crystalline polymers
 - D. Copolymers

Ans. A

Sol. Some of the complex thermoplastic chains become so stiff that they act as rigid rods, even when heated above the melting point. These materials are solid crystalline polymers.

In crystalline polymers, the chains behave differently. They still form folds, but instead of becoming hopelessly tangled, they form orderly stacks of folded chains, known as lamellae.

- 27.** Which one of the following are the well-known routing attacks on IoT ?
- A. Clone Id and Sybil attacks
 - B. Selective-reversing attacks
 - C. Packet reversing attacks
 - D. Frame selective wired attacks

Ans. A

Sol. (I) In a sybil attack, a malicious or attacker node will create many fake identities to affect the overall network performance.

(II) Sybil nodes are capable of generating false reports, spamming users with messages and causing breaches in privacy.

(III) Clone ID attack is same as sybil attack. So, clone ID attack occurs when a malicious node pretends to be a legitimate existing node.

- 28.** Which one of the following layers in the OSI reference model is concerned with transmission of unstructured bit stream over physical medium; deals with the mechanical, electrical, functional, and procedural characteristics to access the physical medium?

- A. Transport layer B. Network layer
- C. Data link layer D. Physical layer

Ans. D

Sol. The physical layer in the OSI model is concerned with transmission of unstructured bits stream over physical medium. The physical layer also deals with mechanical, electrical functional and procedural characteristics to access the physical medium.

The other three layers are concerned with structured bit stream in which the transport layer bit stream is called segment, the network layer bit stream is called packet and the data link bit stream is called frames.

- 29.** Which one of the following systems is used when there are rigid time requirements on the operation of a processor or the flow of data, and thus is often used as a control device in a dedicated application?

- A. A real-time system
- B. A distributed system
- C. A parallel system
- D. A serial system

Ans. A

Sol. Real-time systems are used when there is a rigid requirement on the operation of a processor or the flow of data. Real-time system can also be used as a control device in a dedicated application. A real-time system is defined as a data processing system wherein the time required to process and respond to inputs is so small that it controls the environment.

- 30.** Which one of the following servers is a tool that allows an information provider to prepare indexes of unstructured documents, and allows users to search these indexes with natural language questions?
- A. Name server
 - B. Terminal server
 - C. Wide area information server
 - D. File server

Ans. C

Sol. Wide Area Information Server is the required tool. The user of wide area information server is provided with or obtains a list of distributed databases. The user enters a search argument for a selected database and the client then accesses all the servers on which the database is distributed. The result provide a description of the text that meets the search requirement. The user can then retrieve the full text.

The name server or domain name server helps in the translation of human memorable domain name into IP address.

A terminal server is a hardware device that enables to connect serial devices across a network.

File server is a computer containing files available to all users connected to a local-area network (LAN).

- 31.** Which one of the following protocols is designed to provide privacy between two communicating applications viz a client and a server?
- A. Data link layer protocol
 - B. Physical layer protocol
 - C. Secure socket layer protocol
 - D. Session layer protocol

Ans. C

Sol. Secure Socket layer protocol is used to provide a private channel or privacy between two communicating application such as client and server. It also ensures privacy of data authentication of partners and integrity.

The other three mentioned protocols have nothing to do with privacy between two communicating applications.

- 32.** Which one of the following is an advantage of branched or Intrinsic programming type or style in ICT based teaching and learning process?
- A. Large frames reduce the time of learning
 - B. There is a possibility of guesswork
 - C. It is very expensive to provide so many audio-visual aids
 - D. Revise/redesign at frequent intervals is difficult and expensive

Ans. A

Sol.

- (I) Branching or intrinsic programming technique provides the student a piece of information, presents a situation requiring and multiple choice or recognition response, and on the basis of that choice instructs the student to proceed to another frame, where he or she learns if the choice was correct and if not, why not.
 - (II) A student who respond incorrectly will either be returned to the original frame or routed through a subprogram designed to remedy the deficiency indicated by wrong choice.
 - (III) A Student who selects correctly advances to the next frames in the program. This process is repeated at each step throughout the program, and a student may be exposed to differing amounts of material depending upon errors made.
- ∴ Advantages of branched programming:
- (i) In branched programming style freedom is given to the learners so that they can learn at their own pace.
 - (ii) Large frames reduce the time of learning at each steps.

- 33.** Which one of the following learnings is a teaching approach that engages students in sustained, collaborative real-world investigations?
- A. Project-based learning
 - B. Cooperative learning
 - C. Collaborative learning
 - D. Outcome based learning

Ans. C**Sol.**

- (I) Collaborative learning is the educational approach of using groups to enhance learning through working together. Groups of two or more learners work together to solve problems, complete tasks, or learn new concepts.
- (II) This approach actively engages learners to process and synthesize information and concepts rather than using rote memorization of facts and figures.
- (III) Learners work with each other on projects, where they must collaborate as a group to understand the concept being presented to them.

- 34.** Which one of the following schemes is used for radio stations within the same region, where each radio station has its own frequency?
- A. Space division multiplexing
 - B. Frequency division multiplexing
 - C. Time division multiplexing
 - D. Code division multiplexing

Ans. B**Sol.**

- (I) Frequency Division Multiplexing FDM applies only to analog channels. Many low-band-width analog channels (or digital channels modulated to their analog equivalent) share a high-bandwidth analog channel on a frequency division basis.
- (II) Here, the individual low-band-width analog channels with their own carrier frequencies are superimposed on the carrier frequency of a high-band-width channel.

35. The AES key expansion algorithm takes as input a 4-word (16-byte) key and produces a linear array of

- A. 50 words (200 bytes)
- B. 44 words (176 bytes)
- C. 40 words (160 bytes)
- D. 35 words (140 bytes)

Ans. B

Sol.

- (I) The AES key expansion algorithm takes as input a 4-word (16-byte) key and produces a linear array of 44-word (176-bytes).
- (II) This is sufficient to provide a 4-word round key for the initial "Add Round Key" Stage and each of the 10 rounds of the cipher.

36. Consider the following statements regarding engineers as responsible experimenters:

- 1. It includes a conscientious commitment to live by moral values.
- 2. It can be accountable for the results of the project.
- 3. It restricts free-personal involvement in all steps of the project or product development.
- 4. It includes constant awareness of the progress of the experiment and readiness to monitor the side effects, if any.

Which of the above statements are correct?

- A. 1 and 2 only B. 3 and 4 only
- C. 1,2 and 4 only D. 1, 2, 3 and 4

37. Which one of the following is NOT included in Nussbaum's basic human functional capabilities?

- A. Being able to live a human life of normal length
- B. Being able to use senses, imagine, think, and reason

C. Being able to laugh, play, and enjoy recreational activities

D. Being able to earn livelihood and live peacefully

Ans. D

Sol. Nussbaum's basic human functional capabilities:

- Being able to live to the end of a human life of normal length.
- Being able to have good health, adequate nutrition, adequate shelter, opportunities for sexual satisfaction and choice in reproduction, and mobility.
- Being able to avoid unnecessary and non-beneficial pain and to have pleasurable experiences.
- Being able to use the senses, imagine, think, and reason; and to have the educational opportunities necessary to realize these capacities.
- Being able to have attachments to things and persons outside ourselves.
- Being able to form a conception of the good and to engage in critical reflection about the planning of one's own life.
- Being able to live for and to others, to recognize and show concern for other human beings.
- Being able to live with concern for and in relation to animals and the world of nature.
- Being able to laugh, to play, to enjoy recreational activities.
- Being able to live one's own life and no one else's; enjoying freedom of association and freedom from unwarranted search and seizure.

- 38.** Which one of the following is NOT a type of virtue for responsible professionalism
- Public-spirited virtue
 - Teamwork virtue
 - Self-realization virtue
 - Self-direction virtue

Ans. C

Sol. Professional responsibility/types of virtues

Responsibilities based on

- Self-direction virtues
- Public spirited virtues
- Teamwork virtues
- Proficiency virtues

- 39.** Which one of the following is NOT Davis' eight moral tests?
- Harm test
 - Acceptability test
 - Virtue test
 - Professional test

Ans. B

Sol. Use such tests as the following:

Harm test: Does this option do less harm than the alternatives?

Publicity test: Would I want my choice of this option published in the newspaper.

Defensibility test: Could I defend my choice of option before the associate teacher/child/principal/parents/my peers/my family.

Reversibility test: Would I still think my choice of this option is good if I were adversely affected by it.

Colleague test: What do my colleagues say when I describe my problem and suggest this option is my solution.

Professional test: What might the New Zealand Teachers Council say about this option.

Organization test: What does the school's policy say about this.

- Viral News Test
- Outcomes Test
- Rights Test
- Everybody Test
- Choices Test
- Justice Test
- Common Good Test
- Character/Virtue Test

- 40.** Arrange the following in hierarchical order as suggested by Carroll in the four-part model of corporate social responsibility?
- Economic
 - Philanthropic
 - Legal
 - Ethical

Select the correct answer using the code given below :

- 2, 4, 3, 1
- 4, 3, 1, 2
- 2, 1, 3, 4
- 1, 3, 4, 2

Ans. A

Sol.



41. The Engineers for a Sustainable World (ESW) meant for using the professional talents to create a more sustainable world was founded in

- A. 1999 B. 2000
C. 2001 D. 2002

Ans. C

Sol. ESW was established in 2001 in Ithaca, New York at Cornell University.

42. Which one of the following is NOT covered under the International Labour Organization declaration on fundamental principles and rights at work (1998)?

- A. Freedom of association and the right to collective bargaining
B. The elimination of forced and compulsory labour
C. The volition of child labour
D. The global compact on migration

Ans. D

Sol. These categories are: freedom of association and the effective recognition of the right to collective bargaining, the elimination of forced

or compulsory labour, the abolition of child labour and the elimination of discrimination in respect of employment and occupation.

43. Which one of the following does NOT come under business ethics?

- A. Avoid breaking the law
B. Avoid action that are bad for one's image
C. Avoid action
D. Avoid conflict?

44. Which one of the following principles refers to whom may be affected by the actions of the company that affect health, safety, or the environment and refrain from taking reprisals against employees who report dangerous incidents to management or appropriate authorities?

- A. Safe product and service
B. Informing the public
C. Environmental restoration
D. Risk reduction?

45. The Defence Research and Development Organization (DRDO) has successfully test-fired medium-range subsonic cruise missile Nirbhay from the Integrated Test Range (ITR) at

- A. Chandipur, Odisha
- B. Cuddalore, Tamil Nadu
- C. Nellore, Andhra Pradesh
- D. Digha, West Bengal?

Ans. A

Sol. The Defence Research and Development Organisation (DRDO) has successfully test-fired medium-range subsonic cruise missile Nirbhay from the Integrated Test Range (ITR) at Chandipur, off Odisha coast. Nirbhay is India's first Indigenous Technology Cruise Missile (ITCM).

About the Missile:

- ITCM Nirbhay was successfully test-launched with a Made-in-India Manik turbofan engine.
- This was the first successful test-firing of the missile with the indigenous booster engine. It can use both conventional and nuclear weapons of 200 to 300 kilograms.
- The missile can be launched from multiple platforms. ITCM Nirbhay can travel at a speed of 0.7 to 0.9 Mach, or 4 to 7 times faster than the speed of sound.

- 46.** Which one of the following is NOT correct regarding the Khel Ratna Award ?
- A. The award was inaugurated in 1991-92
 - B. The award comprises a medallion, a certificate, and a cash prize of Rs. 15 lakh
 - C. The first recipient of the Khel Ratna was chess legend, Viswanathan Anand
 - D. The award renamed as Major Dhyan Chand Khel Ratna Award

Ans. B

Sol. Khel Ratna Award:

- The Khel Ratna Award. officially known as the Major Dhyan Chand Khel Ratna Award. formerly known as the Rajiv Gandhi Khel Ratna Award in Sports and Games. is the highest sporting honour of India. It is awarded annually by the Ministry of Youth Affairs and Sports.
- The award was inaugurated in 1991-92.
- As of 2020, the award comprises a medallion, a certificate, and a cash prize of RS. 25 lakh (US\$33,000).
- The first recipient of the award was Chess Grandmaster Viswanathan Anand, who was honoured for the performance in the year 1991-92.

Therefore, statement 2 is incorrect. Hence, option B is correct.

- 47.** How many Indian companies have found a place in 2021 Fortune's Global 500 list ?

- A. Three
- B. Five
- C. Seven
- D. None

Ans. C

Sol. Seven Indian companies have found a place in 2021 Fortune's Global 500 list.

Indian Companies in the list:

1. Reliance Industries
2. State Bank of India
3. Indian Oil
4. Oil & Natural Gas
5. Rajesh Exports
6. Tata Motors
7. Bharat Petroleum

- 48.** Which one of the following is NOT important initiatives under EASE 4.0 ?

- A. Smart lending for aspiring India
- B. New age 24 x 7 banking with resilient technology
- C. Collaborative banking for synergistic outcomes
- D. Parameters of FI-Index?

Ans. D

Sol. Important Initiatives under EASE 4.0:

- Smart Lending for Aspiring India.
- New Age 24x7 banking with resilient technology.
- Collaborative banking for synergistic outcomes.
- Tech-enabled Ease of Banking.
- Institutionalizing Prudent Banking.
- Governance and Outcome Centric HR.

49. Which one of the following statements is NOT, correct regarding the Pension Fund Regulatory and Development Authority (PFRDA) ?

- A. It has increased the entry for the National Pension System (NPS) from 60 years to 65 years
- B. Earlier the eligible age to invest in NPS was 18-65 years which has now been revised to 18-70 years
- C. As per the revised norms, any Indian Citizen, resident or non-resident and Overseas Citizen of India (OCI) between the age of 65-70 years can join NPS
- D. Subscribers can continue or defer their NPS Account up to the age of 75 years?

Ans. A

Sol. Pension Fund Regulatory and Development Authority is the regulatory body under the jurisdiction of Ministry of Finance , Government of India for overall supervision and regulation of pension in India. The Government of India had, in the year 1999, commissioned a national project titled "OASIS" (an acronym for old age social & income security) to examine policy related to old age income security in India.

The contributory pension system was notified by the Government of India on 22 December 2003, now named the National Pension System (NPS) with effect from 1 January 2004. Earlier the eligible age to invest in NPS was 18-65 years which has now been revised to 18-70 years.

As per the revised norms, any Indian Citizen, resident or non-resident and Overseas Citizen of India (OCI) between the age of 65-70 years can join NPS

Subscribers can continue or defer their NPS Account up to the age of 75 years

50. World's largest star sapphire cluster has been found in

- A. Rajkot, India
- B. Ratnapura, SriLanka
- C. Pretoria, South Africa
- D. Brisbane, Australia?

Ans. B

Sol. The star sapphire cluster was found in Ratnapura, a traditional centre for the Sri Lankan gem trade, located 100 km southeast of the country's capital Colombo. Sri Lankan officials said the cluster weighs around 510 kg or 2.5 million carats and has been named the "Serendipity Sapphire".

51. Consider the following statements regarding Cybersecurity Multi-Donor Trust Fund:

1. The World Bank has launched a new 'Cybersecurity Multi-Donor Trust Fund', to better roll out cybersecurity development agenda in a systematic manner.

2. The new fund has been developed as an associated trust fund under the broader Digital Development Partnership (DDP) umbrella program.
3. World Bank has partnered with four countries, namely Estonia, Japan, Germany, and the Netherlands, to launch the fund.

Which of the above statements are correct ?

- A. 1 and 2 only B. 2 and 3 only
C. 1 and 3 only D. 1, 2 and 3

Ans. D

Sol.

1. The World Bank has launched a new 'Cybersecurity Multi-Donor Trust Fund', to better roll out cybersecurity development agenda in a systematic manner.
2. The new fund has been developed as an associated trust fund under the broader Digital Development Partnership (DDP) umbrella program.
3. World Bank has partnered with four countries, namely Estonia, Japan, Germany, and the Netherlands, to launch the fund.

Hence, all statements are correct. Therefore, option D is correct.

52. Consider the following statements regarding Hydrogen Breakthrough Ironmaking Technology :

1. Swedish green steel venture HYBRIT, which had made the 'world's first' customer delivery of steel produced with using coal.
2. The steel was made using Hydrogen Breakthrough Ironmaking Technology, which uses 100% fossil-free hydrogen instead of coal and coke.

3. The venture has started delivering the fossil-free steel to the Volvo Group as part of its trial run.

Which of the above statements is/are correct?

- A. 1 only B. 2 and 3 only
C. 1 and 3 only D. 2 only

Ans. B

Sol. Swedish green steel venture HYBRIT, which had made the 'world's first' customer delivery of steel produced without using coal. The steel was made using Hydrogen Breakthrough Ironmaking Technology, which uses 100% fossil-free hydrogen instead of coal and coke. The venture has started delivering the fossil-free steel to the Volvo Group as part of its trial run.

Development for the Hybrit project, which was set up in 2016 and is owned by SSAB, energy firm Vattenfall and LKAB, a mining and minerals group. Both Vattenfall and LKAB are owned by the Swedish state. The idea underpinning Hybrit is to use "100% fossil-free hydrogen" rather than coal and coke in steel production.

Important takeaways for all competitive exams:

1. Stockholm is the capital of Sweden.
2. The krona is the official currency of Sweden.
3. The current PM of Sweden is Stefan Lofven.

- 53.** US-based Ohmium International has started India's first green hydrogen electrolyzer manufacturing-unit at
- A. Pune, Maharashtra
B. Hyderabad, Telangana
C. Bengaluru, Karnataka
D. Noida, Uttar Pradesh

Ans. C

Sol. US-based Ohmium International has started India's first green hydrogen electrolyzer manufacturing unit at Bengaluru, Karnataka. The factory will manufacture India-made Proton Exchange Membrane (PEM) hydrogen electrolyzers. Green hydrogen is made from non-fossil sources as against blue hydrogen that is made from fossil sources. Making green hydrogen in India will give a cost advantage for manufacturers rather than going for imports.

The gigafactory will manufacture India-made Proton Exchange Membrane (PEM) hydrogen electrolyzers with an initial manufacturing capacity of about 500 MW per year and will scale it up to 2 GW per year. The PEM hydrogen electrolyzer is the main equipment for the production of green hydrogen as it uses power generated from renewable resources to break water into hydrogen and oxygen.

54. Which one of the following ministries has repealed the Unmanned Aircraft Systems (UAS) Rules, 2021 and replaced the same with the liberalized Drone Rules, 2021 ?

- A. Ministry of Home Affairs
- B. Ministry of Defence
- C. Ministry of Science and Technology
- D. Ministry of Civil Aviation

Ans. D

Sol. Ministry of Civil Aviation has repealed the Unmanned Aircraft Systems (UAS) Rules, 2021 and replace the same with the liberalized Drone Rules, 2021. The step has been taken as the earlier UAS Rules 2021 was perceived by academia, Startups, end-users and other stakeholders as being restrictive in nature as they involved considerable

paperwork, required permissions for every drone flight and very few "free to fly" green zones were available.

55. Consider the following statements regarding Forum for Decarbonizing Transport :

1. NITI Aayog and World Resources Institute (WRI), India, jointly launched the 'Forum for Decarbonizing Transport' in India.
2. NITI Aayog is the implementing partner for India.
3. The aim of the project is to bring down the peak level of GHG emissions (transport sector) in Asia (in line with a well below 2-degree pathway), resulting in problems like congestion and air pollution.

Which of the above statements are correct ?

- A. 1 and 2 only
- B. 2 and 3 only
- C. 1 and 3 only
- D. 1, 2 and 3

Ans. D

Sol. NITI Aayog and World Resources Institute (WRI), India, jointly launched the 'Forum for Decarbonizing Transport' in India. NITI Aayog is the implementing partner for India. The aim of the project is to bring down the peak level of GHG emissions (transport sector) in Asia (in line with a well below 2-degree pathway), resulting in problems like congestion and air pollution.

The Forum has been launched under the NDC-Transport Initiative for Asia (NDC-TIA) project. The NDC Transport Initiative for Asia (TIA 2020-2023) is a joint programme of seven organizations that will engage China, India, and Vietnam in promoting a comprehensive approach to decarbonizing transport in their respective countries.

- NITI Aayog Formed: 1 January 2015
- NITI Aayog Headquarters: New Delhi
- NITI Aayog Chairperson: Narendra Modi
- NITI Aayog CEO: Amitabh Kant
- World Resources Institute Headquarters: Washington, D.C., United States
- World Resources Institute Founder: James Gustave Speth
- World Resources Institute Founded: 1982.

56. Which one of the following national parks has become the first national park in India to be equipped with satellite phones?

- A. Kaziranga National Park in Assam
- B. Sundarbans National Park in West Bengal
- C. Desert National Park In Rajasthan
- D. Indravati National Park in Chhattisgarh

Ans. A

Sol. Kaziranga National Park (KNP) in Assam has become the first national park in India to be equipped with satellite phones. Assam Chief Secretary Jishnu Barua handed over 10 satellite phones to the forest personnel of the Kaziranga National Park. The satellite phones will boost the anti-poaching measures in the park. BSNL will be the service provider of these phones.

57. Which one of the following cities has been named as the world's safest city from among 60 global cities, in Safe Cities Index 2021, released by the Economist Intelligence Unit (EIU) ?

- A. Yangon
- B. Copenhagen
- C. New York
- D. Toronto

Ans. B

Sol. Copenhagen, the capital city of Denmark, has been named as the world's safest city from among 60 global cities, in Safe Cities Index 2021, released by the Economist Intelligence Unit (EIU). Copenhagen scored 82.4 points out of 100, to top the fourth edition of the EIU's biennial index, which measures the level of urban safety. Yangon is at the bottom of the index, as least safe city, with a score of 39.5.

58. The First-ever G20 Ministerial Conference on Women's Empowerment was held at

- A. Vienna, Austria
- B. Hamburg, Berlin
- C. Geneva, Switzerland
- D. Santa Margherita Ligure, Italy

Ans. D

Sol. The First-ever G20 Ministerial Conference on Women's Empowerment was held at **Santa Margherita Ligure, Italy**. It was held in mixed format i.e people participated in physical form and via video conference also. The Union Minister of Women & Child Development, Smt. Smriti Irani addressed the meet on behalf of India. The Union Minister reaffirmed India's commitment towards addressing gender and women-centric issues through mutual cooperation.

59. Which one of the following countries did the Indian Navy participate in the U.S. Navy-led Southeast Asia Cooperation and Training (SEACAT) military exercise, to demonstrate its maritime manoeuvres ?

- A. Malaysia
- B. Australia
- C. Singapore
- D. New Zealand

Ans. C

Sol. The Indian Navy participated in the U.S. Navy-led **Southeast Asia Cooperation and Training (SEACAT)** military exercise in **Singapore**, to demonstrate its maritime manoeuvres. The main objective of SEACAT 2021 was to enhance the interoperability and shared maritime security concerns and preserve rules-based international order. The exercise comprised approximately 400 personnel and 10 ships.

60. Most serious students are happy students, and most serious students go to graduate school. Furthermore, all students who go to graduate school are overworked.

Which one of the following can be properly inferred from the statements above?

- A. Most overworked students are happy students
- B. Some happy students are overworked
- C. All overworked students are serious students
- D. Some unhappy students go to graduate school

61. Some environmentalists question the prudence of exploiting features of the environment, arguing that there are no economic benefits to be gained from forests, mountains, or wetlands that no longer exist. Many environmentalists claim that because nature has intrinsic value it would be wrong to destroy such features of the environment, even if the economic costs of doing so were outweighed by the economic costs of not doing so.

Which one of the following can be logically inferred from the passage ?

- A. It is economically imprudent to exploit features of the environment
- B. Some environmentalists appeal to a noneconomic justification in questioning the defensibility of exploiting features environment.
- C. Most environmentalists appeal to economic reasons in questioning the defensibility of exploiting features of the environment.
- D. Many environmentalists provide only a noneconomic justification in questioning the defensibility of exploiting features of the environment.

Ans. B

Sol. (A) It is economically imprudent to exploit features of the environment.

This is a general statement and it doesn't include the "economic" factor. The economists say it is wrong for a specific case and not for every case.

(B) Some environmentalists appeal to a non-economic justification in questioning the defensibility of exploiting features of the environment.

Most economists appeal to non-economic justification (Intrinsic value) while questioning the exploiting features of the environment. - Correct

(C) Most environmentalists appeal to economic reasons in questioning the defensibility of exploiting features of the environment.

It is actually the opposite. Most economists actually used intrinsic value of nature to justify the non exploitation of the environment that is appealed to non - economic reasons to question the defensibility of exploiting features of the environment.

(D) Many environmentalists provide only a non-economic justification in questioning the defensibility of exploiting features of the environment.

Only is strong word and cannot be inferred from the above premises.

Hence B is correct option.

- 62.** Some argue that laws are instituted at least in part to help establish a particular moral fabric in society. But the primary function of law is surely to help order society so that its institutions, organizations, and citizenry can work together harmoniously, regardless of any further moral aims of the law. Indeed, the highest courts have on occasion treated moral beliefs based on conscience or religious faith as grounds for making exceptions in the application of laws.

The statements above, if true, most strongly support which one of the following ?

- A. The manner in which laws are applied sometimes takes into account the beliefs of the people governed by those laws.
- B. The law has as one of its functions the ordering of society but is devoid of moral aims.
- C. Actions based on religious belief or on moral conviction tend to receive the protection of the highest courts.
- D. The way a society is ordered by law should not reflect any moral convictions about the way society ought to be ordered.

Ans. D

Sol. The answer overstates the case by saying that a society ordered by law should not reflect any moral conviction about the ordering.

- 63.** Unlike newspapers in the old days, today's newspapers and televised news programs are full of stories about murders and assaults in our city. One can only conclude from this change that violent crime is now out of control, and, to be safe from personal attack, one should not leave one's home except for absolute necessities.

Which one of the following, if true, would cast the most serious doubt on the conclusion?

- A. Newspapers and televised news programs have more comprehensive coverage of violent crime than newspapers did in the old days.
- B. National data show that violent crime is out of control everywhere, not just in the author's city.
- C. Police records show that people experience more violent crimes in their own neighborhoods than they do outside their neighborhoods.
- D. Murder comprised a larger proportion of violent crimes in the old days than it does today.

Ans. A

Sol. Newspapers and televised news programs have more comprehensive coverage of violent crime than newspapers did in the old days. Definitely weakens the argument.

- 64. Fact 1:** Jessica has four children.

Fact 2: Two of the children have blue eyes and two of the children have brown eyes.

Fact 3 : Half of the children are girls.

If the first three statements are facts, which of the following statements must also be a fact?

- I. At least one girl has blue eyes.
- II. Two of the children are boys.
- III. The boys have brown eyes.

Select the correct answer using the code given below:

- A. II only
- B. I and III only
- C. II and II only
- D. None of the statements is a known fact

65. Children are in pursuit of a dog whose leash has broken. James is directly behind the dog. Ruby is behind James. Rachel is behind Ruby. Max is ahead of the dog walking down the street in the opposite direction. As the children and dog pass, Max turns around and joins the pursuit. He runs in behind Ruby. James runs faster and is alongside the dog on the left. Ruby runs faster and is alongside the dog on the right. Which child is directly behind the dog?

- A. James
- B. Ruby
- C. Rachel
- D. Max

Ans. D

Sol. James is directly behind the dog \Rightarrow

1 \Rightarrow Dog

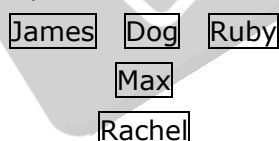
2 \Rightarrow James.

Ruby is behind James thus Ruby > 3

Max is ahead of dog \Rightarrow Max < 1

after passing, Max is behind Ruby

So sequencey



66. At the baseball game, Henry was sitting in seat 253. Marla was sitting to the right of Henry is seat 254. In the seat to the left of Henry was George Inez was sitting to the left of George. Which seat is Inez sitting in?

- A. 215
- B. 254
- C. 255
- D. 256

Ans. B

Sol. Seat

Henry - 153

Marla \rightarrow Right to Henry - 254

I	G	G	M
251	252	253	254

George Inez in 251

67. The difference between simple interest and compound interest on a sum for 2 years at 8% when the interest is compounded annually is ₹ 16. If the interest were compounded half yearly the difference in two interests would be nearly

- A. ₹21.35
- B. ₹24.64
- C. ₹27.85
- D. ₹29.94

Ans. B

Sol. Number of year - 2

Interest rate = 8

CI - SI = 16

\Rightarrow When compounding was done annually.

$$\Rightarrow P \left\{ \left(1 + \frac{R}{100} \right)^n - 1 \right\} - \frac{PRT}{100} = 16$$

$$\Rightarrow P \left\{ \left(1 + \frac{8}{100} \right)^2 - 1 \right\} - \frac{8 \times 2}{100} = 16 \quad \dots(1)$$

Now interest is compounded half yearly then

n = 4

$$P \left\{ \left(1 + \frac{8}{100} \right)^4 - 1 \right\} - \frac{8 \times 2}{100} = \Rightarrow \text{Let } x \quad \dots(2)$$

Dividing (1) & (2)

$$\frac{\left\{ \left(1 + \frac{8}{100} \right)^2 - 1 - \frac{16}{100} \right\}}{\left\{ \left(1 + \frac{4}{100} \right)^4 - 1 - \frac{12}{100} \right\}} = \frac{16}{x}$$

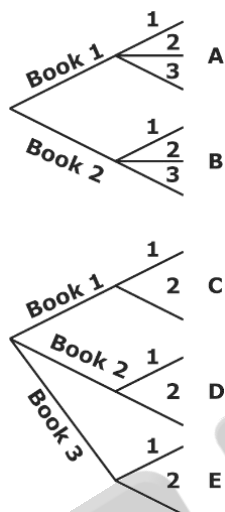
$$x = 24.64$$

- 68.** A library has two books each having three copies and three other books each having two copies. In how many ways can all these books be arranged in a shelf so that copies of the same book are not separated?

[illegible]

Ans. C

Sol.



there are total 5 object, A, B, C, D, E these can be arranged $5!$ ways = 120.

- 69.** 21 mango trees, 42 apple trees and 56 orange trees have to be planted in rows such that each row contains the same number of trees of one variety only. Minimum number of rows in which the above trees may be planted is

A. 9
B. 12
C. 14
D. 17

Ans. D

Sol. Number of mango trees = 21

Number of apple trees = 42

Number of orange trees = 56

Total number of trees = 119

So, H.C.F. of 21, 42, 56 is = 7

So, each row will be containing 7 trees,

So, Total number of row = $119/7 = 17$.

- 70.** A general wishes to draw up his 36562 soldiers in the form of a solid square. After arranging them, he found that some of them are left over. How many are left?

A. 81 B. 75
C. 61 D. 52

Ans. A

Sol. Nearest possible complete square root = 191

So, number of soldiers in each row = 191

total soldiers will be required for the same

$$= 191 \times 191$$

So, left soldiers = $36562 - (191 \times 191) = 81$

- 71.** A tank can be filled by 20 buckets each of capacity 13.5 litres. If the capacity of each bucket be 9 litres, how many buckets will fill the same tank?

A. 30
B. 25
C. 20
D. 15

Ans. A

Sol. Capacity of cache bucket = 1.35 liter

Number of bucket = 20

Total capacity of tank = $13.5 \times 20 = 270$ liter

Now,

Capacity of each bucket = 9 liter

So, Number of bucket required = $\frac{270}{9} = 30$

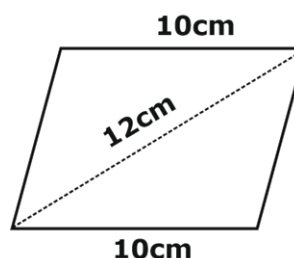
- 72.** One side of a rhombus is 10 cm and one of its diagonals is 12 cm. The area of the rhombus is

A. 24 sq. cm B. 48 sq. cm

C. 72 sq. cm D. 96 sq. cm

Ans. D

Sol.



One side of rhombus, $a = 10$ cm

One of diagonal, $d = 12$ cm

area of the rhombus,

$$\begin{aligned}
 &= \frac{1}{2} d \sqrt{4a^2 - d^2} \\
 &= \frac{1}{2} \times 12 \sqrt{4 \times 10^2 - 12^2} \\
 &= \frac{1}{2} \times 12 \times 16
 \end{aligned}$$

$$= 96 \text{ cm}^2$$

- 73.** Two boys begin together to write out a booklet containing 817 lines. The first boy starts with first line, writing at the rate of 200 lines an hour and the second boy starts with the last line. He writes line 817 and so on back-wards proceeding at the rate of 150 lines an hour. At what line will they meet?

- A. 469th B. 467th
C. 465th D. 463rd

Ans. B

Sol. Boy 1 \Rightarrow 200 lines/hr

Boy 2 \Rightarrow 150 lines/hr

Number of lines type by boy 1 after t hours =
 $200 \times t$

Number of lines type by boy 2 after t hours =
 $150 \times t$

Let at t hours they meet

So

$$200t + 150t = 817$$

$$t = 2.3342 \text{ hr}$$

So, after t time, number of lines type by boy

$$\begin{aligned}
 1 &= 200 \times t \\
 &= 200 \times 2.3342 \\
 &= 466.85 \\
 &= 467 \text{ lines}
 \end{aligned}$$

- 74.** Rohith spends 40% of his monthly income on food items and 50% of the remaining on cloths and conveyance. He saves one-third of the remaining amount after spending on food, clothes and conveyance. If he saves Rs. 19,200 every year, what is his monthly income?

- A. Rs. 32,000 B. Rs. 16,000
C. Rs. 12,000 D. Rs. 6,000

Ans. B

Sol. Let Monthly income = x

Spent in food = $0.4x$

Remaining income = $0.6x$

Spent on cloth = $0.5 \times 0.6x = 0.3x$

Total spent = $0.4x + 0.3x = 0.7x$

Total remaining = $x - 0.7x = 0.3x$

Now saving = $\frac{1}{3}$ of remaining

$$= \frac{1}{3} \times 0.3x = 0.1x$$

Annually saving = 19200

$$\text{Monthly saving} = \frac{19200}{12} = 1600$$

thus,

$$\text{Monthly saving} = 0.1x = 1600$$

$$x = 16000$$

- 75.** The value of $L^{-1} \left[\frac{5s^2 + 8s - 1}{(s+3)(s^2+1)} \right]$ is

- A. $2e^{-3t} + 3 \cos t - \sin t$
B. $2e^{-3t} - 3 \cos t + \sin t$
C. $3e^{-3t} + 2 \cos t - \sin t$
D. $3e^{-3t} - 2 \cos t + \sin t$

Ans. A

$$\text{Sol. } \frac{5s^2 + 8s - 1}{(s+3)(s^2+1)} = \frac{2}{s+3} + \frac{3s}{s^2+1} - \frac{1}{s^2+1}$$

$$L^{-1} \left[\frac{5s^2 + 8s - 1}{(s+3)(s^2+1)} \right] = 2e^{-3t} + 3 \cos t - \sin t$$

76. What is the Laplace transform of $2e^{3t}(4 \cos 2t - 5 \sin 2t)$?

- A. $\frac{8s + 44}{s^2 + 6s - 13}$ B. $\frac{4s - 44}{s^2 - 6s + 13}$
 C. $\frac{4s + 44}{s^2 + 6s - 13}$ D. $\frac{8s - 44}{s^2 - 6s + 13}$

Ans. D

Sol. $L(4 \cos 2t) = \frac{4s}{s^2 + 2^2}$

$L(5 \sin 2t) = \frac{5 \times 2}{s^2 + 2^2}$

$\therefore L(4 \cos 2t - 5 \sin 2t) = \frac{4s - 10}{s^2 + 2^2}$

$L(e^{3t}(4 \cos 2t - 5 \sin 2t)) = \frac{4(s - 3) - 10}{(s + 3)^2 + 2^2}$

$L(2e^{3t}(4 \cos 2t - 5 \sin 2t)) = 2 \left(\frac{4s - 12 - 10}{s^2 - 6s + 13} \right)$
 $= \frac{8s - 44}{s^2 - 6s + 13}$

77. A batch of 100 capacitors contains 73 which are within the required tolerance values, 17 which are below the required tolerance values, and the remaining are above the required tolerance values. What is the probability that when randomly selecting capacitor and then a second capacitor, if both are within the required tolerance values when selecting with replacement?

- A. 0.3319 B. 0.5329
 C. 0.7239 D. 0.9249

Ans. B

Sol. The probability of selecting a capacitor within the required tolerant values is $\frac{73}{100}$. The first capacitor drawn is now replaced and a second one is drawn from the batch of 100. The

probability of this capacitor being within the required tolerance values also $\frac{73}{100}$.

Thus, the probability of selecting a capacitor within the required tolerance values for both first and the second draw is

$$\frac{73}{100} \times \frac{73}{100} = \frac{5329}{10000} = 0.5329$$

78. The value of $\int_0^4 \sqrt{16 - x^2} dx$ is

- A. π B. 2π
 C. 3π D. 4π

Ans. D

Sol. $\int_0^4 \sqrt{16 - x^2} dx$

we know

$$\int \sqrt{a^2 - x^2} dx = \frac{x\sqrt{a^2 - x^2}}{2} + \frac{a^2}{2} \sin^{-1} \left(\frac{x}{a} \right)$$

$$= \left[\frac{x\sqrt{16 - x^2}}{2} + 8 \sin^{-1} \left(\frac{x}{4} \right) \right]_0^4$$

$$= 8 \times \frac{\pi}{2} = 4\pi$$

79. The value of $\int_0^2 \frac{3x}{\sqrt{2x^2 + 1}} dx$ is

(takes positive values of square roots only)

- A. 1 B. 2
 C. 3 D. 4

Ans. C

Sol. $\int_0^2 \frac{3x}{\sqrt{2x^2 + 1}} dx$

Put $2x^2 + 1 = t$

$4x dx = dt \Rightarrow$ at $x = 0, t = 1$

$x = 2, t = 9$

$$= \int_1^9 \frac{3x}{\sqrt{t}} \times \frac{dt}{4x}$$

$$= \frac{3}{4} \int_1^9 t^{-1/2} dt$$

$$= \frac{3}{2} \times \left[t^{1/2} \right]_1^9$$

$$= 1.5 \times [3 - 1]$$

$$= 1.5 \times 2$$

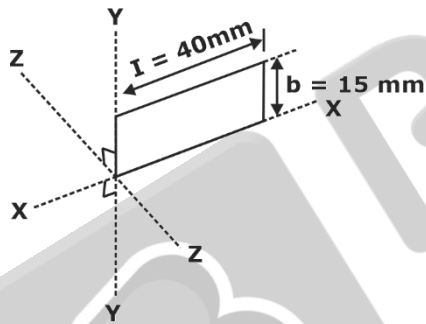
$$= 3$$

- 80.** What is the radius of gyration of a rectangular lamina of length 40 mm and width 15 mm about an axis through one corner, perpendicular to the plane of the lamina?

- A. 1.27 cm B. 2.47 cm
C. 3.67 cm D. 4.87 cm

Ans. B

Sol. The lamina is shown in figure.



From the perpendicular axis theorem:

$$I_{ZZ} = I_{XX} + I_{YY}$$

$$I_{XX} = \frac{lb^3}{3} = \frac{(40)(15)^3}{3} = 45000 \text{ mm}^4$$

And $I_{YY} = \frac{bl^3}{3} = \frac{(15)(40)^3}{3} = 32000 \text{ mm}^4$

Hence $I_{ZZ} = 45000 + 32000$
 $= 365000 \text{ mm}^4$ or 36.5 cm^4

Radius of gyration,

$$k_{ZZ} = \sqrt{\frac{I_{ZZ}}{\text{area}}} = \sqrt{\frac{365000}{(40)(15)}}$$

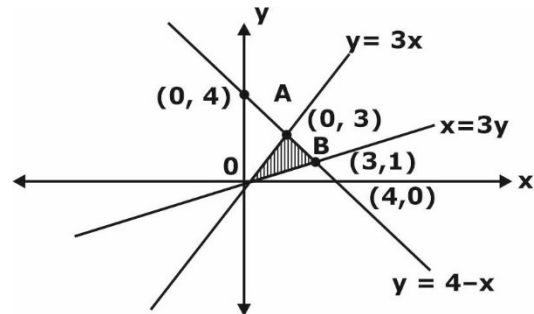
$$= 24.7 \text{ mm or } 2.47 \text{ cm}$$

- 81.** By integration the area bounded by the three straight lines $y = 4 - x$, $y = 3x$ and $3y = x$ is

- A. 2 square units B. 3 square units
C. 4 square units D. 5 square units

Ans. C

Sol. Required area = area of $\triangle DAC$ - Area of $\triangle OBC$



$$\left(\frac{1}{2} \times 3 \times 4 \right) - \left(\frac{1}{2} \times 1 \times 4 \right)$$

$$= 6 - 2$$

$$= 4 \text{ sq. units.}$$

- 82.** The power series for $\ln\left(\frac{1+x}{1-x}\right)$ is

A. $\left(x + \frac{x^3}{3} + \frac{x^5}{5} + \dots \right)$

B. $2 \left(x - \frac{x^3}{3} + \frac{x^5}{5} - \dots \right)$

C. $2 \left(x + \frac{x^3}{3} + \frac{x^5}{5} + \dots \right)$

D. $\left(x - \frac{x^3}{3} + \frac{x^5}{5} - \dots \right)$

Ans. (c)

Sol. $\ln\left(\frac{1-x}{1-x}\right)$

From the formula

$$\ln\left(\frac{m}{n}\right) = \ln(m) - \ln(n)$$

$$\ln\left(\frac{1-x}{1-x}\right) = \ln(1-x) - \ln(1-x)$$

Expansion of

$$\ln(1+x) \left[x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \dots \right]$$

Expansion of

$$\left[\ln(1-x) = 1x - \frac{x^2}{2} - \frac{x^3}{3} - \frac{x^4}{4} - \frac{x^5}{5} \dots \right]$$

Therefore

$$\ln(1+x) - \ln(1-x) = 2 \left[x + \frac{x^3}{3} + \frac{x^5}{5} + \dots \right]$$

$$\ln\left(\frac{1+x}{1-x}\right) = 2 \left[x + \frac{x^3}{3} + \frac{x^5}{5} + \dots \right]$$

- 83.** The mean value of $y = 3x^2 + 4x + 1$ between $x = -1$ and $x = 2$ is

- A. 2 B. 4
C. 6 D. 8

Ans. C

Sol. Mean value, $\bar{x} = \frac{1}{b-a} \int_a^b f(x) dx$

$$= \frac{1}{2 - (-1)} \int_{-1}^2 (3x^2 + 4x + 1) dx$$

$$= \frac{1}{3} [x^3 + 2x^2 + x]^2$$

$$= \frac{1}{3} [8 + 8 + 2 + 1 - 2 + 1]$$

$$= 6$$

- 84.** What is the length of the curve $x = 2\cos^3\theta, y = 2\sin^3\theta$ between the points

corresponding to $\theta = 0$ and $\frac{y^2}{4} - \frac{x^2}{25} = -1$?

- A. 2 unit B. 3 unit
C. 4 unit D. 5 unit

Ans. B

Sol. Length of curve $\int_0^{\pi/2} \sqrt{\left(\frac{dx}{d\theta}\right)^2 + \left(\frac{dy}{d\theta}\right)^2} d\theta$

$$\frac{dx}{d\theta} = 2(3\cos^2\theta)(\sin\theta) = -6\cos^2\theta\sin\theta$$

$$\frac{dy}{d\theta} = 2(3\sin^2\theta)(\cos\theta) = 6\sin^2\theta\cos\theta$$

Length of curve

$$= \int_0^{\pi/2} \sqrt{(-6\cos^2\theta\sin\theta)^2 + (6\sin^2\theta\cos\theta)^2} d\theta$$

$$\int_0^{\pi/2} \sqrt{(6\cos\theta\sin\theta)^2(\cos\theta)^2 + \sin\theta)^2} d\theta$$

$$= \int_0^{\pi/2} 6\cos\theta\sin\theta d\theta = \int_0^{\pi/2} 3\sin 2\theta d\theta$$

$$= 3 \left[\frac{-\cos\theta}{2} \right]_0^{\pi/2} = 3 \left[\frac{1}{2} + \frac{1}{2} \right]$$

$$= 3 \text{ unit.}$$

- 85.** What is the largest eigenvalue in modulus of the matrix

$$A = \begin{pmatrix} 2 & 3 & 2 \\ 4 & 3 & 5 \\ 3 & 2 & 9 \end{pmatrix} \text{ with an initial vector } (1,1,1)^T$$

by power method?

- A. 11.84 B. 12.84
C. 13.84 D. 14.84

- 86.** Reduce the matrix $A = \begin{bmatrix} 1 & 3 & 4 \\ 3 & 2 & -1 \\ 4 & -1 & 1 \end{bmatrix}$ to the tridiagonal form.

A. $\begin{bmatrix} 1 & -5 & 0 \\ -5 & \frac{2}{5} & \frac{1}{5} \\ 0 & \frac{1}{5} & \frac{13}{5} \end{bmatrix}$ B. $\begin{bmatrix} 1 & 0 & -5 \\ -5 & \frac{2}{5} & -\frac{1}{5} \\ 0 & -\frac{13}{5} & \frac{1}{5} \end{bmatrix}$

C. $\begin{bmatrix} 1 & -5 & 0 \\ -5 & -\frac{2}{5} & -\frac{13}{5} \\ 0 & \frac{1}{5} & \frac{1}{5} \end{bmatrix}$ D. $\begin{bmatrix} 1 & -5 & 0 \\ -5 & -\frac{2}{5} & \frac{1}{5} \\ 0, & \frac{13}{5} & \frac{1}{5} \end{bmatrix}$

87. From the Taylor series for $y(x)$, what is the value of $y(0.1)$ correct to four decimal places

if $y(x)$ satisfies $y' - x - y^2$ and $y(0) = 1$?

- A. 0.9138 B. 0.7254
C. 0.5286 D. 0.3524

Ans. A

Sol. Given $y' = f(x, y) = x - y^2$

$$\Rightarrow y'' = 1 - 2yy', \quad y''' = -2yy'' - 2y'^2,$$

$$y^{iv} = -2yy''' - 6y'y'', \quad y^v = -2yy^{iv} -$$

$$8y'y''' - 6y''^2$$

Since at $x = 0, y = 1$;

$$Y' = -1, \quad y'' = 3, \quad y''' = -8, \quad y^{iv} = 34$$

And $y^v = -186$

The forth order Taylor's formula is

$$y(x) = y(x_0) + (x - x_0) y'(x_0, y_0) + \frac{(x - x_0)^2}{2!} y''(x_0, y_0) +$$

$$\frac{(x - x_0)^3}{3!} y'''(x_0, y_0) + \frac{(x - x_0)^4}{4!} y^{iv}(x_0, y_0) + \dots$$

$$(x_0, y_0)/4! + h^5 y^v(x_0, y_0)/5! + \dots$$

$$= 1 - x + 3x^2/2! - 8x^3/3!$$

$$+ 34x^4/4! - 186x^5/5! \quad (\text{since } x_0 = 0)$$

$$= 1 - x + 3x^2/2 - 4x^3/3$$

$$+ 17x^4/12 - 31x^5/20$$

Now,

$$y(0.1) = 1 - (0.1) + 3(0.1)^2/2 - 4(0.1)^3/3$$

$$+ 17(0.1)^4/12 - 31(0.1)^5/20$$

$$= 0.9 + 3(0.1)^2/2 - 4(0.1)^3/3 + 17(0.1)^4$$

$$/12 - 31(0.1)^5/20$$

$$= 0.915 - 4(0.1)^3/3 + 17(0.1)^4/12 - 31$$

$$(0.1)^5/20$$

$$= 0.9137 + 17(0.1)^4/12 - 31(0.1)^5/20$$

$$= 0.9138 - 31(0.1)^5/20$$

$$= 0.9138$$

88. What is the shape of the curve represented by

$$\frac{x}{5} = \sqrt{1 + \left(\frac{y}{2}\right)^2}?$$

- A. Hyperbola B. Rectangular
C. Parabola D. Ellipse

Ans. A

Sol.

$$x = 5\sqrt{1 + \left(\frac{y}{2}\right)^2}$$

$$\frac{x^2}{25} = 1 + \frac{y^2}{4}$$

$$\frac{y^2}{4} - \frac{x^2}{25} = -1$$

Equation represents hyperbola.

89. What is the particular solution of the differential equation $5\frac{dy}{dx} + 2x = 3$ if the

boundary conditions are $y = \frac{7}{5}$ and $x = 2$?

- A. $y = \frac{3x}{5} - \frac{x^2}{5} + 1$ B. $y = \frac{3x}{5} + \frac{x^2}{5} - 2$
C. $y = \frac{5x}{3} - \frac{x^2}{3} + 1$ D. $y = \frac{5x}{3} + \frac{x^2}{3} - 2$

Ans. A

Sol. $5\frac{\partial y}{\partial x} + 2x = 3$

By variable separation

$$\int 5\partial y = \int (3 - 2x)\partial x$$

$$y = \frac{3}{5}x - \frac{x^2}{5} + c \quad \dots(1)$$

By given boundary condition

$$x = 2, y = \frac{7}{5}$$

$$\frac{7}{5} = \frac{6}{5} - \frac{4}{5} + c$$

$$c = 1$$

from (1)

$$y = \frac{3}{5}x - \frac{x^2}{5} + 1 \text{ option (a) correct}$$

90. Which of the following factors are included in product realization process?

1. Marketing functions to assess customer requirements
2. Documentation of the design
3. Legal requirements

Select the correct answer using the code given below :

- A. 1 and 2 only B. 2 and 3 only
C. 1 and 3 only D. 1,2 and 3

Ans. D

Sol. Factors included in project realization process in ISO 9001:2008

1. Planning of product realization;
2. Customer-related processes;
3. Design and development;

92. Continuous thin (narrow) with zigzags (straight) lines are generally used to represent

- A. long-break line B. hidden outline
C. visible outline D. reference line

Ans. A

Sol.

4. Purchasing;
5. Production and service provision;
6. Control of monitoring and measuring equipment.







91. In general, which one of the following is NOT included in the list of parts or the bill of materials in an engineering drawing sheet?



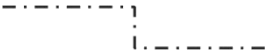

- A. Part number B. Material Name
C. Cost D. Quantity

Ans. C

Sol. The bill of materials should give the following information:

- the part number
- the part name
- the quantity required
- material specifications
- the drawing number of each individual part
- other applicable information

Line	Description	Application
	Continuous THICK	Visible outlines, Visible edges.
	Continuous THIN	Dimension lines, Projection lines, Leader lines, Imaginary lines of intersections, Outlines of revolved sections.
	Continuous THIN Freehand	Boundaries of Limits of Partial of Interrupted views.
	Continuous THIN Zig-Zag	Long break lines
	Dashed THICK	Hidden outlines, Hidden edges,
	Dashed THIN	

	Chain THIN	Centre lines, Lines of Symmetry, Trajectories.
	Chain THIN and THICK at ends & Changes of Direction	Cutting Planes
	Chain THICK	Indication of lines of surfaces to which special treatment required.
	Chain THIN Double Dash	Outlines of adjacent parts, Alternate and Extreme positions of movable parts, Centroidal liens, Initial outlines, Prior to forming.

93. When the receding lines are drawn to full size scale and the projectors inclined at an angle of 30° or 45° or 60° to the plane of projection, such oblique projection is known as

- A. Cabinet projection
- B. Vertical projection
- C. Cavalier projection
- D. Horizontal projection

Ans. C

Sol. Cavalier projection is one of the type of oblique projection in which the receding lines are drawn to full size scale and projectors are inclined at 30 degrees, 45 degrees, 60 degrees to the plane of projection.

94. Which one of the following statements is correct about oblique projection?

- A. The object is drawn with the reduced (about 82%) dimensions
- B. All the faces of the object are distorted in the shape and size
- C. Projectors from an object are parallel to each other perpendicular to the plane of picture
- D. The faces of object which are perpendicular to the plane of projection will be distorted in the shape and size

Ans. D

Sol. (A) (not true) Mathematically, the parallel projection of the point (x, y, z) on the x, y plane gives $(x + az, y + bz, 0)$. The constants a and b uniquely specify a parallel projection. When $a = b = 0$, the projection is said to be "orthographic" or "orthogonal". Otherwise, it is "oblique". The constants a and b are not necessarily less than 1, and as a consequence lengths measured on an oblique projection may be either larger or shorter than they were in space

(B) (wrong) In a general oblique projection, spheres of the space are projected as ellipses on the drawing plane, and not as circles as they would appear from an orthogonal projection. And they can be same as the original object C(wrong) In both oblique projection and orthographic projection, parallel lines of the source object produce parallel lines in the projected image. The projectors in oblique projection intersect the projection plane at an oblique angle to produce the projected image, as opposed to the perpendicular angle used in orthographic projection.

(D) (correct) In oblique projection, the object is aligned such that one face (front face) is parallel to the projection plane. In such projection, the projectors are not perpendicular to the plane of projection rather inclined to the plane of projection at 30° , 45° or 60° . Thus they are distorted

- 95.** Which one of the following methods is used when the non-isometric lines or their ends lie in isometric planes?

A. Intersection method
B. Box method
C. Co-ordinate method
D. Offset method

Ans. B

Sol. Box method: This method is used when the non-isometric lines or their ends lie in isometric planes.

- 96.** If a line is perpendicular to the V.P. and its V.T. coincides with its front view which is a point, then

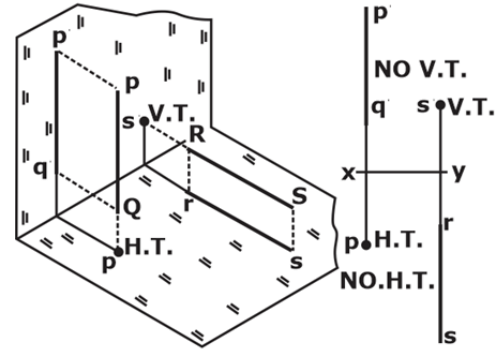
A. V.T. is a point on H.P.
B. H.T. is a point on V.P.
C. it has no V.T.
D. it has no H.T.

Ans. D

Sol. Thus, when a line is parallel to a plane it has no trace upon that plane.

(i) A line PQ is perpendicular to the H.P. Its H.T. coincides with its top view which is a point. It has no V.T.

(ii) A line RS is perpendicular to the V.P. Its V.T. coincides with its front view which is a point. It has no H.T.



Hence, when a line is perpendicular to a plane, its trace on that plane coincides with its projection on that plane. It has no trace on the other plane.

- 97.** Each of the next **Four (04)** items consists of two statements, one labelled as the 'Statement (I)' and the other as "Statement (II)". You are to examine these two statement (II)'. You are examine these statements carefully and select the answers to these items using the codes given below:

Statement (I): The drawings and machining processes can be automated using CAD/CAM change the primary function of these drawings and processes.

Statement (II): The primary function is to provide information about the product to the designer and production people.

- A. Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
B. Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)
C. Statement (I) is true but Statement (II) is false
D. Statement (I) is false but Statement (II) is true

98. Statement(I): environmental pollution has become global problem.

Statement(II) : The rapidly growing human population, rapid urbanization and industrialization together with human activities resulted in the environmental pollution.

- A. Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- B. Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)
- C. Statement (I) is true but Statement (II) is false
- D. Statement (I) is false but Statement (II) is true

Ans. A

Sol. Here, Environment pollution has become global problem due to the rapidly growing human population, rapid urbanization, intensive agriculture and industrialization together with the human activities resulted in the environmental population.

99. Statement (I) : Content is the heart of any IT project

Statement(II): Implementation and maintenance of e-government project thorough IT professional hired from the market is likely to result in failure of the project as the organization is bound to disown such outsiders.

- A. Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

- B. Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)
- C. Statement (I) is true but Statement (II) is false
- D. Statement (I) is false but Statement (II) is true

Ans. D

Sol. Statement I is false.

Content is the heart of any IT project is false. The particular reason for the circumstance is that the project planning is the heart of any IT project

Statement II is true.

Implementation of e-government projects through IT professional hired from the market is likely to result in failure of the project as the organization is bound to disown such outsiders.

Thus D is the answer.

100. Statement(I): Social involvement discourages additional government regulation and intervention.

Statement (II): Social involvement can create a weakened international balance of payments situation.

- A. Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- B. Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)
- C. Statement (I) is true but Statement (II) is false
- D. Statement (I) is false but Statement (II) is true

Ans. B

Sol. Arguments For and Against Social Involvements of Business:

Arguments For:

1. Business received its license from society and consequently has to respond to the needs of society.
2. Society gains through better neighbourhoods and employment opportunities; business benefits from a better community since the community is the source of its workforce and the consumer of its products and services.

3. Social involvement discourages additional government regulation and interventions. The result is greater freedom and more flexibility in decision making for business.

4. Business have a great deal of power which, should be accompanied with an equal amount of responsibility.
5. Modern society is an interdependent system, and the internal activities of the enterprise have an impact on the external environment.
6. Social involvement may be in the interest of stockholders.

7. Problems can constitute profits. Items that may once considered waste can be profitably used.

Arguments Against:

1. The primary task of business is to maximize profits through economic activities. Social activities might reduce economic resources.
2. Social involvement can create a weakened international balance of payments situation. The cost of social programs would have to be added to the products price.
3. Business has enough power, and additional social involvement would further increase its power and influence.
4. Business people lack the social skills to deal with social problems.
5. There is a lack of accountability of business to the society. Unless accountability is established, business should not be involved.
6. There is no complete support for involvement of business in social actions. This different viewpoints might result in frictions.

Hence, statement (I) & (II) both are correct.

Answer Key

Q. No.	Set A	Set B	Set C	Set D
1	D	C	C	A
2	D	D	A	D
3	B	C	*	B
4	D	*	B	B
5	B	A	B	A
6	C	B	*	D
7	D	C	D	B
8	B	D	C	D
9	A	A	D	*
10	A	B	A	B
11	C	C	C	A
12	*	A	D	*
13	A	*	C	A
14	*	B	*	A
15	A	B	A	D
16	B	*	B	A
17	A	D	C	B
18	B	C	D	C
19	C	D	A	D
20	C	A	B	A
21	A	C	C	C
22	C	*	*	C
23	A	A	A	C
24	C	*	*	B
25	C	A	A	D

Q. No.	Set A	Set B	Set C	Set D
26	A	B	B	*
27	*	A	A	*
28	D	B	B	A
29	A	C	C	A
30	C	C	C	A
31	C	D	A	D
32	A	D	C	D
33	*	B	A	B
34	B	D	C	C
35	B	B	C	D
36	*	C	A	A
37	D	D	*	B
38	C	B	D	D
39	D	A	A	C
40	A	A	C	*
41	C	A	D	C
42	D	C	D	A
43	C	A	B	C
44	*	C	D	D
45	A	C	B	B
46	B	A	C	D
47	C	*	D	D
48	D	D	B	A
49	A	A	A	*
50	B	C	A	B

Q. No.	Set A	Set B	Set C	Set D
51	D	C	C	D
52	B	A	A	D
53	C	C	C	B
54	D	D	D	D
55	D	B	B	B
56	A	D	D	C
57	B	D	D	D
58	D	A	A	B
59	C	*	*	A
60	*	B	B	A
61	A	C	D	A
62	*	C	D	C
63	A	C	B	A
64	A	B	C	C
65	D	*	D	C
66	A	*	A	A
67	B	A	B	*
68	C	A	D	D
69	D	A	C	A
70	A	D	*	C
71	A	A	C	C
72	D	A	C	*
73	B	A	C	A
74	B	A	B	-
75	A	D	D	A

Q. No.	Set A	Set B	Set C	Set D
76	D	A	*	B
77	B	B	*	A
78	D	C	A	B
79	*	D	A	C
80	B	A	A	C
81	C	D	A	C
82	C	B	*	D
83	C	C	A	C
84	B	D	A	*
85	*	D	D	A
86	*	A	A	B
87	A	B	B	C
88	A	D	C	D
89	A	C	D	A
90	D	*	A	B
91	C	A	A	C
92	A	D	D	A
93	C	B	B	*
94	D	B	B	B
95	B	A	A	B
96	D	D	D	*
97	D	B	B	D
98	A	D	D	C
99	*	*	*	D
100	B	B	B	A
