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**ESE
2019**

**Prelims Exam
Paper - I**

**GENERAL STUDIES
& ENGINEERING APTITUDE**



**Detailed Solution
(SET-C)**

Office Address

DELHI: F-126, Katwaria Sarai, New Delhi - 110 016

Ph: 011-41013406, Mobile: 8130909220, 9711853908

NOIDA: B-23 A, 5th Floor, Gaurav Deep Heights, Near Fortis Hospital
Sector 62, Noida- 201305 **Ph:** 0120 415 1100

Web: www.iesmaster.org | E-mail: info@iesmaster.org



SET - C

1. A committee of 4 is to be formed from among 4 girls and 5 boys. What is the probability that the committee will have number of boys less than number of girls?

- (a) $\frac{2}{9}$ (b) $\frac{4}{9}$
(c) $\frac{4}{5}$ (d) $\frac{1}{6}$

Ans. (d)

Sol. No. of girls = 4

No. of boys = 5

The committee shall have 4 members.

Probability that the committee will have less number of boys than girls

$$= \frac{{}^5C_0 \times {}^4C_4 + {}^5C_1 \times {}^4C_3}{{}^9C_4}$$

$$= \frac{1 \times 1 + 5 \times 4}{9!} = \frac{21 \times 4 \times 3 \times 2 \times 1}{9 \times 8 \times 7 \times 6} = \frac{1}{6}$$

2. The solution of initial value problem; $\frac{\partial u}{\partial x} =$

$$2 \frac{\partial u}{\partial t} + u, \text{ where } u(x, 0) = 6e^{-3x} \text{ is}$$

- (a) $u = 6e^{-3x+t}$ (b) $u = 6e^{-(2x+2t)}$
(c) $u = 6e^{-(3x+2t)}$ (d) $u = 6e^{-(3x-2t)}$

Ans. (c)

Sol. Given DE: $\frac{\partial u}{\partial x} = 2 \frac{\partial u}{\partial t} + u \dots(i)$

Using option (c), $u = 6e^{-(3x+2t)}$

$$\frac{\partial u}{\partial x} = -18e^{-(3x+2t)}, \quad \frac{\partial u}{\partial t} = -12e^{-(3x+2t)}$$

Putting these values in (i), it is verified hence (c) is the correct option.

3. Polar form of the Cauchy-Riemann equations is

- (a) $\frac{\partial u}{\partial r} = r \frac{\partial v}{\partial \theta}$ and $\frac{\partial v}{\partial r} = -r \frac{\partial u}{\partial \theta}$
(b) $\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta}$ and $\frac{\partial v}{\partial r} = -\frac{1}{r} \frac{\partial u}{\partial \theta}$
(c) $\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta}$ and $\frac{\partial v}{\partial r} = -r \frac{\partial u}{\partial \theta}$
(d) $\frac{\partial u}{\partial r} = r \frac{\partial v}{\partial \theta}$ and $\frac{\partial v}{\partial r} = -\frac{1}{r} \frac{\partial u}{\partial \theta}$

Ans. (b)

Sol. It is the standard result.

4. If $f(z)$ has a pole of order n at $z = a$, then Residue of function $f(z)$ at a is

- (a) $\text{Res } f(a) = \frac{1}{(n)!} \left\{ \frac{d^{n-1}}{dz^{n-1}} \left((z-a)^{n-1} f(z) \right) \right\}_{z=a}$
(b) $\text{Res } f(a) = \frac{1}{(n-1)!} \left\{ \frac{d^{n-1}}{dz^{n-1}} \left((z-a)^{n-1} f(z) \right) \right\}_{z=a}$
(c) $\text{Res } f(a) = \frac{1}{(n)!} \left\{ \frac{d^{n-1}}{dz^{n-1}} \left((z-a)^n f(z) \right) \right\}_{z=a}$
(d) $\text{Res } f(a) = \frac{1}{(n-1)!} \left\{ \frac{d^{n-1}}{dz^{n-1}} \left((z-a)^n f(z) \right) \right\}_{z=a}$

Ans. (d)

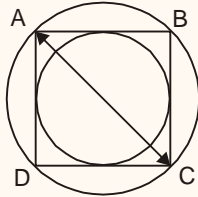
Sol. If $z = z_0$ is a pole of order 'm' then

$$\text{Res } f(z) = \frac{1}{(m-1)!} \left[\frac{d^{m-1}}{dz^{m-1}} (z-z_0)^m f(z) \right]_{z=z_0}$$

Put $z_0 = a$ and $m = n$

$$\text{Res } f(z) = \frac{1}{(n-1)!} \left[\frac{d^{n-1}}{dz^{n-1}} (z-a)^n f(z) \right]_{z=a}$$

5. Consider following diagram : AC is a diameter of the large circle and $AB = BC$.

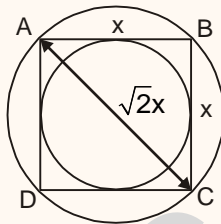


The ratio of areas of the large circle to the small circle of a square is

- (a) 4 : 1 (b) 1 : 4
(c) 2 : 1 (d) 1 : 2

Ans. (c)

Sol.



Diameter of large circle (AC) = $\sqrt{2}x$

Dia of small circle = x

Ratio of area of large circle to small circle =

$$\frac{(\sqrt{2}x)^2}{x^2} = 2 : 1.$$

6. Which term refers to a single person having authority to oversee all aspects of a product's production scheduling, inventory, dislocation and sales?

- (a) Project management
(b) Product management
(c) Commercial management
(d) Venture management

Ans. (b)

Sol. Project Management is the process which includes initiating the project, developing a plan, executing the project as per approved plan, monitoring and controlling the project, handing over the output of the project to the client and finally closing the project.

Product Management is responsible to oversee all the aspects of product's production is set a product vision and strategy that is differentiated and delivers unique value based on customer demand, define what product will deliver and timeline for implementation, provide cross functional leadership, most notably between engineering team, stores, distribution, sales, marketing and support.

Commercial Management is identification and development of business opportunities and profitable management of projects and contracts from inception to completion.

Venture management is a discipline that focuses on being both innovative and challenging in the realm of introducing what could be a completely new product or entering a promising new emerging market.

7. The lowest Eigen value of the 2×2 matrix

$$\begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix} \text{ is}$$

- (a) 1 (b) 2
(c) 3 (d) 5

Ans. (b)

Sol. Characteristic equation is given as :

$$\begin{bmatrix} 4-\lambda & 2 \\ 1 & 3-\lambda \end{bmatrix} = 0$$

$$\Rightarrow (4-\lambda)(3-\lambda) - 2 = 0$$

$$\Rightarrow 12 - 4\lambda - 3\lambda + \lambda^2 - 2 = 0$$

$$\Rightarrow \lambda^2 - 7\lambda + 10 = 0$$

$$\Rightarrow \lambda^2 - 5\lambda - 2\lambda + 10 = 0$$

$$\Rightarrow \lambda(\lambda - 5) - 2(\lambda - 5) = 0$$

$$\Rightarrow \lambda = 2 \text{ and } 5$$

So, the lowest Eigen value = 2.

8. Consider the following statements :

1. Mobile cranes are sophisticated machines which are designed for lifting efficiently.
2. Mobile cranes are a versatile and reliable means of lifting on site.

Which of the above statements is/are correct?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Ans. (b)

9. Which of the following statements are correct for portable step-ladders?

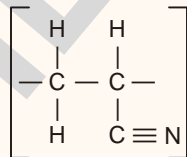
1. Used on working platforms to gain height above the protected edge
2. Used in the fully opened position
3. Should be of a length that ensures a person's feet are not positioned any higher than the second top rung

Select the correct answer using the codes given below :

- (a) 2 and 3 only (b) 1 and 3 only
(c) 1 and 2 only (d) 1, 2 and 3

Ans. (b)

10. Consider the following Repeat Unit Structure :



What is the above polymer?

- (a) Poly (amide – imide)
(b) Polyacrylonitrile
(c) Polybutadiene
(d) Polyethylene

Ans. (b)

Sol. Polyacrylonitrile (PAN) is also known as creslan 61 is a synthetic polycrystalline organic polymer with linear formula $(\text{C}_3\text{H}_3\text{N})_n$. It is carbon fibre reinforced polymer.

11. Which of the following measures is/are correct for using Mobile Equipment Working Platform (MEWP)?

1. Tyres are properly inflated and air filled.
2. SWL to be marked in platforms as identification for carrying loads.

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Ans. (c)

12. Ozone layer present in the atmosphere protects life on earth by not permitting harmful radiations present in the sunlight to penetrate through it. Ozone layer is formed by the reaction of

- (a) Chlorofluorocarbons (CFCs) on oxygen (O_2)
(b) Chlorine (Cl) on oxygen (O_2)
(c) Solar Ultraviolet rays on oxygen (O_2)
(d) Chlorine nitrate (ClNO_3) on oxygen (O_2)

Ans. (c)

Sol. UV-rays are involved in both formation and destruction of ozone layer solar UV-rays strikes on oxygen molecule and atomic oxygen is released, when this atomic oxygen combines with any collisional molecule in presence of UV rays then triatomic oxygen/ O_3 /ozone is formed.

13. The insert command is used in 'Auto CAD' to insert

- (a) Objects in the current file
(b) Objects in any file

- (c) Blocks in any drawing file
(d) Blocks and wblocks in the current drawing

Ans. (d)

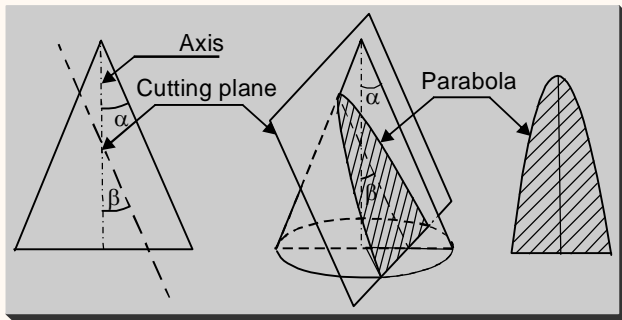
Sol. The INSERT command is used to insert a block and wblocks from within the current drawing (or) and entire drawing file as a block.

14. A cone resting on its base in horizontal plane (HP) is cut by a plane inclined to the axis and parallel to one of its generators, the sectional view will be

- (a) Ellipse (b) Parabola
(c) Hyperbola (d) Circle

Ans. (b)

Sol. Parabola: A parabola is formed when the cutting plane is parallel to one of the generator i.e. ' $\beta = \alpha$ ' as shown below.



15. Consider the following components :

1. Knowledge of psychology
2. Knowledge of the theory of variation
3. Knowledge of process
4. Knowledge of the system and the theory of optimization

Which of the above components comprise the basis of Deming's Systems of Profound Knowledge?

- (a) 1, 2 and 3 only (b) 1, 3 and 4 only
(c) 1, 2 and 4 only (d) 2, 3 and 4 only

Ans. (a)

Sol. Deming's systems of profound knowledge consists of four parts:

1. **Appreciation of a system** – understanding the overall processes involving suppliers, producers, and customers of goods and services.
2. **Knowledge of variation** – the range and causes of variation in quality and use of statistical sampling in measurements.
3. **Theory of knowledge** – the concepts explaining knowledge and the limits of what can be known.
4. **Knowledge of psychology** – concepts of human nature.

16. Consider the following statements :

1. Greenfield Privatization or Incremental Privatization denotes encouragement to private sector in areas hitherto reserved for Public Enterprises
2. Cold Privatization refers to measures taken to distance Public Enterprises from the Government.

Which of the above statement(s) is/are correct?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Ans. (c)

Sol. Greenfield Privatization means private sector is allowed to come and compete in areas hitherto reserved for public sector.

Cold Privatization means granting greater autonomy to Public Enterprises by making them sign Memorandum of Understanding in order to distance them from the Government.

17. Which of the following steps are involved in the product improvement cycle?

1. Sell it in the market



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- Determine quality of performance
- Design the product based on customer needs
- Test it in the laboratory

Select the correct answer using the codes given below :

- (a) 1 and 3 only (b) 2 and 4 only
(c) 1, 3 and 4 only (d) 1, 2, 3 and 4

Ans. (d)

Sol. The product improvement cycle consists of following steps:

- Design the product
- Manufacture the product and test it in the laboratory.
- Sell the product.
- Test the product in service and through market research to find out what users think about it and why non-users have not bought it.

18. Who is responsible for establishing, documenting and maintaining procedures for post-production handling functions such as storage, packaging and delivery?

- (a) Production Manager
(b) Marketing Manager
(c) Vendor
(d) Quality Supervisor

Ans. (c)

Sol. As per ISO 9000-2 clause 4.15, the supplier/vendor shall establish and maintain documented procedures for handling storage, packaging, preservation and delivery of product.

19. A unit produces packing boxes. Out of hourly production of 4,000 boxes, 20 were found to be non-conforming. If the inspector randomly

chooses a box from an hour's production, the probability of it being non-conforming is

- (a) 0.02 (b) 0.10
(c) 0.005 (d) 0.05

Ans. (c)

Sol. Probability of being non-conforming

$$= \frac{20}{400} = 0.005$$

20. Which of the following are relevant factors regarding quality in service sectors?

- Timeliness of service
- Customer participation
- Company personnel motivation
- Company culture

Select the correct answer using the codes given below :

- (a) 1, 3 and 4 only (b) 1, 2 and 3 only
(c) 1, 2, 3 and 4 (d) 2, 3 and 4 only

Ans. (c)

Sol. Service should be provided in a timely manner. The customer should give their feedback and based on that customised services can be provided. The service staff should be trained and motivated to provide good quality services. Further, service quality also depends on the organisation culture.

21. Which one of the following is a viable alternative to term-loans and are instruments for raising debt finance by large publicly traded firms?

- (a) Shares (b) Debentures
(c) Asset loans (d) Gold loans

Ans. (b)

Sol. A debenture is a long-term debt instrument that is not secured by physical assets or collateral and is used by governments and large public traded companies to obtain funds. It is a certificate of agreement of loans given under the company's stamp.



It has an undertaking that holder of debenture will get a fixed return and the principal amount on the maturity of debenture.

- 22.** Which one of the following makes the design, assembly and operation of complex systems feasible and practical?
- (a) System Architecture
 - (b) Modularization
 - (c) Standardization
 - (d) Composition

Ans. (b)

Sol. Systems are designed and assembled from subsystems that themselves are designed and assembled from subsystems and so on. This practice, called modularisation, is what makes the design, assembly and operation of complex systems feasible and practical.

- 23.** Which one of the following schedules shows the specific activities necessary to complete an activity or work package?
- (a) Project schedule
 - (b) Master schedule
 - (c) Task schedule
 - (d) Internal schedule

Ans. (a)

- 24.** In a stable ceramic crystal structure, a cation is surrounded by three anions in the form of a planar equilateral triangle. The ratio of the cation-anion radius for the crystal is nearly
- (a) 0.16
 - (b) 0.24
 - (c) 0.32
 - (d) 0.41

Ans. (a)

Sol. Limiting radius ratio for planer triangle is lie in between 0.155-0.225 so, answer is (a).

- 25.** During tensile testing of a material, if cross-sectional area of the specimen is doubled, the load required to produce the same elongation shall be
- (a) Double
 - (b) Half
 - (c) Same
 - (d) Four times

Ans. (a)

- 26.** When two or more chemically different monomers are polymerized to form a cross link polymer along with some byproduct such as water, the process is known as
- (a) Crystallographic polymerization
 - (b) Addition polymerization
 - (c) Copolymerization
 - (d) Condensation polymerization

Ans. (d)

Sol. It is the formation of polymers by stepwise inter molecular chemical reaction. There is visually a small molecular weight of product area as water.

- 27.** The number of atoms per unit length whose centres lie on the direction vector for a specific crystallographic direction is called
- (a) Linear density
 - (b) Theoretical density
 - (c) Atomic density
 - (d) Avogadro number

Ans. (a)

Sol. Linear density = $\frac{\text{No. of atoms in that direction}}{\text{Length of direction vector}}$

- 28.** Which of the following features of atoms determine the degree to which the solute atoms dissolve in the solvent atoms ?
1. Atomic size factor
 2. Crystal structure
 3. Electronegativity
- (a) 1 and 2 only
 - (b) 1 and 3 only
 - (c) 2 and 3 only
 - (d) 1, 2 and 3

Ans. (d)

Sol. It is Hume–Rothery rules which require all 3-options along with one more.
Option: metal dissolve a metal of higher



valency to a greater extent one of lower valency.

29. A state of ionic compounds wherein there is the exact ratio of cations to anions as predicted by the chemical formula is

(a) Electroneutrality (b) Stoichiometry
(c) Equiliometry (d) Frankel defect

Ans. (b)

Sol. Frankel defect is a stoichiometry defect and stoichiometry define the electrical neutrality.

30. The capacity of a material to absorb energy when it is deformed elastically and then, upon unloading, to have this energy recovered is called

(a) Ductility (b) Tensile strength
(c) Elasticity (d) Resilience

Ans. (d)

Sol. Resilience: Ability of the material to absorb energy when deformed elastically and to release the energy when unloaded. Used for spring.

Elasticity: Ability of material to return to original shape and size instantaneously after the deformation when unloaded.

31. In which one of the following phase transformations, there are two compositional alternations ?

(a) Incongruent transformations
(b) Congruent transformations
(c) Non-equilibrium transformations
(d) Equilibrium transformations

Ans. (b)

Sol. In congruent transformation there is no compositional alternation.

32. In a simple cubic structure, atomic packing factor is nearly

(a) 0.9 (b) 0.7
(c) 0.5 (d) 0.3

Ans. (c)

Sol. The atomic packing fraction or factor of simple cubic is 0.52.

33. Which of the following are the advantages of coding audiovisual objects?

1. It allows interaction with the content
2. It improves reusability and coding the content

3. It allows content-based scalability

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

Ans. (d)

Sol. Advantages of coding Audio-Visual objects are: Interaction, Scalability and Reusability.

- Coding allows interactivity with the audio-visual content.
- Coding allows reusability of both data and tools.
- Coding allows scalability to match bandwidth etc.

34. The transmission of real-time streams across networks uses Bandwidth Allocation Mechanism (BAM), which is based on

(a) Stream peak rate (b) Bucket rate
(c) Token bucket depth (d) Packet size

Ans. (a)

Sol. Transmission of real-time streams over networks is required in multimedia applications. The streams have variable bandwidth requirements. This creates a problem when such streams are delivered over networks especially internet. To solve this problem, differentiated services which uses bandwidth allocation mechanism (BAM) based on stream peak rate can be used.



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35. The quality of service provided in a computer network is

- (a) Presentation layer issue
- (b) Session layer issue
- (c) Network layer issue
- (d) Data link layer issue

Ans. (c)

Sol. Quality of Service (QoS) refers to any technology that manages data traffic to reduce latency, packet loss and jitter on the network. QoS controls and manages network resources by setting priorities for specific types of data on the network.

36. The Pre-echo PE distortions in audio signal represents the

- (a) Theoretical limit on compressibility of particular signals
- (b) Imaginary components of a signal
- (c) Critical band analysis of signal
- (d) Histogram of the signals

Ans. (a)

Sol. Pre-echo sometimes called a **forward echo** is a digital audio compression artifact where a sound is heard before it occurs. It is most noticeable in impulsive sounds from percussion instruments such as castanets or cymbals. It represents a theoretical limit on the compressibility of particular signal.

37. In a computer network, a point-to-point transmission, with one sender and receiver is called

- (a) Unicasting (b) Multicasting
- (c) Broadcasting (d) Internetworking

Ans. (a)

Sol. A point-to-point transmission in a computer network with one sender and one receiver is called unicasting.

38. The protocol (http), the DNS name of the host, and the file name is identified through

- (a) Uniform Resource Locator
- (b) Web Browser
- (c) Web Server
- (d) IP address

Ans. (a)

Sol. **URL (Uniform Resource Locator)** represents an address of a certain file on the TCP/IP network and leads a user to a file on any computer connected to the Internet anywhere in the world.

The format is standardized as <the method of protocol to be used://domain name/the directory name/the file name>

Example: <http://www.gmu.edu/departments/telecomm/special.html>

- http: – protocol to be used to search for the other protocols such as ftp, telnet, gopher
- www.gmu.edu – the domain or host name, the name of the network or the computer you are trying to contact, should be unique in the world
- departments/telecomm/ – indicates there is a folder or a directory named department and subdirectory named telecomm on the web site's computer disk, should be connected with a slash (/)
- special.html – the file name in the directory, could end with such as html, htm, cgi, etc.

39. The traditional way to handle forms and other interactive Web pages is a system called

- (a) Graphical User Interface
- (b) Common Gateway Interface
- (c) Text Based User Interface
- (d) Command Line Interface



Ans. (a)

Sol. A graphical user interface (GUI) is an interface through which a user interacts with electronic devices such as computers, hand-held devices and other appliances.

40. Pretty Good Privacy (PG) which encrypts the data by using a block cipher is used in

- (a) FTP security
- (b) e-mail security
- (c) Browser security
- (d) Bluetooth security

Ans. (b)

Sol. Pretty good privacy (PGP) is an end-to-end encryption and decryption software. It provides cryptographic privacy and authentication.

It is used for encrypting and decrypting texts, emails, files, directories and whole disk partitions and to increase the security of e-mail communication.

41. The core elements of high-level programming languages are

- (a) Keywords, Expressions and Punctuation
- (b) Functions, Keywords and Operators
- (c) Keywords, Operators and Punctuation
- (d) Functions, Expressions and Operators

Ans. (c)

Sol. High-level languages, such as BASIC, C, C++, COBOL, FORTRAN, Ada, and Pascal has a unique set of syntax for organizing program instructions. Core elements are Punctuation, Keywords and Operators.

42. The philosophical study of beliefs and knowledge is better known as

- (a) Ontology
- (b) Epistemology
- (c) Entomology
- (d) Etymology

Ans. (b)

Sol. Ontology: The branch of metaphysics dealing with the nature of being or a set of concepts

and categories in a subject area or domain that shows their property and the relations between them.

Epistemology: The theory of knowledge, especially with regards to its methods, validity, scope and the distinction between justified belief and opinion or the philosophical study of beliefs and knowledge.

Entomology: The study of insects and their relationship to humans, environment and other organisms.

Etymology: The origin of a word and the historical development of its meaning.

43. One branch of ethical philosophy claims that it is possible to know right from wrong or good from bad in a very clear and objective manner, is called

- (a) Non-Cognitivism
- (b) Ethical Pluralism
- (c) Cognitivism
- (d) Utilitarianism

Ans. (c)

Sol. Non-cognitivism: It is a meta-ethical view that ethical sentences do not express propositions and thus can not be true or false in an objective manner.

Ethical pluralism: It is the idea that there are many theories about what is 'right' and 'wrong' (moral norms) which may be incompatible with one's own personal moral norms.

It respects the diversity of ethical norms based on diversity of different societies and their culture.

Cognitivism: It claims that moral judgements are capable of being objectively true. It is the meta-ethical view that ethical sentences express propositions and therefore can be true or false. It is based on the philosophy of **moral naturalism**.

Utilitarianism: It is a consequentialist philosophy which states that goodness of an action depends upon its consequences on the principle of "greatest happiness of the greatest numbers".



Its main proponents were Jeremy Bentham (Act utilitarianism and Hedonism) and John Stuart Millm (Rule utilitarianism).

44. Consider the following statements regarding 'Engineering Ethics'.

1. It is the activity of understanding moral values
2. It resolves the moral issue and justifies moral judgements
3. It would refer to the set of specifically moral problems and issues related to Engineering.

Which of the above statements are correct ?

- (a) 1, 2 and 3 (b) 1 and 2 only
(c) 1 and 3 only (d) 2 and 3 only

Ans. (a)

Sol. **Engineering Ethics** as an area of activity which deals with what ought to be the standard moral/ethical behaviour of an engineer as a professional. hence, statement-1 is correct.

Engineering ethics helps in decision making with respect to engineering projects and issues involving a moral/ethical dilemma. Hence, statement-2 is also correct.

Engineering ethics as a branch of applied ethics which deals with specific controversial issue of engineering having a moral dimension. Hence, statement-3 is also correct.

45. A situation where very high prices are charged from customers for a limited period of time is known as

- (a) Gouging (b) Zipping
(c) Bamboozling (d) Hoodwinking

Ans. (a)

Sol. **Gouging:** An act of engaging in swindling (to deprive some one of money or possessions) through over charging.

Zipping: An act of proceeding swiftly and energetically.

Bamboozing: Alternate pronunciation of Bamboozling which means to cheat or fool somebody.

Hoodwinking: To receive or trick somebody especially by false appearance or to close one's eye with an obstacle to restrict the actual reality.

46. Consider the following steps for an individual regarding preparation for disclosure of unethical behavior :

1. Study and document the facts and formulate a plan for an appeal
2. Take up the matter with higher management.
3. Discuss the matter with immediate supervisor
4. If the internal appeal does not resolve the conflict, then he should notify the company that he intends to continue with an external review of the problem

What is the correct sequence of order of the above steps :

- (a) 2, 3, 1 and 4 (b) 1,3, 2 and 4
(c) 3, 2, 4 and 1 (d) 1,2, 3 and 4

Ans. (b)

Sol. The chronological steps should be:

1. Study and document the facts and formulate a plan for an appeal.

(To back up arguments and strengthen the case).

3. Discuss the matter with immediate supervisor.

2. Take up the matter with higher management.

(The appeal should go through a systematic communication channel and competitive authority in order to be solved.)

4. If the internal appeal does not resolve the conflict, then he should notify the company



that he intends to continue with an external review of the problem.

(It is the formal and final step for the case to become a case of internal whistle blowing).

47. Which of the following are the attributes of a profession ?

1. The work requires sophisticated skills, use of judgement and exercise of discretion
2. Membership in the profession does not require extensive formal education as well as practical training
3. There are set standards for admission to the profession and conduct for members.
4. Significant public good results from practice of the profession

Select the correct answer using the codes given below :

- (a) 1, 2 and 3 only (b) 1, 2 and 4 only
(c) 1, 3 and 4 only (d) 2, 3 and 4 only

Ans. (c)

Sol. **Statement-II** is incorrect, as the membership in the profession does require extensive formal education as well as practical training.

48. What are the core qualities of a professional practitioner ?

1. Integrity both with themselves and with others
2. Independence-to be free of secondary interests with other parties
3. Competence
4. Discretion-care with communications

Select the correct answer using the codes given below :

- (a) 1, 2, 3 and 4 (b) 1, 2 and 3 only
(c) 1 and 3 only (d) 3 and 4 only

Ans. (a)

Sol. **Statement-I and Statement-II** corresponds to the principle of openness and honesty. Integrity refers to purity of character i.e. a personality trait which is infact irrespective of the quantum of the self-interest involved.

Independence from secondary interests with other parties helps in taking unbiased decisions leading to justice.

Statement-3 corresponds to the principle of competence i.e., one should always practice a profession in his/her domain of competency intems of basic skills and discretion as public interests at large are at stake.

Statement-4 Discretion-care with communications is a soft-skill which require proper handling of issues regarding communications which are not planned earlier, as if may lead to conflicts in the organization.

49. When should whistleblowing be attempted?

1. There must be a clear and greater harm that can be avoided
2. The whistleblower must be in a clear position to report on the problem
3. The whistleblower must have a reasonable chance of success in stopping the harmful activity
4. The whistleblower feels that all other lines of action within the context of the organization have been explored and shut off

Select the correct answer using the codes given below :

- (a) 1, 2, 3 and 4 (b) 1, 2 and 4 only
(c) 1, 3 and 4 only (d) 2 and 3 only

Ans. (a)

Sol. **Statement-I** refers to the "Need" aspect of Whistleblowing.



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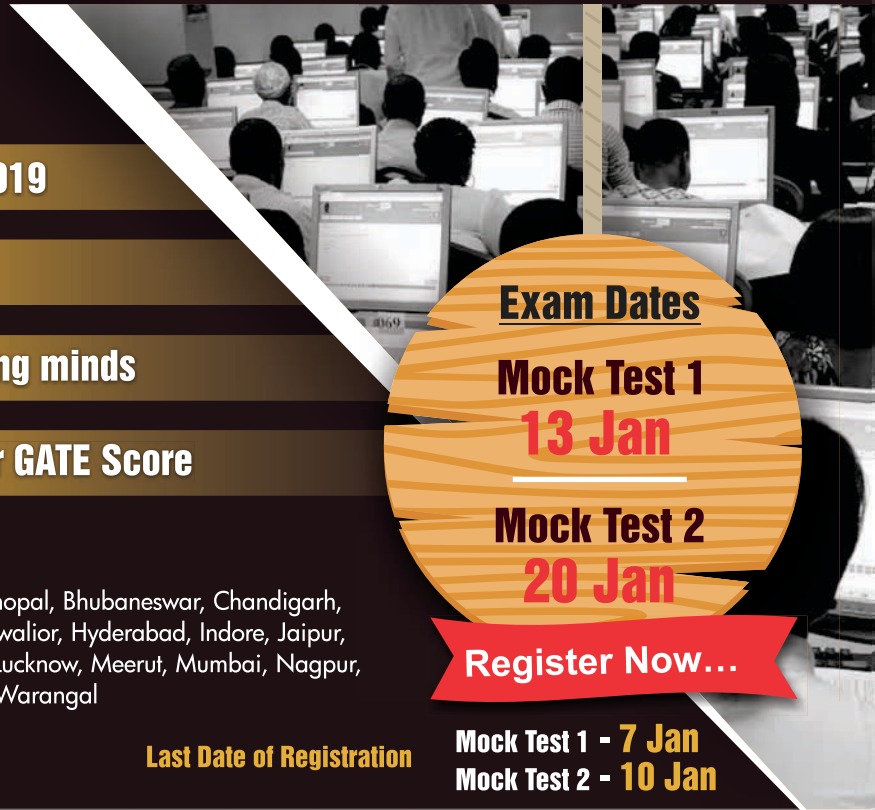
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Statement-2 refers to the “capability” aspect of Whistleblowing.

Statement-4 refers to the “Last resort” aspect of Whistleblowing.

Statement-3 refers to a practical approach towards Whistleblowing, so that the interests of Whistleblower also remains intact.

50. Which of the following are the salient features of the Patent Act 1970 ?

1. It codifies inventions which are not patentable
2. It provides for endorsement of patent with the words ‘license of right’.
3. It provides for revocation of patents in public interest.
4. It has provision for validity period also for the patents.

Select the correct answer using the codes given below :

- (a) 1, 2, 3 and 4 (b) 1, 2 and 4 only
(c) 1, 3 and 4 only (d) 2 and 3 only

Ans. (a)

Sol. All the given statements are the salient features of Indian Patent Act, 1970.

Directions:

Each of the next Ten (10) items consists of two statements, one labelled as the ‘Statement (I)’ and the other as ‘Statement (II)’. You are to examine these two statements carefully and select the answers to these items using the codes given below :

Codes:

- (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.

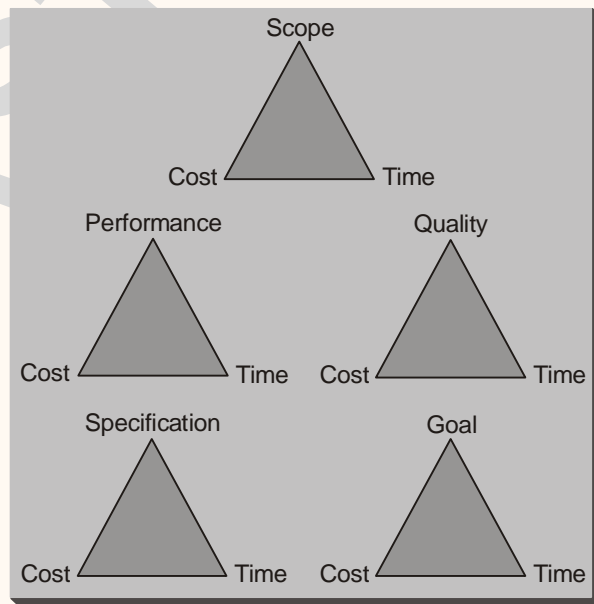
51. Statement (I) : All projects have constraints or limitations that inhibit their ability to reach goals and objectives.

Statement (II) : Time and money are universal constraints in projects.

Ans. (b)

Sol. All projects have constraints which are limiting factors or holding back elements that decide upon the boundaries of project which also inhibit their ability to reach goals and objectives.

Time and money are universal constraints in projects as various models of constraints in projects are:



52. Statement (I) : Training should be conducted among the line and low management for ensuring the importance of environmental protection plan.

Statement (II) : Environmental science is a developing subject and the people implementing environment strategies should remain up to date with the environmental control process.

Ans. (a)



Sol. Environmental science is the study of the effects of natural /unnatural processes, and the interactions of the physical components of the planet on the environment.

It is developing in nature and is still evolving. So the scientists, researchers and other people who are implementing various environment strategies and procedures should be given training; especially persons working in low management.

Training and guidance should be given about all the environmental control processes and the importance of environmental protection plan.

It will enhance the efficiency of the people implementing various environment protection plan and also improve its implementation.

53. Statement (I) : Metals having same crystal structure will have greater solubility.

Statement (II) : Differences in crystal structure limits the solid solubility.

Ans. (a)

Sol. We are using phase stabilizer in alloy based on the statement-I. Ni is a austenitic stabilizer because of its FCC structure. Likewise Cr is ferritic stabilizer because of its BCC structure.

54. Statement (I) : The tie line is constructed across the two-phase region at the temperature of the alloy.

Statement (II) : The overall alloy composition is located on the tie line.

Ans. (b)

Sol. Both of the statements are related to lever Rule for finding the composition of each alloying element in binary phase diagram.

55. Statement (I) : Cross linked polymers may be synthesized in which side-branch chains are connected to the main ones.

Statement (II) : Linear polymers are those in which the repeat units are joined together end to end in single chains.

Ans. (b)

Sol. In branch side polymer are connected to main branch not in crosslinked polymer.

56. Statement (I) : Abrasive ceramics are used to wear, grind, or cut away other material, which necessarily is softer.

Statement (II) : The prime requisite for abrasive ceramic group of materials is hardness or wear resistance and a high degree of toughness is essential to ensure that the abrasive particles do not easily fracture.

Ans. (a)

Sol. Abrasive ceramics should have high wear resistance, high degree of toughness so that they do not shatter during cutting and refractoriness to withstand high temperature during cutting.

57. Statement (I) : The prevention costs increase with the introduction of a quality system and may be a significant proportion of the total quality costs.

Statement (II) : Cross associated with education and training are not included in the prevention costs.

Ans. (c)

Sol. Prevention costs include the costs associated with planning, education and training.

Cost of quality = Prevention cost + Appraisal cost + Internal failure cost + External failure cost

58. Statement (I) : An emulator is not a mixture of hardware and software and it cannot be used to test and debut the hardware and software of an external system.

Statement (II) : Part of the hardware of an emulator is a multiwire cable which connects the host system to the system being developed.



Ans. (d)

Sol. An emulator is a hardware device or software program that enables one computer system (host) to behave like another computer system (guest).

It enables the host system to run software or use peripheral device designed for the guest and system.

59. Statement (I) : Agency-loyalty is acting to fulfill one's contractual duties to an employer.

Statement (II) : Agency-loyalty is entirely a matter of actions, whatever its motives.

Ans. (b)

Sol. Agency loyalty: It is acting to fulfill one's contractual duties to an employer. There are specified interms of particular tasks for which one is paid. It is a matter of "Actions" irrespective of motives.

Hence, both the statements are individually correct but statement-II is not the correct explanation of statement-I.

60. Statement (I) : An EIA is study of the probable changes in socioeconomic and bio-physical characteristics of the environment that may result from a proposed action.

Statement (II) : The purpose of an EIA is to help design projects, which do not disturb the quality of the environment by examining alternatives.

Ans. (b)

Sol. As per the definition provided by UNEP, Environmental Impact Assessment (EIA) is a tool used to identify the environmental, social and economic impacts of a project prior to decision-making.

Its main objectives are to:

- (a) Predict environmental impacts at an early stage in project planning and design,
- (b) Find ways and means to reduce adverse impacts,
- (c) Shape projects to suit the local environment and
- (d) Present the predictions and options to decision-makers.

EIA assists to achieve both environmental and economic benefits. For e.g. reduced cost and time of project implementation and design, avoided treatment/clean-up costs and impacts of laws and regulations.

Thus, both statements are correct but Statement (II) is not the reason behind statement I. Both are the objectives of Environment Impact Assessment.

61. Which of the following is not a component of 'Capital Receipts' ?

- (a) Market borrowings including special bonds
- (b) External loans raised by the Central Government from abroad.
- (c) Receipts from taxes on property and capital transactions
- (d) Provident Funds (State Provident Funds and Public Provident Fund)

Ans. (c)

Sol. Capital receipts refer are the receipts which are a liability to the government or leads to reduction in the assets of the government.

All kinds of borrowings made by the government are capital receipts.

But, any kind of tax received by the Government is not a capital receipt as it does not result in creation of any liability.

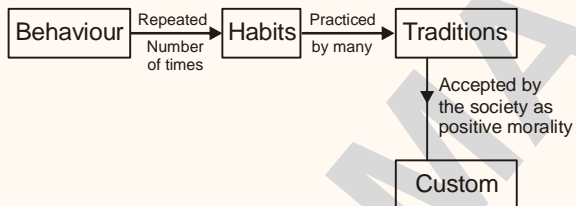
Hence, (c) is the answer.

62. Which of the following statement is correct with respect to the 'societal development'.

- (a) Behavior grows into habits, habits into tradition and tradition becomes custom
- (b) Customs grow into mores and mores grow into custom.
- (c) Behaviours grow into customs and customs grow into traditions
- (d) Folkways grow into tradition and traditions grow into customs

Ans. (a)

Sol. Societal development refers to a process by which the members of the society and society as a whole progress towards a more mature state of being. In this process various social institutions (social facts) are established, altered over time based on values (within and beyond the realm of morals/ethics) due to the following process.



63. Which one of the following statement is correct with respect to 'the convergence theory' on social change ?

- (a) The societal adaptive culture is changing more slowly
- (b) As societies become modernized, they begin to resemble one another more closely
- (c) The developed countries show more growth in social changes than the less developed countries
- (d) Strong opposition by old people retards the social change

Ans. (b)

Sol. The 'convergence theory' on social change states that as societies modernize through the

process of industrialization, they begin to resemble each other more closely.

The convergence theory became popular in 1960's. The main proponent of this theory was "Clark Kerr".

64. With respect to the conduct and performance of a company, 'perfect competition' refers to

- (a) Large number of small firms producing differentiated products
- (b) Complete freedom in economics life and absence of rivalry among firms
- (c) Many companies selling similar products with free entry
- (d) Sole producer selling a distinct product

Ans. (c)

Sol. Sole producer selling a distinct product is "Monopoly".

Small numbers of large firms having most or all the sales of distinct products is termed as 'oligopoly'.

Large number of small firms producing differentiated products may lead to Monopolistic competition in future.

Hence, option (a) and option (d) are wrong.

Option (b) is also wrong as absence of rivalry will lead to monopoly.

Whereas option (c) is correct as "perfect competition" refers to a situation prevailing in market in which buyers and sellers are so numerous and well informed so that there is freedom of choice.

65. The cheapest method of marketing of securities with the only cost incurred being on sending 'letters of rights' to existing holders is

- (a) Public issue through prospectus method
- (b) Offer for sale method
- (c) Rights issue
- (d) Subscription by inside coterie method

Ans. (c)



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Sol. Rights issue is the most economical method of raising fresh capital because it includes no underwriting and brokerage costs.

Under this method, the shares of an existing company are offered to its existing shareholders and letters of rights are sent to them.

66. 'Fiscal policy' means

- Balancing the revenue collection and expenditure
- Establishing equilibrium between demand and supply of goods and services
- Use of taxation, public borrowing and public expenditure by Government for purposes of 'stabilization' or 'development'
- Deficiency as an instrument of growth

Ans. (c)

Sol. Fiscal policy assists a government to adjust its spending levels and tax rates to monitor and influence the economy of a country.

Its objective is to maintain the condition of full employment, economic stability and to stabilize the rate of growth.

67. Which of the following come under the offerings of 'MUDRA' Bank?

- Portfolio Credit Guarantee
- Credit for large industries
- MUDRA Card
- Credit Enhancement

Select the correct answer using the codes given below:

- (a) 1, 2 and 3 only (b) 1, 3 and 4 only
(c) 1, 2 and 4 only (d) 2, 3 and 4 only

Ans. (b)

Sol. Product/Offerings of MUDRA:

- MUDRA Card is a debit card, issued against the MUDRA loan account which provides working capital facility as a cash credit arrangement.

- Creation of resources for Credit Enhancement/Guarantee Facility
- Portfolio Credit Guarantee
- Micro industries



68. Which of the following is/are the key reasons for encouraging start up Entrepreneurship?

- Innovations
- Focusing on service industry
- Bringing the values of proactivity into the society

Select the correct answer using the codes given below:

- (a) 1 only (b) 2 only
(c) 1 and 3 only (d) 1, 2 and 3

Ans. (c)

Sol. Key reasons for encouraging startup entrepreneurship:

- Innovations
- New jobs and economic growth
- Bringing new competitive dynamics into the economic system
- Promoting the research-innovation system
- Bringing the values of proactivity into the society

69. Which of the following are the main objectives of Gold Monetization Scheme launched in the country?

1. To monetize gold holdings in the country
2. To increase export of gold from the country
3. To reduce India's import bill
4. To meet the targets of reduction in fiscal deficit

Select the correct answer using the codes given below:

- (a) 1 and 4 only (b) 2 and 4 only
(c) 2 and 3 only (d) 1 and 3 only

Ans. (d)

Sol. The main objectives of Gold Monetization Scheme are:

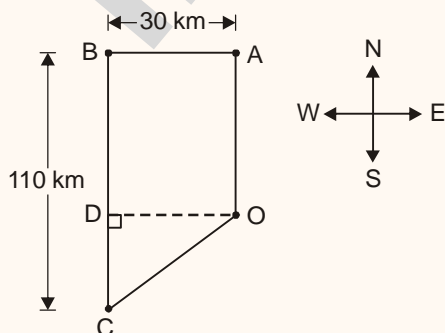
- (i) To mobilise gold held by households and institutions of the country and facilitate its use for productive purposes.
- (ii) To reduce country's reliance on the import of gold.

70. A person travelled by car 70 km towards north to A then covered 30 km turning left to B. Again he turned towards left and travelled 110 km to C. Then he cycled at the rate of 10 km/hour towards the starting point. The time taken by him to reach the starting point from C will be

- (a) 3 hours (b) 5 hours
(c) 7 hours (d) 21 hours

Ans. (b)

Sol. The moment of the person can be shown in the figure below.



From the figure,

$$BD = 70 \text{ km}$$

$$\therefore CD = BC - BD = 110 - 70 = 40 \text{ km}$$

$$OD = AB = 30 \text{ km}$$

$$OC = \sqrt{OD^2 + CD^2}$$

[$\therefore \triangle ODC$ is a right angled triangle]

$$= \sqrt{30^2 + 40^2} = 50 \text{ km}$$

Speed of person = 10 km/hr

$$\therefore \text{Time required} = \frac{50}{10} = 5 \text{ hrs.}$$

71. A student purchases some books for Rs. 1600. If he had bought 8 more books for the same amount, each book would cost Rs. 10 less. The number of books he buys is

- (a) 30 (b) 32
(c) 34 (d) 36

Ans. (b)

Sol. Let the number of books purchased = x

Rate of each book = R

Given, $x \times R = 1600$

$$\Rightarrow R = \frac{1600}{x} \quad \dots(i)$$

$$(x + 8)(R - 10) = 1600 \quad \dots(ii)$$

Putting the value of R in equation (ii)

$$(x + 8)\left(\frac{1600}{x} - 10\right) = 1600$$

$$\Rightarrow (x + 8)(1600 - 10x) = 1600x$$

$$\Rightarrow 1600x - 10x^2 + 12800 - 80x = 1600x$$

$$\Rightarrow -10x^2 - 80x + 12800 = 0$$

$$\Rightarrow x^2 + 8x - 1280 = 0$$

$$\Rightarrow x^2 + 40x - 32x - 1280 = 0$$

$$\Rightarrow x(x + 40) - 32(x + 40) = 0$$

$$\Rightarrow (x - 32)(x + 40) = 0$$

$$\Rightarrow x = 32 \text{ or } x = -40 \text{ (discarded)}$$



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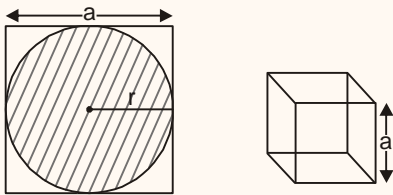
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72. A hemisphere depression is cut out from one face of the cubical wooden block such that the radius r of the hemisphere is equal to half of the edge of the cube. What will be the surface area of the remaining solid?

- (a) $2r^2(\pi + 24)$ (b) $r^2(\pi + 24)$
 (c) $2r^2(\pi + 36)$ (d) $r^2(\pi + 36)$

Ans. (b)

Sol.



Surface area of remaining solid
 = (Surface area of 5 remaining square faces)
 + (Hemispherical area exposed) + (Area of the 6th – Square face after cutting the hemisphere)

$$= 5a^2 + 2\pi r^2 + (a^2 - \pi r^2)$$

Since, $a = 2r$

$$\Rightarrow 5 \times 4r^2 + 2\pi r^2 + (4r^2 - \pi r^2)$$

$$\Rightarrow 20r^2 + 2\pi r^2 + 4r^2 - \pi r^2$$

$$\Rightarrow 24r^2 + \pi r^2$$

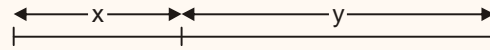
$$\Rightarrow r^2(24 + \pi)$$

73. A rod of length l is to be divided into two parts, such that if 5 times the smaller portion is added to half of the larger portion, it will always be less than l . This can be achieved by taking length of the larger portion more than

- (a) $\frac{9}{10}l$ (b) $\frac{7}{8}l$
 (c) $\frac{6}{7}l$ (d) $\frac{5}{6}l$

Ans. (a)

Sol.



Let the length of the rod = $l = x + y$

Here, $x \rightarrow$ smaller portion

$y \rightarrow$ larger portion

So, according to question

$$5x + \frac{y}{2} < l$$

$$\Rightarrow 5(l - y) + \frac{y}{2} < l$$

$$\Rightarrow 5l - 5y + \frac{y}{2} < l$$

$$\Rightarrow 4l < \frac{9}{2}y$$

$$\Rightarrow y > \frac{8}{9}l$$

$$\approx 0.88 l$$

Comparing the options, only option (a) is greater than this value.

$$\text{Hence, } y > \frac{9}{10}l.$$

74. Which of the following conditions hold good for a train which crosses the bridge of length l in time t_1 and crosses another bridge of length $\frac{l}{2}$ in time t_2 ?

1. $t_2 = \frac{t_1}{2}$ 2. $2t_2 > t_1$

3. $t_2 < \frac{t_1}{2}$

4. Speed of train is $\frac{l}{10}$ if $t_1 - t_2 = 5$

Select the correct answer using the codes given below:

- (a) 1 and 4 only (b) 2 and 4 only
 (c) 1 and 3 only (d) 2 and 3 only

Ans. (b)

Sol. Suppose length of train = l_0

Length of longer bridge = l

Length of shorter bridge = $\frac{l}{2}$

Assume speed of train = V_0

Time to cross longer bridge

$$= \frac{\text{Total length travelled}}{\text{Speed of train}}$$

$$t_1 = \frac{l_0 + l}{V_0} \quad \dots(i)$$

$$\text{Similarly, } t_2 = \frac{l_0 + \frac{l}{2}}{V_0} \quad \dots(ii)$$

Now, from eqn. (i) and (ii)

$$(t_1 - t_2) = \frac{l}{2V_0}$$

$$V_0 = \frac{l}{2 \times (t_1 - t_2)}$$

$$\boxed{V_0 = \frac{l}{10}} \quad (\text{if } t_1 - t_2 = 5 \text{ sec})$$

Again, from eqn. (i) and (ii)

$$\frac{t_2}{t_1} = \frac{l_0 + \frac{l}{2}}{l_0 + l} = 1 - \frac{\frac{l}{2}}{(l_0 + l)}$$

$$\boxed{\frac{t_2}{t_1} = 1 - \frac{1}{2 \left(1 + \frac{l_0}{l}\right)}}$$

$$\frac{t_2}{t_1} > \frac{1}{2} \quad \left[\because \frac{1}{2 \left(1 + \frac{l_0}{l}\right)} < \frac{1}{2} \right]$$

$$\boxed{2t_2 > t_1} \quad \text{Ans.}$$

75. A tourist covers half of his journey by train at 60 km/h, half of the remainder by bus at 30

km/h and the rest by cycle at 10 km/h. Average speed of the tourist during the journey is

(a) 36 km/h (b) 33 km/h

(c) 24 km/h (d) 18 km/h

Ans. (c)

$$\text{Sol. } V_{\text{avg}} = \frac{\text{Total distance}}{\frac{L_1}{V_1} + \frac{L_2}{V_2} + \frac{L_3}{V_3}}$$

$$L_1 = \text{Journey covered by train @ 60 km/h} = \frac{L}{2}$$

$$L_2 = \text{Journey covered by bus @ 30 km/h} = \frac{L}{4}$$

$$L_3 = \text{Journey covered by cycle @ 10 km/h} = \frac{L}{4}$$

$$V_{\text{avg}} = \frac{L}{\frac{L/2}{60} + \frac{L/4}{30} + \frac{L/4}{10}} = \frac{1}{\frac{1}{120} + \frac{1}{120} + \frac{1}{40}}$$

$$\boxed{V_{\text{avg}} = 24 \text{ km/h}}$$

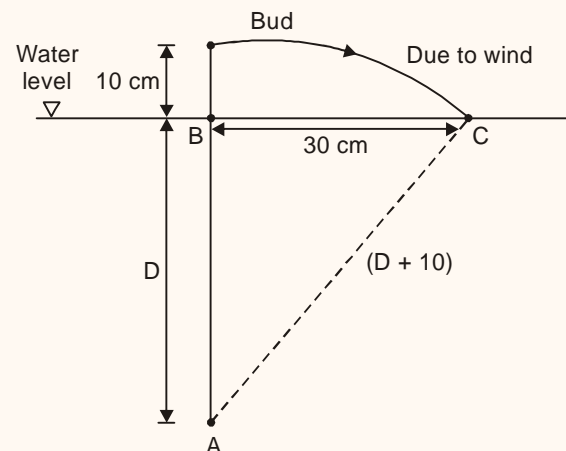
76. In a lake, the tip of a bud of lotus is seen 10 cm above the surface of water. Forced by the wind, it gradually moved, and just submerged at a distance of 30 cm. The depth of water at the root of the lotus plant will be

(a) 40 cm (b) 50 cm

(c) 60 cm (d) 70 cm

Ans. (a)

Sol.



$$AC^2 = AB^2 + BC^2$$

$$(D + 10)^2 = D^2 + 3^2$$

$$D^2 + 100 + 20D = D^2 + 30^2$$

$$\boxed{D = 40 \text{ cm}}$$

77. A man sold a chair and a table together for Rs. 7,600, thereby making a profit of 25% on the chair and 10% on the table. By selling them together for Rs. 7,500 he would make a profit of 10% on the chair and 20% on the table. Then the cost price of chair and table will be

- (a) Rs. 3000 and Rs. 4000
- (b) Rs. 3500 and Rs. 4000
- (c) Rs. 3000 and Rs. 3500
- (d) Rs. 3500 and Rs. 3500

Ans. (c)

Sol. Cost price of chair = Rs. x
Cost price of table = Rs. y

Case (1) :

Selling price for chair = Rs. $x \times (1 + 0.25)$

Selling price for table = Rs. $y \times (1 + 0.1)$

Total selling price = $1.25x + 1.1y$

$$1.25x + 1.1y = 7600 \text{ (given)} \quad \dots(A)$$

Case (2) :

Selling price for chair = Rs. $x(1 + 0.1)$

Selling price for table = Rs. $y(1 + 0.2)$

Total selling price = $1.1x + 1.2y$

$$1.1x + 1.2y = 7500 \text{ (Given)} \quad \dots(B)$$

Solving equation (A) and (B)

$$x = \text{Rs. } 3000$$

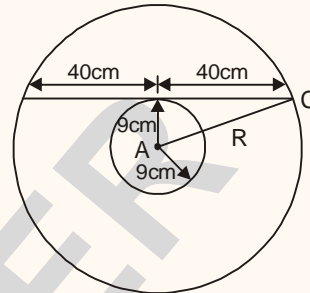
$$y = \text{Rs. } 3500$$

78. In two concentric circles, a chord length 80 cm of larger circle becomes a tangent to the smaller circle whose radius is 9 cm. The radius of the larger circle will be

- (a) 13 cm
- (b) 41 cm
- (c) 52 cm
- (d) 75 cm

Ans. (b)

Sol.



$$AC^2 = AB^2 + BC^2$$

$$R^2 = 9^2 + 40^2$$

$$R = 41 \text{ cm.}$$

79. Professionals who breach the 'duty of care' are liable for injuries their negligence causes. This liability is commonly referred to as

- (a) Professional offense
- (b) Professional negligence
- (c) Professional misdeed
- (d) Professional malpractice

Ans. (b)

Sol. In Tort law, a duty of care is a legal obligation which is imposed on an individual requiring adherence to a standard of reasonable care while performing an act that could foreseeably harm others. It is called "Professional negligence".

80. Information used in a business, generally unknown to the public, that the company has taken strong measures to keep confidential is called

- (a) A patent
- (b) A copyright
- (c) A trade secret
- (d) A trade mark

Ans. (c)



Sol. A trade secret refers to a confidential information, unknown to public at large, which has a direct impact on the business of a commercial entity. Eg. the Google search algorithm. The trade-secret may cover following areas :

- Research & Development information
- Software algorithm
- Inventions
- Designs
- Formulas
- Ingredients
- Devices
- Methods, etc.

81. Which one of the following tests can be resorted to in order to check the structural soundness conformance to the specified standards, when all other tests fail?

- (a) Destructive (b) Non-destructive
(c) Full scale load (d) Masonry

Ans. (c)

Sol. As per IS-456 if sample test get fail in all the test full scale test is used.

82. Which of the following are the sources of variation in quality control process in construction?

1. Material
2. Operator
3. Inspection activity

Select the correct answer using the codes given below:

- (a) 1, 2 and 3 (b) 1 and 2 only
(c) 1 and 3 only (d) 2 and 3 only

Ans. (b)

Sol. The sources of variation in the construction quality may be the variations in the input raw material and the variable workforce. Inspection is done to check the quality.

83. What is the break-even sale for the following products?

	Products		
	A	B	C
Sales (Units)	5,000	6,000	4,000
Unit selling price (Rs.)	10	15	18
Unit variable price (Rs.)	6	4	13
Fixed cost of the product is (Rs. 20,000)			

- (a) Rs. 90,000 (b) Rs. 80,000
(c) Rs. 60,000 (d) Rs. 40,000

Ans. (d)

Sol. Break even point

$$= \frac{\text{Total fixed expenses}}{\text{Weighted average selling price} - \text{Weighted average variable expenses}}$$

Weighted average selling price

$$= \frac{5000}{15000} \times 10 + \frac{6000}{15000} \times 15 + \frac{4000}{15000} \times 18$$

$$= 14.133$$

Unit variable price

$$= \frac{5000}{15000} \times 6 + \frac{6000}{15000} \times 4 + \frac{4000}{15000} \times 13$$

$$= 7.067$$

Break even point (no. of units)

$$= \frac{20000}{14.133 - 7.067} = 2831$$

⇒ Break even point in rupees

$$= 2831 \times 14.133$$

$$= \text{Rs. } 40010 \approx \text{Rs. } 40000.00$$

84. Which of the following approaches are correct regarding total quality?

1. Opportunity to improve
2. Adoption requires little change
3. React to competitive threats

Select the correct answer using the codes given below:

- (a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

Ans. (b)

Sol. TQM involves continuous improvement. It requires a complete change in company culture and management. TQM is a continuous improvement for excellence by creating the right skills and attitudes in people to make prevention of defects possible and satisfy the customers totally at all times. TQM is an organisation-wide activity that has to reach every individual within an organisation. TQM should be adopted as it gives an opportunity to improve and it helps in profitable survival in reaction to competitive threat.

85. Which of the following are constraints to the use of TQM in construction process?

1. A transient labour force
2. The construction process is relatively short in duration
3. Hierarchical and vertical organization structure
4. The construction process has not focused on the detailed needs of the customer

Select the correct answer using the codes given below:

- (a) 1 and 4 only (b) 2 and 3 only
(c) 1 and 2 only (d) 3 and 4 only

Ans. (a)

Sol. The variable and transient nature of workforce is a major constraint in achieving quality in construction sector.

86. BOD of a waste water sample is estimated to be 180 mg/l. Assuming 4 mg/l BOD can be consumed in the BOD bottle, the volume of undiluted sample to be added to a 300 ml bottle is nearly

- (a) 6.7 ml (b) 5.6 ml
(c) 4.4 ml (d) 3.3 ml

Ans. (a)

Sol. BOD = 180 mg/l

BOD consumed = 4 mg/l

As,

BOD = BOD consumed × Dilution factor

$$\text{Dilution factor} = \frac{\text{Volume of diluted sample}}{\text{Volume of undiluted sample}}$$

$$= \frac{300}{V}$$

$$\Rightarrow 180 = 4 \times \frac{300}{V}$$

$$\Rightarrow \boxed{V = 6.67 \text{ mg/l}}$$

87. Venturi scrubber, a device used to remove particulate matter from the atmosphere, works on the principle of

- (a) Settling by gravitational force
(b) Removal by centrifugal force
(c) Removal by electrically charged particles
(d) Removal by atomized water vapour

Ans. (d)

Sol. Venturi Scrubber uses the differential between high streaming (velocities) gases and water flowing in it to produce droplets (atomized water vapour) which captures the contaminants and pollutants (Particulate Matter). Thus, pollutants are removed from the atmosphere based on the principle of atomized water vapour.

88. Environmental Impact Assessment (EIA) is aimed to help



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AIR 88 Hemant Kumar	AIR 89 Ashish Dubey	AIR 90 Gaurav Agarwal	AIR 91 Rohit Mehta	AIR 92 Kunwar Shubham Patel	AIR 94 Suman Kumar	AIR 95 Saurabh Kumar	AIR 96 Akshil Prabhakar Soni	AIR 97 Gaurav Joshi	AIR 98 Dhawal Kakra	AIR 99 Abhinav Kumar	AIR 100 Anjali Kumar Maurya	AIR 101 Varid Gupta	AIR 102 Rajesh Kumar	AIR 103 Sajal Mittal	AIR 104 Lalit Meena	AIR 105 Premraj Singh	AIR 106 Aman Hasdika	AIR 107 Prasant Kumar	
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- (a) Estimate future needs of the society
- (b) Smooth implementation of a project
- (c) Cope with rapid increase in population
- (d) Resource conservation

Ans. (d)

Sol. One of the objectives of Environment Impact Assessment is to protect and conserve the productivity and capacity of natural system, resources and the ecological processes.

89. Which one of the following is a terrestrial type of ecosystem?

- (a) Limnetic
- (b) Estuary
- (c) Prairie
- (d) Reefs

Ans. (c)

Sol. Limnetic is a photic zone in zentic ecosystems like lake and ponds.

- Estuary is zone and transition between river and marine ecosystem.
- Prairie is temperate grassland/Terrestrial type of ecosystem found in great plains of North America.
- Reefs are found in nestic zone of marine ecosystem.

90. What are the limitations of solar energy?

1. Collecting solar energy over large areas and converting it to other forms that can be conveniently transported, stored and used in existing equipment is not economical
2. Low density of solar energy as compared to coal, oil and gas
3. Its major applications are photo-thermal conversion, solar water heating, green housing technology and photo voltaic conversion.

Select the correct answer using the codes given below:

- (a) 1, 2 and 3
- (b) 1 and 2 only
- (c) 1 and 3 only
- (d) 2 and 3 only

Ans. (b)

Sol. Statement 3 is not a limitation of solar energy. It is the advantage and application of solar energy. Therefore statement 3 is incorrect. The first two statements are the limitations of solar energy.

91. Acid rain results when gaseous emissions of Sulfur oxides (SO_x) and nitrogen oxides (NO_x) interact with water vapour and

- (a) Moonlight, and are chemically converted to strong acidic compounds such as sulfuric acid (H_2SO_4) and nitric acid (HNO_3)
- (b) Sunlight, and are chemically converted to strong acidic compounds such as sulfuric acid (H_2SO_4) and nitric acid (HNO_3)
- (c) Moonlight, and are chemically converted to weak acidic compounds such as sulfuric acid (H_2SO_4) and nitric acid (HNO_3)
- (d) Sunlight, and are chemically converted to weak acidic compounds such as sulfuric acid (H_2SO_4) and nitric acid (HNO_3)

Ans. (b)

Sol. Acid rain results when gaseous emissions and SO_x (Sulfur oxides) and Nitrogen oxides (NO_x) interact with water vapour and sunlight. Sunlight releases more moisture into the atmosphere resulting into acid rain. Acid rain whose main component is sulfuric acid and nitric acid is so strong that it can convert lakes into graveyard of fishes, chlorosis, Necrosis and finest death.

92. The 'Minamata Tragedy' was caused by the eating of fish growing in the Minamata Bay contaminated with

- (a) Peroxy allynitrate
- (b) Methyl isocyanate
- (c) Potassium cyanide
- (d) Methylmercury

Ans. (d)

Sol. The release of Methylmercury as industrial waste that enters into aquatic food chain (Algae → Zooplanktons → Small fishes → Large fishes) through biomagnification and bioconcentration.

The concentration of Methylmercury was high in fishes in minamata bay of Japan. Thus, eating these contaminated fishes leads to Minamata Tragedy/Minamata disease.

- 93.** What are the advantages of Biomass as a source of energy?
1. Its storage and transportation is possible
 2. It is ecologically safe and is inoffensive
 3. Can be developed with present man and material abilities
 4. Low capital input required

Select the correct answer using the codes given below:

- (a) 1, 2, 3 and 4 (b) 1, 2 and 3 only
- (c) 1, 3 and 4 only (d) 2, 3 and 4 only

Ans. (c)

Sol. The biomass as a source of energy includes wood products, dried vegetation, crop residues, aquatic plants and organic matter (stored energy) of plants. The organic matter of plants has stored energy and can be easily transferred through the food chain to animal bodies and their wastes/excreta that also behaves as a source of energy. Biomass has become one of most commonly used renewable sources of energy due to its low cost and indigenous nature and can be developed with present man and material abilities.

The biggest problem is the use of wood and other plant material for fuel may mean deforestation, denuding forest, soil erosion and ground water contamination so it is ecological not highly safe.

- 94.** Consider the following data for a domestic biogas plant:

Number of cows = 5

Retention time = 20 days

Temperature = 30°C

Dry matter consumed = 2 kg/day

Biogas yield = 0.24 m³/kg

Efficiency of burner = 60%

Methane proportion = 0.8

Heat of combustion of Methane = 28 MJ/m³

Density of dry material in fluid = 50 kg/m³

The power available from the digester will be nearly

- (a) 16.2 MJ/day (b) 24.3 MJ/day
- (c) 32.3 MJ/day (d) 48.6 MJ/day

Ans. (c)

Sol. Power available from the digester:

Volume of biogas = Biogas yield × Total mass of dry matter consumed

$$(V_{\text{biogas}}) = 0.24 \times 2 \times 5 = 2.4 \text{ m}^3/\text{day}$$

$$P = \eta_{\text{burner}} \Delta H_{\text{methane}} \times \text{Methane proportion} \times V_{\text{biogas}}$$

$$= 0.6 \times 28 \times 0.8 \times 2.4$$

$$P = 32.256 \text{ MJ/day}$$

- 95.** The best tool to ensure that there is neither piling up of stocks nor shortage of materials in a project to run it economically is

- (a) Economic order quantity
- (b) ABC analysis
- (c) Inventory control and management
- (d) Gantt chart method



Ans. (a)

Sol. EOQ is the order size at which the sum of carrying cost and ordering cost is minimum.

Thus, it ensures that neither there is excessive stock nor there is too less stock.

96. A machine is expected to generate cash saving (after-tax) of Rs. 50,000 per annum over a period of 5 years. Salvage value of machine is 40% of the original cost. If accounting rate of return is 20%, cost of two such machines will be

- (a) Rs. 78,125 (b) Rs. 1,56,250
- (c) Rs. 3,12,500 (d) Rs. 6,25,000

Ans. (c)

Sol. Average saving (after-tax) per annum = Rs. 50000.00

Salvage value of machine after 5 years = 40%

Consider initial value/cost of machine = x

$$\Rightarrow \text{Depreciation per year} = \frac{(x - 0.4x)}{5} = 0.12x$$

Average accounting profit = 50000.00 – Depreciation

$$= 50000.00 - 0.12x$$

Accounting rate of return

$$= \frac{\text{Average accounting profit}}{\text{Initial investment}} \times 100$$

$$\Rightarrow \frac{50000.00 - 0.12x}{x} \times 100 = 20$$

$$\Rightarrow 0.32x = 50000.00$$

$$\Rightarrow x = 156250.00$$

Cost of 2 machine

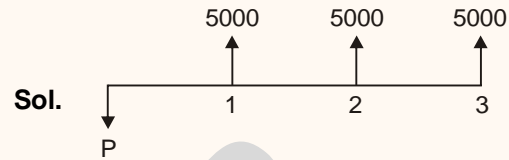
$$\Rightarrow 2x = 2 \times 156250.00 = 312500.00$$

97. It is expected to receive Rs. 5,000 annually for 3 years with each receipt occurring at the end of the year. With a discount rate of 10%, the present value of the annuity will be nearly

(a) Rs. 12,435 (b) Rs. 9,945

(c) Rs. 4,975 (d) Rs. 2,487

Ans. (a)



Sol.

Present value of annuity will be

$$P = A \frac{(1+i)^n - 1}{i(1+i)^n}$$

$\therefore i = 10\%$ per year and $n = 3$ yrs

$$P = 5000 \times \frac{1.1^3 - 1}{0.1 \times 1.1^3}$$

$$P = 12424.26$$

$$P = 12435$$

Note: We can eliminate obtain C and D as they are very small values. If we approximate by binomial theorem.

$$P = 5000 \times \frac{1.3 - 1}{0.1 \times 1.3} = 11538.46 \quad [(1+x)^n = 1+nx]$$

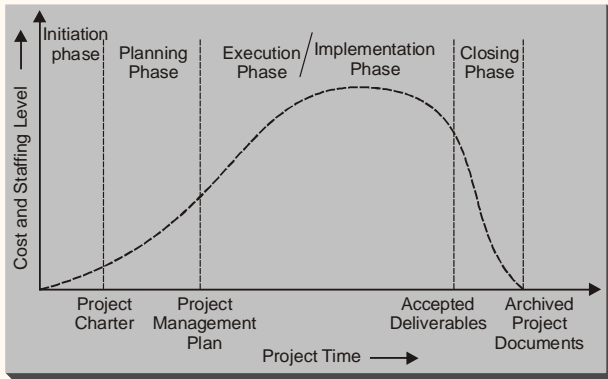
\therefore Ans will be on higher side option (a) will be the ans.

98. In a project life cycle, the maximum percentage of effort is done in

- (a) Concept phase
- (b) Definition phase
- (c) Planning and organizing phase
- (d) Implementation phase

Ans. (d)

Sol. Cost and staffing levels are low at the start of the project, it increases progressively during planning phase, reaches to peak in execution phase (or Implementation phase). Finally drops in closing phase.



99. In progress of a project, the percentage of error will be less in
- Definitive cost estimate
 - Detailed estimate
 - Preliminary estimate
 - Study estimate

Ans. (a)

100. In principle, the network should not be made complex. No control system, for that matter, can operate unless it is kept simple. This principle is called
- CPM
 - PERT
 - KISS
 - GERT

Ans. (c)

- Sol. KISS stands for "keep it simple, stupid". It is a design principle invented by V.S. Navy. It states that most system work best if they are kept simple rather than made complicated, therefore simplicity should be a key goal in design and unnecessary complexity should be avoided.