

ESE 2020

Paper-1

Mechanical Engineering

► Questions & Solutions

1. Which one of the following is not a creative commons license which users can choose to apply when publishing their work?
- A. Attribution
 - B. Share-Alike
 - C. Copyright Infringement
 - D. No Derivative Works

Ans. C

Sol. Copyright Infringement is not a creative commons license which users can choose to apply when publishing their work.

2. The Ethernet designed by IEEE to compete with LAN protocols which can transmit data ten times faster at a rate of 100 Mbps is
- A. fast Ethernet
 - B. bridged Ethernet
 - C. switched Ethernet
 - D. full-duplex Ethernet

Ans. A

Sol. Fast Ethernet standard (IEEE 802.3u) increased the transmission speed from 10 Mbps to 100 Mbps.

It also improved the error detection and correction rates of Ethernet.

It led to faster access to video, multimedia, and the internet.

It is used in networks with Category 5 (Cat-5) copper twisted-pair cable & fiber-optic cable.

3. IEEE standard protocol which defines a wireless Personal Area Network (PAN) operable in a room is
- A. Wi-Fi
 - B. Bluetooth
 - C. Infrared
 - D. Wireless LAN

Ans. B

Sol. IEEE standard protocol which defines a wireless Personal Area Network (PAN)

operable in a room is Bluetooth, which has a range of 10 meters only. Wi-Fi means wireless fidelity. It is a specific type of WLAN that use specifications in the 802.11 wireless protocol.

Wi-

Fi- has a bigger range than a room i.e. 150 feet (46 m) indoors and 300 feet (92 m) outdoors. Wireless LAN is any local area network (LAN) used by a mobile user to connect through a wire-less connection.

Infra-red is not an IEEE standard protocol.

4. Which one of the following points is a private switching station that connects the national internet service provider's network and operates at a high data rate up to 600 Mbps?
- A. Locking point
 - B. Peering point
 - C. Hub point
 - D. Modem point

Ans. B

Sol. Private switching station that connects the national internet service provider's network and operates at a high data rate up to 600 Mbps is known as peering points.

5. Which one of the following is the nodal department to implement public internet access program and rural internet connectivity by converting its offices as multi-service centres?

- A. Department of Electronics and Information Technology
- B. Department of Information and Broadcasting
- C. Department of Telecommunication
- D. Department of Posts

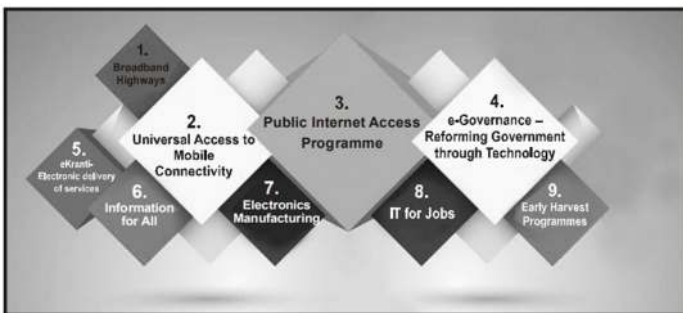
Ans. D

Sol. Public Internet Access Programme has two subcomponents which are: Common Services Centres (CSCs) and Post Offices as multi-service centres. 150,000 Post Offices will be converted into multi service centres. Department of Posts would be the nodal department to implement this scheme.

6. Which one of the following is not the vision area of Digital India as a program to transform India into a digitally empowered society and knowledge economy?
- A. Infrastructure as utility to every citizen
 - B. Governance and services on demand
 - C. Free Wi-Fi access
 - D. Digital empowerment of citizens

Ans. C

Sol. Vision areas of Digital India Program are:



7. Infrastructure aspects provided by the Government of India in formation of National e-Governance Plan for storage of data and hosting applications, network connectivity and capacity building respectively are
- A. SDC, SWAN and NISG
 - B. SWAN, SDC and NISG
 - C. SDC, NISG and SWAN
 - D. SWAN, NISG and SDC

Ans. A

Sol **State Data Centre (SDC)** is one of the important elements of the core infrastructure for supporting e-Governance initiatives of National e-Governance Plan (NeGP). It is

created for the States to consolidate services, applications and infrastructure to provide efficient electronic delivery of G2G, G2C and G2B services. It provides functions such as: Central Repository of the State, Secure Data Storage, Online Delivery of Services, Citizen Information/Services Portal, State Intranet Portal, Disaster Recovery, Remote Management and Service Integration etc.

State Wide Area Network (SWAN) is one of the major infrastructure components under the National e-Governance Plan. Its main objective is to provide secured and high speed network connectivity for Government functioning and connecting State Headquarters, District Headquarters, Blocks Headquarters.

National Institute for Smart Government (NISG) is a not-for-profit organization formed by the Government of India in 2002 with the aim of providing e-Governance consultancy to central and state governments to serve citizens better.

It has a 51% equity contributed by the private sector and 49% by the public sector Its main services are:

- Consulting Services
- Capacity Building
- Project Management
- Talent Acquisition

8. Which one of the following is not the characteristic of Good Governance and e-Governance that are closely linked and depend on each other?
- A. Accountable
 - B. Transparent
 - C. Consciousness
 - D. Consensus-oriented

Ans. C

Sol. E-Governance is a vital force for in achieving the aims of good governance such as improvement in quality, efficiency and effectiveness of governance. Eight characteristics of Good Governance are: participatory, consensus oriented, accountable, transparent, responsive, effective and efficient, equitable and inclusive, and the rule of law. Consciousness is not one of the above mentioned characteristics.

9. Which one of the following is not the skill needed in the workplace of the future for inventive thinking using information and communication technology in education?
- A. Adaptability
 - B. Responsibility
 - C. Curiosity and creativity
 - D. Risk-taking

Ans. B

Sol. The skills required in the workplace of the future of inventive thinking using ICT in education include:

- Adaptability and managing complexity (enable the students to recognize and understand that change is constant, at the same time deal with change positively by modifying their thinking, attitude or behaviour to accommodate and handle new environment.)
- Self direction (students' ability to set goals related to learning, plan for the achievement of those goals, independently manage time and effort, and independently assess the quality of learning and any products that results from the learning experience.)

- Curiosity & creativity (Curiosity is students' desire to learn more about something and is an essential component of lifelong learning. Creativity is the act of bringing something into existence that is genuinely new and original, whether personally or culturally.)
- Risk taking (willingness to go beyond safety zone to make mistakes, to creatively tackle challenges or problems with the ultimate goal of enhancing personal accomplishment and growth.)
- Higher order thinking and sound reasoning (cognitive processes of analysis, comparison, inference and interpretation, evaluation and synthesis applied to a range of academic domains and problem-solving contexts).

10. The pedagogy which involves productive learning and finding new solutions to problems, where manipulation of existing information and creation of real-world products are possible with ICT, is called
- A. collaborative pedagogy
 - B. creative pedagogy
 - C. integrative pedagogy
 - D. evaluative pedagogy

Ans. B

Sol. Collaborative pedagogy is an ICT-supported learning that encourages interaction and cooperation among students, teachers, and experts.

Creative pedagogy is an ICT-supported learning, which involves productive learning and finding new solutions to problems, where manipulation of existing information and creation of real-world products are possible.

Integrative pedagogy is an ICT-enhanced learning which promotes an integrative approach to teaching and learning. It provides relationship between subjects.

Evaluative pedagogy is an ICT-enhanced learning which is student-directed and diagnostic in nature.

It recognizes various different learning pathways and delivery of knowledge.

- 11.** The basic difference between a professional and an amateur is
- A. a professional is someone who is connected with a job that needs special training or skill, while an amateur is someone who works in multi-dimensions without any specialization.
 - B. a professional is clear in thinking and focused on the job, while an amateur is confused and distracted from the job
 - C. a professional does high quality work/job in a specific area, while an amateur is associated with specific area with lowest pay
 - D. a professional remains positive and achieves despite facing grievances, while an amateur does work efficiently due to many imagined grievances

Ans. A

Sol. The basic difference between a professional and an amateur is that a professional remains positive and achieves despite facing grievances while an amateur does not work efficiently due to the many imagined grievances.

- 12.** 'Euthanasia' refers to the
- A. loyalty of the people that take pride in being part of their organization and care for the organization above their own well-being

- B. ills in the society that are caused by ignorance and lack of respect for the laws of the land

- C. emotional intelligence to understand how people perform various functions

- D. killing of a terminally ill person suffering acutely with no hope of survival

Ans. D

Sol. Euthanasia refers to the killing of a terminally ill person suffering acutely with no hope of survival.

- 13.** 'Utilitarianism' in the professional ethics is
- A. an acquired habit that helps to lead a rational life
 - B. a skill to solve a current ethical problem by comparing it with similar problems from the past and their outcome
 - C. a right of activists to decide their own duties
 - D. a judgment of an action by the consequences of that action

Ans. D

Sol. 'Utilitarianism' in the professional ethics is a judgement of an action by the consequences of that action.

- 14.** In the professional ethics, the degree of safety proposed to be attained varies with
- A. design, duration and product
 - B. cost of risk, design and utility
 - C. cost of risk, perception and utility
 - D. product, perception and cost of risk involved

Ans. B

Sol. In the professional ethics, the degree of safety proposed to be attained varies with cost of risk, design and utility.

- 15.** The basic ethical principle of 'Beneficence' states that
- A. all our thoughts and actions must be directed to ensure that others benefit from these thoughts and actions
 - B. our actions must result in the least harm to the others
 - C. we should not impose our views on others
 - D. our actions must be fair to everyone

Ans. A

Sol. The basic ethical principle of 'Beneficence' states that all our thoughts and actions must be directed to ensure that others benefit from these thoughts and actions.

- 16.** Which of the following are the main functions of WTO?
- (1) To organize meetings of member countries to arrive at trade agreements covering international trade
 - (2) To ensure that member countries conduct trade practices as per agreements agreed upon and signed by the member countries
 - (3) To provide a platform to negotiate and settle disputes related to international trade between and among member countries
- A. 1 and 2 only B. 1 and 3 only
C. 2 and 3 only D. 1, 2 and 3

Ans. D

Sol. The World Trade Organization came into being in 1995. It is the successor to General Agreement on Tariffs and Trade (GATT) established after 2nd World War.

Functions:

- Administering trade agreements (related to point 1)
- Acting as a forum for trade negotiations

- Settling trade disputes (related to point 3)
- Reviewing national trade policies
- Building the trade capacity of developing economies
- Cooperating with other international organizations
- Ensure member countries conduct trade practices as per agreements between among member countries (related to point 2)

Directions: Each of the next four (4) items consists of two statements, one labelled as '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 code given below:

Code:

- 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

- 17. Statement (I):** If the project influence is more in decision-making for the project, then the arrangement is considered a strong matrix.

Statement (II): If functional departments are seen to be influencing the decision-making more, the arrangement is considered a weak matrix.

Ans. B

Sol. A matrix may be filled either to the project side or to the functional side depending on the circumstances. If the project influence is more in decision making for the project, then the arrangement is considered a strong matrix. On the other hand, if functional departments are seen to be influencing the decision making more, the arrangement is considered a weak matrix. While a company may operate on matrix, one may see it operating with different strengths in different projects.

18. Statement (I): Raw materials are taken as traded items and their values at domestic and world prices are estimated.

Statement (II): Raw materials, which have a high value-to-volume ratio and involve proportionately high transport cost and are imported, are regarded as non-traded items.

Ans. C

Sol. In general, raw materials are taken as traded items and their value at domestic and world prices are estimated. However, raw materials which have a low value to volume ratio and involve disproportionately high transport cost and which are not imported are regarded as non-traded items.

19. Statement (I): Information and Communication Technologies (ICTs) can facilitate improved service delivery and more efficient internal operations.

Statement (II): ICTs can create new opportunities for the marginalized and the vulnerable of society but do not represent a panacea for all development problems.

Ans. B

Sol. Statement (I) is correct. ICTs do facilitate improved service delivery to customers in organization and citizens of the country and better efficient internal operations.

It also provides deep insights into the performance of the business organization and compares comparison with the other business organizations of the industry.

ICT is not only cost-effective due to its reach, but it also allows for innovative implementation measures to be put in place in an organization.

Statement (II) is correct. It can improve the quality of human life because it can be used as learning and education media, the mass communication media in promoting and campaigning practical and important issues, such as the health and social area.

For e.g.: Access to & use of ICTs assists adolescent girl's access to information about their own sexual and reproductive health or to online trainings, skills development & opportunities in the labour market.

ICT applications do not offer a panacea for social and economic development problems as there are risks of unemployment and social and economic dislocation.

But Statement (I) and Statement (II) are not related to each other as Statement (II) is not the correct explanation of Statement (I).

20. Statement (I): Long-term sustainability of e-Governance projects does not depend on financial viability, especially if they are to be implemented in the Public-Private Partnership (PPP) mode.

Statement (II): Front-end e-services are possible without back-end computerization.

Ans. D

Sol. Statement (I) is not correct. Long-term sustainability of e-Governance projects depend on financial viability, especially if they are to be implemented in the Public-Private Partnership (PPP) mode.

Financial Viability is the process which evaluates the risk involved over the life of a proposed project, to effectively deliver the goods and services which are specified in the project.

Statement (II) is correct. Front end e-services are possible without back-end computerization.

For e.g.: FRIENDS (Fast Reliable Instant Efficient Network for Disbursement of Services) project by the Government of Kerala is a Single Window Facility which helps the citizens to pay taxes and other financial dues to the State Government.

It provides evidence that the state attempted frontend computerisation efforts in the first phase itself, when the backend computerization of individual departments was still in development stage (not implemented).

21. Find the absolute maximum and minimum values of

$$f(x, y) = 2 + 2x + 2y - x^2 - y^2$$

on triangular plate in the first quadrant, bounded by the lines $x = 0$, $y = 0$ and $y = 9 - x$.

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

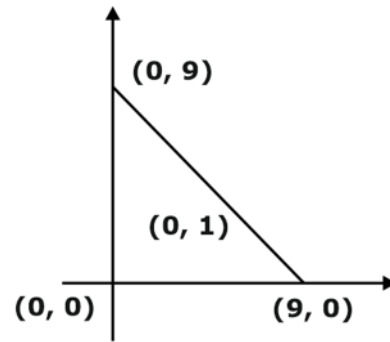
Ans. C

Sol. $f_x = -2x + 2$

$f_y = -2y + 2$

$f_x = 0 \Rightarrow x = 1$

$f_y = 0 \Rightarrow y = 1$



So stationary point (1, 1) which is lying inside triangular plate. There are 4 critical points (0, 0), (9, 0), (0, 9) and (1, 1) (Corner and stationary point).

(x,y)	f(x,y)
(0,0)	2
(9,0)	-61
(0,9)	-61
(1,1)	4

From above table absolute maxima = 4 and absolute minima = -61.

22. For the matrix

$$A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$$

the expression $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$

is equivalent to

- A. $A^2 + A + 5I$
- B. $A + 5I$
- C. $A^2 + 5I$
- D. $A^2 + 2A + 6I$

Ans. B

Sol. Characteristic equation of given matrix

$$(1 - \lambda)(3 - \lambda) - 8 = 0$$

$$\lambda^2 - 4\lambda - 5 = 0$$

Using Cayley Hamilton Theorem

$$A^2 - 4A - 5I = 0$$

$$A^2 = 4A + 5I \quad \dots(1)$$

$$A^3 = 21A + 20I \quad \dots(2)$$

$$A^4 = 104A + 105I \quad \dots(3)$$

$$A^5 = 521A + 520I \quad \dots(4)$$

$$\begin{aligned} \text{Now value of } A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I &= 521A + 520I - 4(104A + 105I) - 7(21A + 20I) + 11(4A + 5I) - A - 10I \\ &= A + 5I \end{aligned}$$

23. The solution of the differential equation $(1 + y^2)dx = (\tan^{-1} y - x) dy$ is

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

Ans. B

Sol. $(1 + y^2)dx = (\tan^{-1} y - x) dy$

$$\frac{dx}{dy} = \frac{\tan^{-1} y}{1 + y^2} - \frac{x}{1 + y^2}$$

$$\frac{dx}{dy} + \frac{x}{1 + y^2} = \frac{\tan^{-1} y}{1 + y^2} \quad \dots(1)$$

Given D.E. is linear differential equation where,

$$P = \frac{1}{1 + y^2}$$

$$Q = \frac{\tan^{-1} y}{1 + y^2}$$

$$\text{I.F.} = e^{\int P dy} = e^{\int \frac{dy}{1 + y^2}}$$

$$= e^{\tan^{-1}(y)}$$

$$x \times \text{I.F.} = \int Q \times \text{I.F.} dy + C$$

$$x \times e^{\tan^{-1}(y)} = \int \frac{\tan^{-1} y}{1 + y^2} \times e^{\tan^{-1} y} dy + C$$

$$xe^{\tan^{-1}(y)} = \int te^t dt + C$$

$$[\text{Let } \tan^{-1} y = t]$$

$$xe^{\tan^{-1}(y)} = te^t - e^t + C$$

$$xe^{\tan^{-1}(y)} = \tan^{-1}(y)e^{\tan^{-1} y} - e^{\tan^{-1} y} + C$$

$$x = \tan^{-1} y - 1 + C(e^{-\tan^{-1}(y)})$$

24. The value of

$$\Delta^{10} [(1 - ax)(1 - bx^2)(1 - cx^3)(1 - dx^4)]$$

is

- A. abcd (10!)
- B. abcd (9!)
- C. abcd (8!)
- D. abcd (7!)

Ans. A

Sol. $(1 - ax)(1 - bx^2)(1 - cx^3)(1 - dx^4)$ is polynomial of degree 10. We know that nth forward difference of a polynomial of degree n is always constant. So

$$\begin{aligned} \Delta^{10} (1 - ax)(1 - bx^2)(1 - cx^3)(1 - dx^4) \\ = \Delta^{10} (1 - ax + \dots abcd x^{10}) \\ = abcd(10!) \end{aligned}$$

25. If $u = \log_e \left(\frac{x^4 + y^4}{x + y} \right)$, the value of $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$

is

- A. 6
- B. 5
- C. 4
- D. 3

Ans. D

Sol. $u = \log_e \left(\frac{x^4 + y^4}{x + y} \right)$

is not a homogeneous function but

$$e^u = \frac{x^4 + y^4}{x + y}$$

is a homogenous function of degree 3 so using Euler's Indirect Theorem

$$\begin{aligned} x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} &= n \frac{\phi(u)}{\phi'(u)} \\ &= 3 \times \frac{e^u}{e^u} = 3 \end{aligned}$$

26. The general value of $\log(1 + i) + \log(1 - i)$ is

- A. $\log 2 - 4nni$
- B. $\log 2 + 4nni$
- C. $\log 2 + 2nni$
- D. $\log 2 - 2nni$

Ans. C

Sol. $\log(1 + i) + \log(1 - i) = \log(1 + i)(1 - i)$
 $= \log 2$

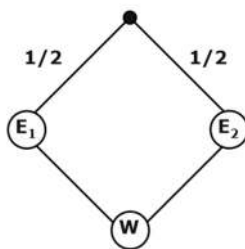
So the general value of $\log(1 + i) + \log(1 - i)$ is $\log 2 + 2nni$

27. A bag contains 4 white and 2 black balls and another bag contains 3 of each colour. A bag is selected at random and a ball is drawn at random from the bag chosen. The probability of the white ball drawn is

- A. 1/3
- B. 1/4
- C. 5/12
- D. 7/12

Ans. D

Sol. $E_1 \rightarrow$ Selected bag is first
 $E_2 \rightarrow$ Selected bag is second
 $W \rightarrow$ Drawn ball is white



$$P\left(\frac{W}{E_1}\right) = \frac{4}{6} \qquad P\left(\frac{W}{E_2}\right) = \frac{3}{6}$$

$$P(W) = P(E_1) \times P\left(\frac{W}{E_1}\right) + P(E_2) \times P\left(\frac{W}{E_2}\right)$$

$$= \frac{1}{2} \times \frac{2}{3} + \frac{1}{2} \times \frac{1}{2}$$

$$= \frac{7}{12}$$

28. X is a continuous random variable with probability density function given by

$$f(x) = kx \qquad (0 \leq x < 2)$$

$$= 2k \qquad (2 \leq x < 4)$$

$$= -kx + 6k \qquad (4 \leq x < 6)$$

The value of k will be

- A. 2/3
- B. 1/8
- C. 1
- D. 8

Ans. B

Sol. If $f(x)$ is a density function.

Then,

$$\int_0^2 f(x) dx + \int_2^4 f(x) dx + \int_4^6 f(x) dx = 1$$

$$\int_0^2 kx dx + \int_2^4 2k dx + \int_4^6 (-kx + 6k) dx = 1$$

$$K\left(\frac{x^2}{2}\right)_0^2 + 2k(x)_2^4 + \left(-\frac{kx^2}{2} + 6kx\right)_4^6 = 1$$

$$2K + 4K + 2K = 1$$

$$8K = 1$$

$$K = 1/8$$

29. The first moment about origin of binomial distribution is

- A. np
- B. npq
- C. n(1 - p)
- D. n(1 - p)q

Ans. A

Sol. First moment is referred as expected value.

Expected value of BD = np

30. For the regression equations:

$$y = 0.516x + 33.73 \text{ and } x = 0.512y + 32.52$$

the means of x and y are nearly

- A. 67.6 and 68.6
- B. 68.6 and 68.6
- C. 67.6 and 58.6
- D. 68.6 and 58.6

Ans. A

Sol. $y = 0.516x + 33.73$

$$y - 0.516x = 33.73 \dots(1)$$

$$-0.516x + y = 33.73$$

$$\text{and } x = 0.512y + 32.52$$

$$x - 0.512y = 32.52 \dots(2)$$

On solving eqn. (1) and (2), we get mean of x and y.

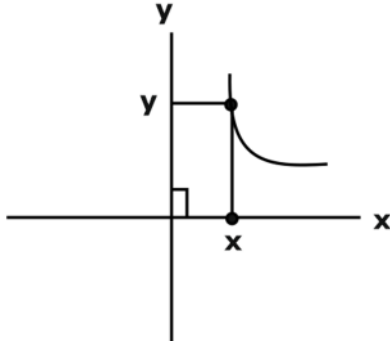
$$x = 67.6 \text{ and } y = 68.6$$

31. In a rectangular hyperbola, if a curve is traced out by a point moving in such a way that the product of its distances from two fixed lines at right angles to each other is a constant, then those fixed lines are called

- A. asymptotes
- B. intercepts
- C. holes
- D. limits

Ans. A

Sol. For a rectangular hyperbola,

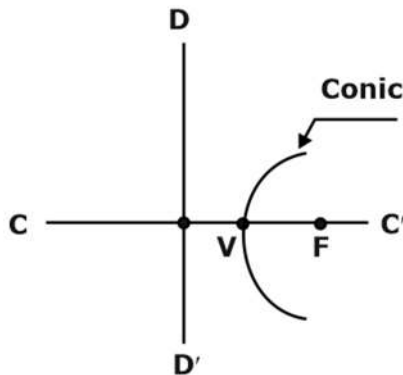


$xy = \text{Constant}$, $x, y = \text{Asymptotes}$

- 32.** The line passing through the focus and perpendicular to the directrix is called
- A. axis B. vertex
C. eccentricity D. conic

Ans. A

Sol. A line passing through focus and perpendicular to directrix is an axis of that conic.



$CC' = \text{Axis}$

$DD' = \text{Directrix}$

- 33.** Dimensions in a series may be placed in any one of the following ways, except
- A. progressive dimensioning
B. proportional dimensioning
C. continuous dimensioning
D. chain dimensioning

Ans. B

Sol. Progressive dimensioning is also known as parallel dimensioning in which dimensioning is done from a datum line. Whereas in chain (or)

continuous dimensioning (or) in proportional dimensioning, dimensions are placed in series.

- 34.** Among the effects of design specifications on costs, which one of the following is the most significant that influences the producibility of end product?
- A. Standard size B. Large tolerance
C. Breakeven point D. Cost estimate

Ans. B

Sol. Among the effects of design specifications on costs, those of tolerance perhaps most significant. Tolerance in design influence the productibility of the end product in many ways from necessitating additional step in processing to rendering apart completely impractical to produce economically.

- Permissible tolerance must be placed on dimension of a part to limit the acceptable variations in the size of a part AOS.
- A small tolerance means greater ease of interchangeability of part but this obviously leads to increase cost in manufacturing.

- 35.** Which one of the following is not the best approach for the prevention of product liability?
- A. Analysis and design
B. Quality control
C. Comprehensive testing
D. Cost

Ans. D

Sol. Best approach for prevention of the product liability are:

- A. Analysis and design
B. Quality control
C. Comprehensive testing

Least approach is cost of product as by lowering the cost we cannot play with the life of the end user.

- 36.** Which one of the following is not the way of estimating the statistical parameters and is integral part of analysis or synthesis tasks when probability of failure is involved?
- A. Propagation of error
 - B. Propagation of uncertainty
 - C. Propagation of weight
 - D. Propagation of dispersion

Ans. C

Sol. There are ways of estimating the statistical parameters describing weight and inertia from those describing size and density. These methods are variously called propagation of error, propagation of uncertainty or propagation of dispersion.

These methods are integral parts of analysis or synthesis task when probability of failure is involved.

- 37.** In order to limit the seriousness of an accident, emergency controls should be provided with which of the following as determining factors in the location of emergency stops?
- A. Speed and ease of operation
 - B. Common sense of workers
 - C. Nearest exits and checkpoints
 - D. Supervisors and decision-makers

Ans. A

Sol. Determining factor in the location of emergency stops is speed and ease of operation of the emergency stops.

- 38.** Human engineering approach is followed to prevent accidents by giving due consideration to physical and mental limitations of the workers by

- A. giving constant attention to how a worker is likely to react rather than how supervisor would like him to react
- B. imposing too many safety rules
- C. not permitting to make safety device or guard inoperative
- D. giving first-aid attention in case of injury

Ans. A

Sol. Human engineering approach or work ergonomics improvements are changes made to improve the fit between a job and capabilities of the employees performing it. They are commonly

- (i) Engineering improvements
- (ii) Administrative improvements
- (iii) Safety fear

- 39.** Which one of the following is not an operator error through triggers leading to an accident which confuses and traps into making mistake?
- A. Faulty design or construction of machine tool
 - B. Poor housekeeping and cleanliness
 - C. Standard operating safety practice
 - D. Lack of standardization and identification

Ans. A

Sol. Faulty design or construction of machine tool is not an operator error but it is a design error.

- 40.** Which one of the following is not included in the safety program for achieving good results during the prevention of accidents?
- A. Development of safe working conditions
 - B. Promotion of employees participation in safety
 - C. Compensation and medical payment
 - D. Corrective action when safety rules are ignored

Ans. C

Sol. The compensation and medical payments are not part of safety program. It is responsibility of non-safety managers.

41. During an assessment of economic viability of project, the ratio of average annual earnings after tax to the average book investment after depreciation is called

- A. Benefit-Cost Ratio (BCR)
- B. Net Present Value (NPV)
- C. Pay-Back Period (PBP)
- D. Return on Investment (ROI)

Ans. D

Sol. Average rate of return is also called as return on investment

$$ROI = \frac{\text{Annual average profit after tax}}{\text{Average investment}} \times 100$$

42. Who is responsible for the following activities in a project?

1. Achieving a unity of control over project activities
 2. Having an authority to control project matters and disburse funds from the budget
 3. Having no actual line of authority over workers
- A. Project Expeditor
 - B. Project Coordinator
 - C. Matrix Manager
 - D. Project Manager

Ans. B

Sol. Davis's classification can be used to introduce four types of project managers :

- **Project expeditors**, whose purpose is to try to speed up work. They are the communication link between senior managers and the project. Their purpose is to achieve unit of communications. They are not really

managers, but are go-betweens who translate technical concepts into business concepts such as costs, schedules, and markets. The role is limited to funnelling information from technical workers to executives, and making suggestions; thus, it tends to be restricted to small projects with low risk and little at stake.

- **Project coordinators**, whose purpose is to achieve unity of control over project activities. They have authority to control project matters and disburse funds from the budget, but no actual line authority over workers. Their authority derives solely from their association with upper-level managers. The construction project manager, for example, would be in this position if he coordinated the work but needed approval from the developer for major decisions such as contracting or allocation of funds.

- **Matrix managers**, whose purpose is to achieve unity of direction. Although they serve the same purposes as the first two, they additionally have authority to plan, direct, and control project work. Matrix managers direct people located administratively in different functional departments, and the resulting crisscross pattern of vertical- functional and horizontal - project reporting relationships create what is called a matrix organization. For example, the manager of Project Over oversees project tasks 1-3, which are performed by people assigned from the functional areas of accounting, contracts, etc. Another example is the manager of a construction project that involves both designing and constructing a building.

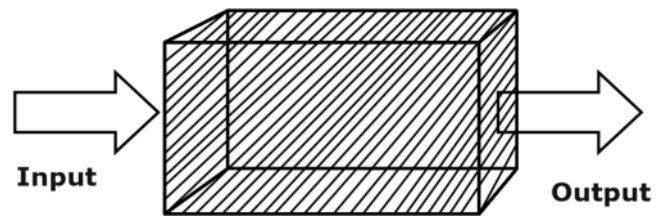
Managers from the architectural and construction departments assign personnel to the project, who then report to the project manager for as long as needed. The same personnel may also work on other projects and report to other matrix managers.

• **Pure project managers**, whose purpose is to achieve unity of command over the people in pure project organizations that report directly to them. They are primarily integrators and generalists rather than technical specialists. They must balance technical factors of the project with schedules, costs, resources, and human factors. In the course of project, they deal with top management, functional managers, vendors, customers, and subcontractors. The manager of large construction project who is hired by the developer and delegated the authority to make major decisions (such as selecting and contracting with the architect and the contractor has such a role).

- 43.** The creative technique applied when the available and required inputs as well as the desired outputs are listed, is
- A. attribute listing B. direct dreaming
C. black box D. Delphi

Ans. C

Sol. Black box testing is also known as behavioral, opaque box, closed box, specification-based or eye-to-eye testing. It is a software testing method that analyses the functionality of a software/application without knowing much about the internal structure/design of the item that is being tested and compares the input value with the output value.



Black Box Testing

- 44.** The market price per share of a company is Rs 125. The dividend per share (DPS) expected a year is Rs 12 and DPS is expected to grow at a constant rate of 8% per annum. The cost of the equity capital to the company will be
- A. 17.6% B. 15.4%
C. 13.2% D. 11.8%

Ans. A

Sol. Cost of equity capital = $\frac{DPS}{MP} + G$

$$= \frac{12}{125} \% + 8\%$$

$$= 9.6\% + 8\%$$

$$= 17.6\% \text{ where,}$$

DPS = Dividend per share
MP = Market price
G = Growth rate

- 45.** Which one of the following risks can be reduced by investing in projects or acquiring other firms that have a negative correlation with the earnings of the firm?
- A. Investment risk B. Business risk
C. Financial risk D. Portfolio risk

Ans. D

Sol. Negative correlation of investments is used with portfolio risk management to decide how to allocate assets. Investors and portfolio manager believe that some of the risk associated with the portfolio would be diversified if they can assemble a portfolio of negative correlated assets.

- 46.** An individual investor who invests in the e-project usually during an early stage is
- A. Corporate strategic investor
 - B. Founder capital
 - C. Angel investor
 - D. Venture capital

Ans. C

Sol. An angel investor is usually a high net worth individual who funds start-ups at the early stages often with their own money. Angel investing is often the primary source of funding for many start-ups who find it more appealing than other, more predatory, forms of funding.

- 47.** If the nominal rate of interest is 12% and is compounded quarterly, the effective rate of interest per annum will be nearly
- A. 10.8%
 - B. 12.6%
 - C. 14.4%
 - D. 16.2%

Ans. B

Sol. Effective annual interest rate = $\left[\left(1 + \frac{i}{c} \right)^c - 1 \right]$

where, i = Nominal interest rate per year

c = Number of times compounding in a year

$$i_{\text{eff}} = \left[\left(1 + \frac{12\%}{4} \right)^4 - 1 \right]$$

$$i_{\text{eff}} = 12.55\% \cong 12.6\%$$

- 48.** In a bank, deposits can be made for periods ranging from 6 months to 10 years. Every quarter, an interest will be added on to the principal. The rate of interest applied is 9% per annum for periods from 12 months to 23 months and 10% per annum for periods from 24 months to 120 months. An amount of Rs 1,000 invested for 2 years to grow, will be nearly

- A. Rs 1,218
- B. Rs 1,334
- C. Rs 1,414
- D. Rs 1,538

Ans. A

Sol. Effective annual interest rate = $\left[\left(1 + \frac{i}{c} \right)^c - 1 \right]$

$$i_{\text{eff}} = \left[\left(1 + \frac{0.10}{4} \right)^4 - 1 \right]$$

$$i_{\text{eff}} = 10.38\%$$

$$\text{Future amount after 2 years} = 1000(1.1038)^2 = 1218.37 \cong 1218$$

- 49.** A company has issued Rs 20 million worth of non-convertible debentures, each at a face value of Rs 100 at the rate of 12%. Each debenture is redeemable at a premium of 5%, after 10 years. If the net amount realized is Rs 95 and tax rate is 40%, the cost per debenture will be

- A. 5.8%
- B. 6.6%
- C. 7.4%
- D. 8.2%

Ans. D

Sol. Cost per debenture

$$= \frac{\left[\text{Interest} \times (1 - \text{tax}) + \frac{(RV - NP)}{n} \right] \times 100}{\left(\frac{RV + NP}{2} \right)}$$

where RV = Redeemable value, NP = Net proceeds from issue

∴ RV = Rs. 105, NP = Rs. 95, Interest = 12%, Tax = 40%.

Cost of Debt =

$$= \frac{\left[12 \times (1 - 0.4) + \frac{(105 - 95)}{10} \right] \times 100}{\left(\frac{105 + 95}{2} \right)}$$

$$= \frac{(7.2 + 1) \times 100}{100} = 8.2\%$$

- 50.** A cybernetic control system that acts to reduce deviations from standard is called
- a negative feedback loop
 - a positive feedback loop
 - a closed loop
 - an open loop

Ans. A

Sol. A cybernetic control system that acts to reduce deviations from standard is called a negative feedback loop. If the system output moves away from the standard in one direction, the control mechanism acts to move it in the opposite direction. The speed or force with which the control operates is, in general, proportional to the size of the deviation from the standard. The precise way in which the deviation is corrected depends on the nature of the operating system and the design of the controller.

- 51.** In which one of the following types of bonds, the bond formation is by free moving electrons in an array of positive ions?
- Homopolar bond
 - Electrostatic bond
 - Metallic bond
 - Covalent bond

Ans. C

Sol. In metallic bond free electron act as glue to hold the ion (+ve) core together. In it lattice of positive ion embedded in a sea of electrons.

- 52.** If a pair of one cation and one anion is missing in an ionic crystal such that those pairs of ions are equal to maintain electrical neutrality, then that pair of vacant sites is called
- Schottky imperfection
 - Pair of vacancies
 - Frenkel defect
 - Point imperfection

Ans. A

Sol.

- This is a kind of stoichiometric defect (i.e. electrical neutrality) and found in AX materials e.g. Hallide.
- In which anion and cation missing in pair and forms vacancy.

- 53.** Which of the following are the characteristics of covalent compounds?

- They are mostly gases and liquids
 - They are usually electric insulators.
 - They are directional in nature.
 - They are insoluble in polar solvents like water but are soluble in non-polar solvents.
- A. 1, 2 and 3 only B. 1, 2 and 4 only
C. 1, 3 and 4 only D. 1, 2, 3 and 4

Ans. D

Sol.

- Covalent compounds are directional in nature due to covalent bond.
- It exists in solid, liquids and gas.
- Covalent solids or compound do not dissolve in polar, solvents.
- These dissolves in non-polar solvents.
- They are usually bad conductors of electricity exception is graphite.
- But as 2, 3, 4 are perfectly correct only doubt is with option 1. But for this option 1 may be considered as correct.

- 54.** The photoelectric current depends on which of the following factors?

- The frequency of the incident light
 - The intensity of the incident light
 - The potential difference between the electrodes
 - The photosensitivity of the non-metal
- A. 1, 2 and 4 B. 1, 2 and 3
C. 1, 3 and 4 D. 2, 3 and 4

Ans. B

Sol. For a given metal photoelectric current depends on:

- (i) The potential difference between two plates
- (ii) The intensity of incident radiation
- (iii) The frequency of incident radiation
- (iv) The photo metal used

55. Which one of the following statements is correct regarding ductile fracture?

- A. Fractured surfaces are crystalline in appearance.
- B. There is virtually no reduction in cross-sectional area during fracture.
- C. Fracture takes place after necking with little sound.
- D. Percentage elongation is about 60% prior to fracture occurs.

Ans. C

Sol. Ductile fracture occurs after prolonged plastic deformation and is accompanied by necking. It requires higher strain energy.

Due to necking warning sign can be easily sensed.

56. Which of the following factors are affecting critical shear stresses?

- 1. Purity of metals reduces the critical shear stress
- 2. Surface films greatly enhance the critical shear stress
- 3. Rise in temperature
- 4. Rate of deformation and the extent of initial deformation also help in raising the critical shear stress

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

Ans. D

Sol. Critical shear stress: The shear stress needed to cause slip in given direction along a given crystallographic plane of single crystal.

Factors influencing the critical shear stress:

- (i) Purity in metals reduces the critical stress
- (ii) Surface effects like surface films greatly increase the critical shear stress.
- (iii) Temperature increases the thermal mobility and hence decrease the critical shear stress.
- (iv) Rate of deformation and the extent of initial deformation will also rise the critical shear stress.
- (v) In dislocation i.e. shear stress, dislocation move only in that plane and direction which have highest planar density and linear density (e.g. polycrystalline material). This defined slip system.

57. Which one of the following types of materials is having high remanence, coercivity and saturation flux density as well as low permeability and high hysteresis energy losses?

- A. Soft magnetic materials
- B. Hard magnetic materials
- C. Hard electrical materials
- D. Soft electrical materials

Ans. B

Sol. Hard magnetic materials have

- (i) High coercive force or coercivity
- (ii) Low permeability
- (iii) Appreciable remanence
- (iv) High hysteresis losses
- (v) Considerable saturation flux density

- 58.** Polymers having strong primary bonds throughout, often formed by condensation polymerization, and their structure resembles one large molecule, are known as
- A. thermoplastic polymers
 - B. thermosoftening polymers
 - C. thermosetting polymers
 - D. random polymers

Ans. C

Sol.

- Thermosetting polymers are formed by condensation polymerization.
- These are characterised by strong cross linked covalent bond (primary bond) and give three-dimensional molecular structure and have very high molecular weight.
- 2nd bond (van der Waals bond) found in thermoplastic material.

- 59.** An FET is a semiconductor device with the output current controlled by an electric field and its current is carried predominantly by one type of carriers. It is known as
- A. junction transistor
 - B. unipolar transistor
 - C. MOSFET
 - D. IGBT

Ans. C

Sol.

- There are two types of field effect transistors (FET) junction FET and metal oxide FET (MOSFET).
- FETs are unipolar devices means the charge carriers are of only one type either electrons or holes.

- 60.** Which one of the following is the trade name of polycarbonates?

- A. Alathon
- B. Baylon
- C. Bexphane
- D. Cycloac

Ans. B

Sol

- Alathon – trade name HDPE
- Baylon – trade name of PAb, PAbb (polyamide nylon)
- Bexaphane – trade name of polypropylene
- Cycloae – trade name of ABS
- Trade name of polycarbonate is Baylon.

- 61.** Which of the following departments ensure the quality of the product?

1. Product design and development
2. Marketing and product planning
3. Packaging and shipping
4. Sales

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

Ans. A

- Sol.** The department responsible for quality are marketing, design engineering, procurement, process design, production, inspection and testing, packaging and shipping and product service.

- 62.** Which of the following are the general subareas of quality control?

1. Off-line quality control
2. Sales/market share
3. Statistical process control
4. Acceptance sampling plans

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

Ans. B

- Sol.** The general area of quality control may be divided into three main subareas:

- (1) Off-line quality control
- (2) Statistical process control
- (3) Acceptance sampling plans

63. Which of the following steps come under 14-step plan for quality improvement?

- 1. Ad hoc committee for the zero defects program
 - 2. Cost of quality evaluation
 - 3. Quantity measurements
 - 4. Supervisor training
- A. 1, 2 and 3 B. 1, 2 and 4
C. 1, 3 and 4 D. 2, 3 and 4

Ans. B

Sol. 14 steps to quality improvement for long term process improvement are:

- (1) Management Commitment
- (2) Quality Improvement Plan
- (3) Quality Measurement
- (4) Cost of quality evaluation
- (5) Quality awareness
- (6) Corrective action
- (7) Establish an Ad Hoc committee for the zero defects program
- (8) Supervisor training
- (9) Zero defects day
- (10) Goal setting
- (11) Error cause removal
- (12) Recognition
- (13) Quality councils
- (14) Do it over again

64. An Average Outgoing Quality (AOQ) is

- A. $\frac{P_a p(N)}{N - n}$ B. $\frac{P_a p(N + n)}{N}$
C. $\frac{P_a p(N - n)}{n - N}$ D. $\frac{P_a p(N - n)}{N}$

where

- P_a = Probability of accepting the lot
- p = Incoming lot quality
- N = Lot size

n = Sample size

Ans. D

Sol. $AOQ = P_a p \left(\frac{N - n}{N} \right)$

65. Which one of the following is the measure of service quality that correlates with the human factors and behavioural characteristics of service quality?

- A. Number of complementary responses based on human traits in delivery of service
- B. Proportion of income tax returns prepared by an agency that have errors
- C. Shabby appearance of a receptionist in a bank or hotel
- D. Inadequate temperature control in a convention meeting room

Ans. A

Sol. For service quality characteristic of human factors and behavioural characteristics, the measures of service quality can be number of customer complaints based on behavioural factors of persons involved in the service process or the number of complementary responses based on human traits in delivery of services.

For service quality characteristic of service non-conformity characteristics, the measures of service quality can be proportion of income tax returns prepared by an agency that have errors for facility related service quality characteristics, the measure of service quality can be inadequate temperature control in a convention meeting room or shabby appearance of a receptionist in a hotel or bank.

66. Which of the following factors affect the quality of conformance in construction?

1. Site construction methods
2. Technical specifications
3. Engineering and design process
4. Supervision and control

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

Ans. D

Sol. Quality of conformance in construction is affected by the following:

1. Field construction methods-skill of workers, efficiencies of the tools and equipment used, and the quality of the materials used.
2. Supervision that is enforced and the managerial controls applied to direct the working crew to conform to the plans and specifications.
3. Inspection and quality control procedures that are applied.

67. Which of the following considerations are important during inspection of the work in prestressed concrete works?

1. Sheathings are threaded properly including correct threading of couplers and taping of joints
2. Only approved sheathings, HTS strands, anchor heads and wedges are to be used
3. Splicing of reinforcement to be provided at the joints

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

Ans. B

Sol. The following considerations are important during inspection of the work in prestressed concrete works:

1. Sheathings are threaded properly including correct threading of couplers and taping of joints
2. Only approved sheathings, HTS strands, anchor heads and wedges are to be used

68. The standard deviation σ for sampling in the case of concrete for construction engineering and management is

- A. $\sqrt{\frac{\sum (X + \bar{X})^2}{N + 1}}$ B. $\sqrt{\frac{\sum (X - \bar{X})^2}{N + 1}}$
C. $\sqrt{\frac{\sum (\bar{X} - X)^2}{N - 1}}$ D. $\sqrt{\frac{\sum (X - \bar{X})^2}{N - 1}}$

where

$X_1, X_2, X_3, X_4, \dots, X_n$ = Compressive strengths of the individual cubes

N = Number of cubes tested

\bar{X} = Average pf series of compressive strength values

Ans. D

Sol. Sampled standard deviation is given by

$$\sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{N - 1}}$$

69. Which of the following variations are true in piece part production?

1. Piece-to-piece variation
2. Time-to-time variation
3. Within-piece variation
4. Process-to-process variation

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

Ans. D

Sol. There are three categories of variation in piece part production:

1. Within-piece variation: This type of variation can be illustrated by the surface roughness of a piece wherein one portion of the surface is rougher than another portion, or the width of one end of a keyway varies from the other end.

2. Piece-to-piece variation: This type of variation occurs among pieces produced at the same time. Thus, the light intensity of four consecutive light bulbs produced from a machine will be different.

3. Time-to-time variation: This type of variation is illustrated by the difference in product produced at different times of the day. Thus, a service given early in the morning would be different from that given later in the day, or as a cutting tool wears, the cutting characteristics change.

- 70.** Which one of the following is the objective of attribute charts in production process control?
- A. To determine the acceptance criteria of a product before production
 - B. To evaluate the quality performance of operating and management personnel
 - C. To keep a periodic record of a particular characteristic
 - D. To determine the highest quality level

Ans. B

- Sol.** The objectives of attribute charts are to
- 1. Determine the average quality level
 - 2. Bring to the attention of management any changes in the average
 - 3. Improve the product quality by motivating the operating and management personnel to initiate ideas for quality improvement.
 - 4. Evaluate the quality performance of operating and management personnel
 - 5. Determine acceptance criteria of a product before shipment to the customer.

- 71.** Which one of the following regions is characterized by sensitive ecosystems, enhanced occurrences of extreme weather events and natural catastrophes?
- A. Mountain region
 - B. Evergreen forest region
 - C. Tropical region
 - D. Tundra region

Ans. C

Sol. Tropical region and mountain region are two available options for this question. Tundra and Evergreen are rejected as they don't experience enhanced occurrences of extreme weather events and sensitive ecosystems as compared to Tropical and mountain region. Mountain region is also rejected when compared with tropical region because most of the mountains/hills are found in tropical regions such as Western Ghats, Eastern Ghats, Himalayas etc., which are rich in biodiversity.

Also, Sensitive ecosystems such as corals are found in tropical region.

And, extreme weather events such as occurrences of natural events such as cyclones, earthquakes and tsunamis are more prevalent in tropical region as compared to Mountain region.

- 72.** Which one of the following is an iterative and evolutionary process for achieving sustainable development?
- A. Flood Control Management (FCM)
 - B. Solid Waste Management (SWM)
 - C. Integrated Coastal Zone Management (ICZM)
 - D. Natural Ecosystem Zone (NEZ)

Ans. C

Sol. Integrated coastal zone management is an iterative and evolutionary process for achieving sustainable development.

73. Which of the following practices are adopted for river basin water resources management?

1. Soil conservation in catchments of river valley projects and flood-prone rivers.
2. Soil and land use surveys
3. Control of shifting cultivation
4. Deforestation

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

Ans. D

Sol. For the river basin water resources management, practices adopted are:

- a) Reforestation, social forestry
- b) Promotion of organic farming
- c) Control of shifting cultivation
- d) Soil and land use surveys
- e) Soil conservation in catchments of river valley projects and flood prone rivers
- f) Zero budget natural farming to control biomagnification and chemical pollution.

74. According to the Stokes' law, the rate of settling of the particles depends on the terminal settling velocity v_t which is

- A. $\frac{gd_p^2}{18\mu_a}(\rho_p - \rho_a)\left(1 + \frac{2C}{d_p\rho}\right)$
- B. $\frac{gd_p^2}{18\mu_a}(\rho_p + \rho_a)\left(1 - \frac{2C}{d_p\rho}\right)$
- C. $\frac{gd_p^2}{18\mu_a}(\rho_p - \rho_a)\left(1 - \frac{2C}{d_p\rho}\right)$
- D. $\frac{gd_p^2}{18\mu_a}(\rho_p + \rho_a)\left(1 + \frac{2C}{d_p\rho}\right)$

Where,

d_p = particle diameter

ρ_p = density of particle

ρ_a = density of air

μ_a = velocity of air

P = air pressure

C = constant

Ans. A

Sol. According to the Stokes' law, the rate of settling of the particles depends on the terminal settling velocity v_t which is:

$$\frac{gd_p^2}{18\mu_a}(\rho_p - \rho_a)\left(1 + \frac{2C}{d_p\rho}\right)$$

75. The sound level L is

- A. $\log_{10} \frac{Q_0}{Q}$ (bels)
- B. $20 \log_{10} \frac{Q}{Q_0}$ (bels)
- C. $\log_{10} \frac{Q}{Q_0}$ (bels)
- D. $20 \log_{10} \frac{Q}{Q_0} + \log_{10} \frac{Q}{Q_0}$ (bels)

Where,

Q = measured quantity of sound pressure or sound intensity

Q_0 = reference standard quantity of sound pressure

Ans. C

Sol.

$$L = \log_{10} \frac{Q}{Q_0} \text{ (bels)}$$

$$= 10 \log_{10} \frac{Q}{Q_0} \text{ (dB)}$$

76. Which one of the following is a hygienic way of disposing solid waste and is more suitable if the waste contains more hazardous material and organic content?

- A. Composting B. Incineration
- C. Oxidation D. Subgrading

Ans. B

Sol. Incineration is a waste treatment process that involves the combustion of organic substances contained in waste materials.

Incineration has particularly strong benefits for the treatment of certain waste types in niche areas such as clinical wastes and certain hazardous wastes where pathogens and toxins can be destroyed by high temperatures.

77. NEPA stands for

- A. National Ecological Physical Area
- B. Natural Environmental Policy Act
- C. National Environmental Policy Act
- D. Natural Ecological Primary Area

Ans. C

Sol. NEPA stands for National Environmental Policy Act.

78. Which one of the following gases is colourless with strong odour, irritates mucous membranes at common levels, can cause cough, fatigue and interference with lung functions at higher concentration?

- A. Carbon monoxide
- B. Hydrogen
- C. Ozone
- D. Nitrogen

Ans. C

Sol. Ozone has a very strong odour and is colourless to pale blue gas depending upon its ppm levels.

It causes various health problems such as chest pain, coughing, throat irritation, and irritation in mucous membranes at higher concentration.

It also can reduce lung function and harm lung tissue, causes bronchitis, emphysema, and asthma.

Hence Ozone is the closest answer to this question.

79. Basel convention provides

- A. Indian standards for pollution measurement and prevention
- B. International guidelines to control the transboundary movements of hazardous wastes between different countries
- C. Indian standards for the disposal of municipal and industrial wastes
- D. International standards to categorize pollution in air and wastewater

Ans. B

Sol. Basel Convention Provides:

1. the reduction of hazardous waste generation and promotion of environmentally sound management of hazardous- waste wherever the place of disposal.
2. The restriction of transboundary movements of hazardous wastes except where it is received to be in accordance with the principles of environmentally sound management.
3. A regulatory system applying to cases where transboundary movement is possible.

80. Which of the following are the suggested ways of reducing NO_x emissions from stationary sources?

1. By reducing the peak temperature
 2. By increasing the availability of N₂ for reaction with O₂
 3. By minimizing the availability of O₂ for reaction with N₂
- A. 1 and 2 only B. 1 and 3 only
C. 2 and 3 only D. 1, 2 and 3

Ans. B

Sol. Suggested ways to reduce NOX emissions from stationary sources are:

- 1) Reducing flame temperatures
- 2) Reducing excess air and/or burning low nitrogen containing fuels
- 3) By minimizing the availability of Oxygen for reaction with Nitrogen

81. What is TADF?

- A. Technology Acquired Desired Firm
- B. Technologically Advanced Direct Fund
- C. Technologically Accomplished Direct Fund
- D. Technology Acquisition and Development Fund

Ans. D

Sol. TADF stands for Technology acquisition and development fund.

82. Technical textiles are

- A. the high-tenacity fibres which are lightest and toughest fabrics mainly used in automobile and aerospace industries
- B. the toughest fabrics which are much heavier than polyester and used in power industries
- C. the toughest fabrics having rigidity mainly used in polyhouse construction
- D. the high-tenacity fabrics having fire resistance property

Ans. A

Sol. Technical textiles are the high-tenacity fibres which are lightest and toughest fabrics mainly used in automobile and aerospace industries.

83. Which one of the following is a measure of sustainable income level that can be secured without decreasing the stock of natural assets?

- A. Natural Capital Stock
- B. Environmental value
- C. Green Accounting
- D. Social discount rate

Ans. C

Sol. Green accounting is a condition of sustainable development.

It allows the computation of a nation's income by including the factors of economic damage and depletion in natural resource base of a country.

In other words, it is a measure of sustainable income level that can be secured without decreasing the stock of natural assets.

84. Which one of the following is a resource allocation as per Chenery's development process?

- A. Investment
- B. Structure of domestic demand
- C. Labour allocation
- D. Government revenue

Ans. B

Sol. Chenery's model requires a change of the existing structures in an underdeveloped economy so that the new industries and modern structures can penetrate of to attain the status of an industrial nation.

It states that investment and savings although necessary are not enough to drive the degree of growth that is required.

It adopts four main strategies to achieve economic growth:

- Transformation of production from agricultural to industrial production
- Changing composition of the consumer demand from emphasis on food commodities and other consumables to desire for multiple manufactured goods and services
- International trade; creating a market for its exports
- Using resources as well as changes in socioeconomic factors as the distribution of the country's population.

- 85.** Which one of the following ratios is referred to as everything that has been invested in the past and to the whole income?
- A. Capital-output ratio
 - B. Average capital-output ratio
 - C. Incremental capital-output ratio
 - D. Marginal ratio

Ans. B

Sol. Capital output ratio is defined as total amount of capital required to produce one unit of output (Economic growth). For example, the total investment (capital) is 30% of GDP, & the economic growth corresponding to this investment is 7%. So, the Capital Output ratio is $30/7 = 4.28$.

Average capital-output ratio is the ratio of total investment made in the past in the economy to the total income generated (GDP growth rate). (as per the question)

Incremental Capital Output Ratio (ICOR) is defined as the additional unit of capital/investment required to produce an additional unit of output (economic growth or GDP growth).

Thus, this ratio changes with increase in investment.

- 86.** Which one of the following methods of planning is an attempt to work out the implications of the allocations and product yields so as to maximize income and employment?
- A. Perspective planning
 - B. Physical planning
 - C. Financial planning
 - D. Indicative planning

Ans. C

Sol. Physical planning is defined as an attempt to work out the implication of the development effort in terms of factor allocations and product yield so as to maximize incomes and employment, as per the 2nd Five Year Plan. It is also known as over all long-term planning rather than a short-term planning.

Financial Planning is defined as to remove the disequilibrium between demand and supply in the economy with the aim to avoid inflation and provide economic stability.

Physical targets can be achieved only through financial resources.

Indicative planning has the main objective to solve the problem of imperfect information in market and mixed economies in order to enhance economic performance.

- 87.** Which one of the following reflects an intrinsic or true value for factors or products?
- A. Price inflation
 - B. Economy pricing
 - C. Penetration pricing
 - D. Shadow price

Ans. B

Sol. Economic pricing reflects an intrinsic or true value for factors or products.

In Economy pricing margins are very low; overheads like marketing and advertising costs are much reduced. It targets the mass market and high market share.

For Example: Friendly low-cost wash detergents such as "Nirma".

88. Which one of the following control policies leaves no freedom to private enterprise to buy plant, machinery, raw materials from the country of its choice?

- A. Import control B. Export control
C. Exchange control D. Physical control

Ans. A

Sol. Import control is defined as to control the volume goods coming into a country

The main import restrictions are:

- (1) Import duties or taxes imposed on the imported goods to make them costlier
- (2) Import licenses/quotas that restrict the total amount of goods imported across the world or imported from a specific country (related to the question which gives no freedom to private enterprise to buy plant, machinery, raw materials from country of its choice.)
- (3) Prohibition that prevents entry of illegal or harmful items.

89. Which one of the following is a particular form of collusive price-fixing behaviour by which firms coordinate their bids on procurement or project contracts?

- A. Predatory pricing
B. Horizontal price-fixing (collusion)
C. Bid rigging
D. Exclusive territory

Ans. C

Sol. Bid rigging is an illegal practice in which firms coordinate their bids to choose the winner of a bidding process while others submit uncompetitive bids.

In bid rigging, the rigged prices are higher than competitive bidding process.

This practice is harmful to consumers and taxpayers who bear the cost of higher prices.

90. Which one of the following is an example of horizontal practice of firm?

- A. Refusal to deal
B. Retail price maintenance
C. Predatory pricing
D. Exclusive territory

Ans. C

Sol. Horizontal Practice of firm is a business strategy where one company takes over another company or removes its competitors that operates at the same level in an industry.

For e.g.: Predatory Pricing

Predatory Pricing is also called as undercutting and is an example of horizontal practice of firm.

It is a pricing strategy in which a product or service is set at a very low price with following objectives:

- To gain new customers through loss
- To remove competitors out of the market
- To create barriers for entry of potential new competitors

91. Ten years ago father was 12 times as old as his son and after 10 years father will be 2 times older than his son. The present ages of father and son respectively are

- A. 32 years and 14 years
B. 34 years and 14 years
C. 32 years and 12 years
D. 34 years and 12 years

Ans. D

Sol. Let,

present age of father = x and son = y

According to question

$$x - 10 = 12(y - 10)$$

$$\Rightarrow x - 12y = -110 \dots(1)$$

$$x + 10 = 2(y + 10)$$

$$x - 2y = 10 \dots(2)$$

Solving (1) and (2)

$$x = 34$$

$$y = 12$$

- 92.** A number of friends decided to go on a picnic and planned to spend Rs 96 on eatables. Four of them, however, did not turn up. As a consequence, the remaining ones had to contribute Rs 4 each extra. The number of those friends who attended the picnic is
- A. 8 B. 12
C. 16 D. 20

Ans. A

Sol. Let n friends decided to attend the picnic. So according to the question

$$n \times \left(\frac{96}{n}\right) = (n - 4) \times \left(\frac{96}{n} + 4\right)$$

$$\Rightarrow 96 = 96 + 4n - \frac{384}{n} - 16$$

$$\Rightarrow n^2 - 4n - 96 = 0$$

$$\Rightarrow n = 12$$

So, the number of students who attended picnic

$$= 12 - 4 = 8$$

- 93.** Consider the following gold articles P, Q, R, S and T with different weights:
- P weighs twice as much as Q
 - Q weighs four and a half times as much as R
 - R weighs half as much as S
 - S weighs half as much as T

- T weighs less than P but more than R

Article T will be lighter in weight than

- A. P and S B. P and R
C. P and Q D. Q and R

Ans. C

Sol. $P = 2Q \dots(1)$

$$Q = 4\frac{1}{2}R$$

$$Q = \frac{9}{2}R \dots(2)$$

$$R = \frac{S}{2} \dots(3)$$

$$S = \frac{T}{2} \dots(4)$$

$$R < T < P$$

Option A. P and S is incorrect because $S = T/2$

(From eqn. (4)] $T = 2S$

Option B. P and R is incorrect.

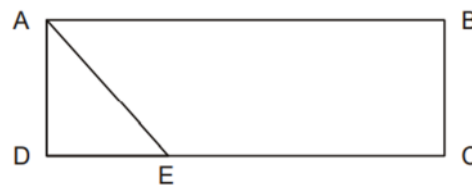
$R < T$ from eqn. (5)

Option D. Q and R also incorrect because $T > R$ [from eqn. (5)]

So, option C. P and Q is right choice.

- 94.** Consider the rectangle ABCD with $DE = \frac{1}{3}DC$

in the figure



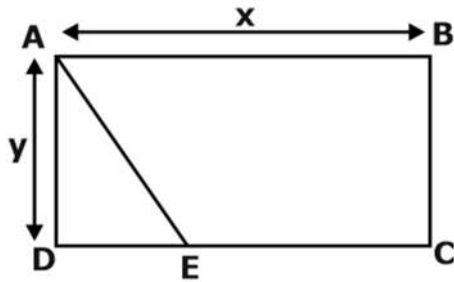
When the area of the triangle ADE is 20 cm^2 , the area of the rectangle ABCD will be

- A. 60 cm^2 B. 80 cm^2
C. 100 cm^2 D. 120 cm^2

Ans. D

Sol. Let $AB = x$ and $AD = y$

So, $DE = \frac{x}{3}$



Area of triangle $ADE = \frac{1}{2} \times \frac{x}{3} \times y = \left(\frac{xy}{6}\right)$

$\frac{xy}{6} = 20$

$xy = 120 \dots(1)$

Which is area of rectangle ABCD.

- 95.** Four metal rods of lengths 78 cm, 104 cm, 117 cm and 169 cm are to be cut into parts of equal length. Each part must be as long as possible. The maximum number of pieces that can be cut will be
- A. 27 B. 36
C. 43 D. 52

Ans. B

Sol. H.C.F. (78, 104, 117, 169) = 13

The maximum number of pieces of equal length (13 cm)

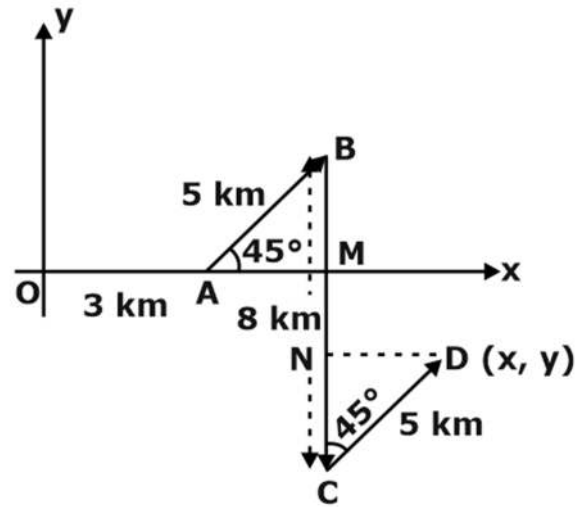
$$= \frac{78}{13} + \frac{104}{13} + \frac{117}{13} + \frac{169}{13}$$

$$= 6 + 8 + 9 + 13 = 36$$

- 96.** A man walked 3 km towards East, then 5 km towards North-East, then 8 km towards South and finally 5 km towards North-East direction. The distance of his present location from the starting point will be
- A. 9 km B. 11 km
C. 15 km D. 21 km

Ans. B

Sol.



In triangle AMB

$\frac{AM}{5} = \cos 45^\circ \Rightarrow AM = \frac{5}{\sqrt{2}}$

$\frac{BM}{5} = \sin 45^\circ \Rightarrow BM = \frac{5}{\sqrt{2}}$

In triangle CND

$\frac{ND}{5} = \cos 45^\circ \Rightarrow ND = \frac{5}{\sqrt{2}}$

$\frac{NC}{5} = \sin 45^\circ \Rightarrow NC = \frac{5}{\sqrt{2}}$

Now, coordinates of final point D .

$x = 3 + AM + ND$

$= 3 + \frac{5}{\sqrt{2}} + \frac{5}{\sqrt{2}}$

$= 3 + 5\sqrt{2}$

$y = -(MN) = -\left(8 - \frac{5}{\sqrt{2}} - \frac{5}{\sqrt{2}}\right)$

$= -8 + 5\sqrt{2}$

Distance $OD = \sqrt{(3 + 5\sqrt{2})^2 + (-8 + 5\sqrt{2})^2}$

$= 10.11$ (Accurate Value)

≈ 11 [Approx. value]

- 97.** A clock strikes once at 1 o'clock, twice at 2 o'clock, thrice at 3 o'clock and so on. The number of times it strikes in 24 hours will be
- A. 116 B. 136
C. 156 D. 196

Ans. C

Sol. The number of times it strikes in 24 hrs.
 $= (1 + 2 + 3 \dots 12) + (1 + 2 + 3 \dots 12)$
 $= 2(1 + 2 + 3 \dots 12)$
 $= 2 \times \left(\frac{1+12}{2} \times 12 \right)$
 $= 12 \times 13$
 $= 156$

- 98.** The sum of all the natural numbers between 1 and 101 which are divisible by 5 is
- A. 1000 B. 1050
C. 1500 D. 2550

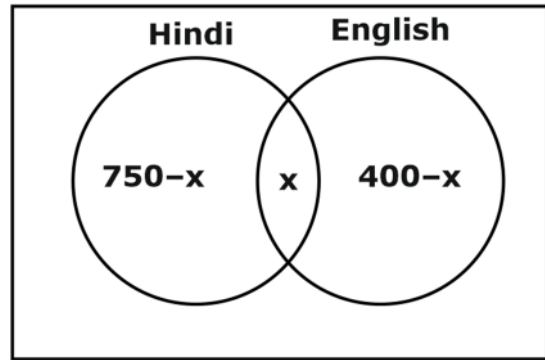
Ans. B

Sol. Sum = $(5 + 10 + 15 + \dots 100)$
 $= 5[1 + 2 + 3 \dots 20]$
 $= 5 \left[\frac{(1+20)}{2} \times 20 \right]$
 $= 5 \times 21 \times 10$
 $= 1050$

- 99.** In a group of 1000 people, 750 speak Hindi and 400 speak English. The number of only Hindi speaking people is
- A. 150 B. 350
C. 600 D. 750

Ans. C

Sol. Use Venn Diagram. Let x people use both Hindi and English.



$$750 - x + x + 400 - x = 1000$$

$$x = 150$$

So, the number of people speaking only Hindi
 $= 750 - x$
 $= 600$

- 100.** Consider the following students in an examination:

- A scored more than B
- C scored as much as D
- E scored more than F
- B scored more than C
- F scored more than D

Who scored the lowest?

- A. E B. C
C. D D. F

Ans. A

- Sol.** $E > B \dots(1)$
 $C = D \dots(2)$
 $E < F \dots(3)$
 $B > C \dots(4)$
 $F > D \dots(5)$

From equation (ii) $C = D$ so option B. and C. cannot be right choice and among E and F, E scored less than F. Hence E scored minimum.

Benefits of Online Classroom Program

1. GATE Learning Tablet

- › Access high-quality classes at your convenience, anywhere and anytime with the tablet

2. Live Classroom Sessions

- › Get Access to Live Classes By India's Leading GATE Faculty

3. Previous Year Question Books

- › 20+ Years PYQs with Solutions

4. Workbooks

- › Access to 3000+ Practice Questions with solutions

5. Regular Quizzes

- › Sample Quizzes for daily practice and regular tests along with live class

6. Doubt Resolution

- › Complete Doubt Resolution within 24 hours by Subject Experts

Additional Offerings

- › **Test Series** - Mock Tests based on GATE Exam pattern
- › **Preparation Guidance** - Get a competitive advantage from our Experts
- › **Subject wise formula Notes** - Comprehensive short notes for Revision
- › **Report Card** - Regular performance analysis along with Live Class