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# ESE - 2020

## PRELIMINARY EXAMINATION

Questions with Detailed Solutions

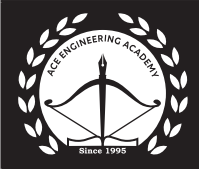
### GENERAL STUDIES & ENGINEERING APTITUDE (SET-A)

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# ESE - 2020 Preliminary Examination

## General Studies & Engineering Aptitude

SET - A  
05/01/20

01. What is TADF?
- Technology Acquired Desired Firm
  - Technologically Advanced Direct Fund
  - Technologically Accomplished Direct Fund
  - Technology Acquisition and Development Fund

**01. Ans: (d)**

**Sol:** Government of India has notified the Scheme for Technology Acquisition and Development Fund (TADF) to provide funding support to MSMEs for the acquisition and development of clean and green technology. The Scheme is applicable to all existing and new Micro, Small and Medium Enterprises (MSMEs) including those in the National Investment and Manufacturing Zones (NIMZs).

02. Technical textiles are
- The high-tenacity fibres which are lightest and toughest fabrics mainly used in automobiles and aerospace industries.
  - The toughest fabrics which are much heavier than polyester and used in power industries
  - The toughest fabrics having rigidity mainly used in polyhouse construction
  - The high-tenacity fabrics having fire resistance property

**02. Ans: (a)**

**Sol:** Technical textiles is an umbrella term covering textiles and textile products that are produced keeping a specific functionality in mind. It is a new and diverse sector which is currently growing at a much faster rate than the conventional apparel and home textiles sectors. Technical textiles today include textiles for automotive applications (car interiors, upholstery), medical textiles (e.g., implants, wound dressings), geo-textiles (reinforcement of embankments), agro-textiles (textiles for crop protection) and protective clothing (e.g., heat and radiation protection for fire fighter

clothing, molten metal protection for welders, stab protection and bullet-proof vests, and spacesuits),

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

- Natural capital stock
- Environmental value
- Green Accounting
- Social Discount Rate

**03. Ans: (c)**

**Sol:**

- Natural capital** can be defined as the world's stocks of natural assets which include geology, soil, air, water and all living things. The required condition for sustainable development is that natural stock should be conserved and improved. It means that natural capital stock should remain constant.
- Environmental value** is the worth that a community or society places on environmental goods or services such as aesthetic and recreational facilities and resources. It concerns comparing the benefits of environmental protection with the costs incurred on it.
- The condition of sustainable development is **green accounting**. It allows the computation of income for a nation by taking into account the economic damage and depletion in natural resource base of a country. It is a measure of sustainable income level that can be secured without decreasing the stock of natural assets.
- It is believed that environmental degradation leads to costs. It also improves benefits on resource users. But the problem is how to measure costs and benefits of environmental effects on the present and the future generation. For this purpose a rate of discount is needed for discounting all costs and benefits. It is termed as **Social discount rate**.



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04. 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

**04. Ans: (b)**

**Sol: Chenery's Development model** - The transformation of an underdeveloped to a developed economy can be defined "*by the set of structural changes required to sustain a continuing increase in income and social welfare*".

According to the study, three types of development pattern are observed:

- Accumulation (investment, government revenue, education);
- Resource Allocation (domestic demand, production, exports, imports);
- Population and Labor Force (population growth, urbanization, labor allocation).

Chenery's model requires an altering of the existing structures within an underdeveloped economy to pave way for the penetration of new industries and modern structures to attain the status of an industrial nation.

**Hence, the resource allocation development pattern (domestic demand) holds good.**

05. 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

**05. Ans: (b)**

**Sol:**

- **Capital-output ratio** is the amount of capital required to produce output worth Re. 1. If Y stands for output or income and K for the stock of capital used to produce that output, then  $K/Y$  represents capital-output ratio.

- **Average capital-output ratio** describes the ratio of total capital to total output or income of the economy.
- **Marginal capital-output ratio** is ratio of increment in the stock of capital to the increment in output.
- **Incremental Capital-Output Ratio (ICOR)** indicates additional unit of capital or investment needed to produce an additional unit of output. Thus, ICOR and Marginal ratio are same.

06. Which one of the following methods of planning is an attempt to work out the implications of the development effort in terms of factor allocations and product yields so as to maximize income and employment?

- (a) Perspective planning      (b) Physical planning
- (c) Financial planning        (d) Indicative planning

**06. Ans: (b)**

**Sol:**

- **Perspective planning** is a long run planning where targets are fixed for long period say 15 to 25 years. But a perspective plan cannot mean one plan for the complete period. In a true sense, broader objectives are to be achieved in a fixed period by dividing the perspective plan into short-run plans of 4 to 6 years.
- **Physical planning** is that where targets or objectives are fixed in terms of real physical resources. Plans are also formulated on the basis of real resources of the economy, i.e., the availability of natural, human, raw materials and capital resources. On the basis of these resources, the output targets are fixed. To quote second Five Year Plan, Physical planning, is 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.
- **Financial planning** is followed as a mean to achieve physical targets only. But the target under it, should be properly balanced. Financial planning helps in removing disequilibrium between demand and supply to avoid inflation and to bring about economic stability. Finance is the basic key to

economic planning. Without financial resources, physical targets cannot be achieved. All objectives are fixed in terms of finance i.e, how much national income, savings and investments are to be increased.

- **Indicative planning** is a form of economic planning implemented by a state in an effort to solve the problem of imperfect information in market and mixed economies in order to increase economic performance.

07. 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

**07. Ans: (d)**

**Sol:**

- **Shadow Price** - Shadow prices reflect true values for factors and products for the calculation or estimations of prices in social cost-benefit analysis.  
 J. Tinbergen defines, “**Shadow prices are prices indicating the intrinsic or true value of a factor or product.**”
- **Price Inflation** - Price inflation is an increase in the price of a standardized good/service or a basket of goods/services over a specific period of time (usually one year).
- The four key pricing strategies are:
  - Premium pricing** - Use a high price where there is a uniqueness about the product or service. This approach is used where a substantial competitive advantage exists Eg: high prices charged for luxuries such as Cruises, luxury hotel rooms
  - Penetration pricing** - The price charged for products and services is set artificially low in order to gain market share. Once this is achieved, the price is increased.
  - Economy pricing** - This is a no frills low price. The cost of marketing and manufacturing are kept at a minimum. Eg: Supermarkets often have economy brands for daily grocery items.
  - Price skimming** - Charge a high price because you have a substantial competitive advantage. The high price tends to attract new competitors into

the market, and the price inevitably falls due to increased supply. Eg: mobile phones, electronic items.

08. Which one of the following control policies leaves no freedom machinery, raw materials from the country of its choice?

- (a) Import control                      (b) Export control  
 (c) Exchange control                (d) Physical control

**08. Ans: (c)**

**Sol:**

- **Import control** - an action taken by a government to limit the number of goods that can be brought into a country from abroad to sell
  - **Export control** regulations are federal laws that prohibit the unlicensed export of certain commodities or information for reasons of national security or protections of trade.
  - **Foreign Exchange Control** is a method of state intervention in the imports and exports of the country, so that the adverse balance of payments may be corrected”. Here the government restricts the free play of inflow and outflow of capital.
09. 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
- 09. Ans: (c)**
- Sol: Collusion** occurs when entities or individuals work together to influence a market or pricing for their own advantage.
- **Predatory pricing**, also known as undercutting, is a pricing strategy in which a product or service is set at a very low price with the intention to achieve new customers (Loss leader), or driving competitors out of the market or to create barriers to entry for potential new competitors.

- **Horizontal Price Fixing** occurs when companies decide to fix prices or price levels for a good or service at a premium or a discount.
  - **Bid rigging** is a particular form of collusive price-fixing behaviour by which firms coordinate their bids on procurement or project contracts. There are two common forms of bid rigging. In the first, firms agree to submit common bids, thus eliminating price competition. In the second, firms agree on which firm will be the lowest bidder and rotate in such a way that each firm wins an agreed upon number or value of contracts.
  - **Exclusive territory** refers to a territory or area where only the franchisee who has been granted the territory may operate, usually specified by the Master Franchisor. No other Franchisees, including the Franchisor, is allowed to operate within this territory.
10. 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
- 10. Ans: (c)**  
**Sol:** **Horizontal practice** of firm in price-fixing occurs when two or more competitors conspire to set prices, price levels, or price-related terms for their goods or services.
- **Refusal to deal** or a concerted refusal to deal is an agreement between competing companies, or between a company and an individual or business, that stipulates that they refuse to do business with another.
  - **Retail price maintenance** is the practice whereby a manufacturer and its distributors agree that the distributors will sell the manufacturer's product at certain prices
  - **Predatory pricing** also known as undercutting, is a pricing strategy in which a product or service is set at a very low price with the intention to achieve new customers (Loss leader), or driving competitors out of the market or to create barriers to entry for potential new competitors.
- **Exclusive territory** refers to a territory or area where only the franchisee who has been granted the territory may operate, usually specified by the Master Franchisor. No other Franchisees, including the Franchisor, is allowed to operate within this territory.
11. 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
- 11. Ans: (d)**  
**Sol:** Present father = x  
 Son = y  
 10 year ago,  $x - 10 = 12(y - 10)$   
 $x - 12y = -110$   
 10 years hence  $x + 10 = 2(y + 10)$   
 $x - 2y = 10$   
 Simplify the equation  $(y) = 12$   
 then  $(x) = 34$   
 Father = 34 year ; son = 12 year
12. 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
- 12. Ans: (a)**  
**Sol:** No of persons attended = x  
 Each price = y  
 $xy = 96 \rightarrow (1)$   
 Person decreased by (4)  
 Money increased by 4  
 After simplify  
 $xy - 4y - 16 + 4x = xy$  [from (1)]

$$4(x - y) = 16$$

$$xy \xrightarrow{x} 96$$

$$\begin{array}{l} 12 \quad 8 \text{ (Satisfied)} \\ x = 12 \\ y = 8 \end{array}$$

13. 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 four and a half times 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

**13. Ans: (c)**

**Sol:**  $P = 2Q$

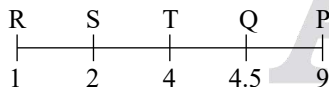
$$Q = 4\frac{1}{2}R = \frac{9}{2}R \Rightarrow Q = 4.5R$$

$$R = \frac{1}{2}S \Rightarrow S = 2R$$

$$S = \frac{1}{2}T \Rightarrow T = 2S$$

$$P > T > R$$

Assume  $R = 1 \text{ kg}$



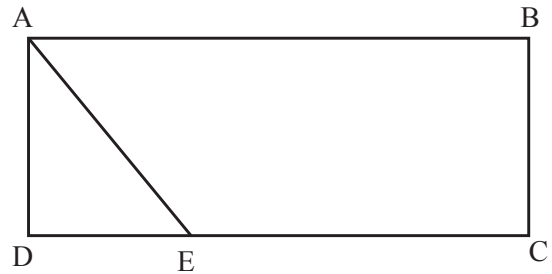
$$S = 2, R = 1$$

$$T = 2, S = 4$$

$$Q = 4.5R = 4.5$$

$$P = 2Q = 9$$

14. Consider the rectangle ABCD with  $DE = \frac{1}{3} DC$  in the figure:

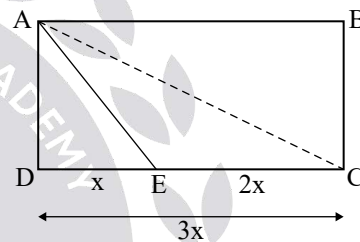


When the area of the triangle ADE is  $20 \text{ cm}^2$ , the area of the rectangle ABCD will be

- (a)  $60 \text{ cm}^2$                       (b)  $80 \text{ cm}^2$   
(c)  $100 \text{ cm}^2$                       (d)  $120 \text{ cm}^2$

**14. Ans: (d)**

**Sol:**



$$\text{Triangle area} = \frac{1}{2} \text{ base} \times \text{height}$$

$$20 = \frac{1}{2} \left[ \frac{1}{3} DC \right] [A.D]$$

$$(\because DE = \frac{1}{3} DC \text{ given})$$

$$\begin{aligned} \text{Rectangular area} &= lb \\ &= DC \times AD \\ &= 120 \end{aligned}$$

15. 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

**15. Ans: (b)**

**Sol:** H.C.F 78, 104, 117, 169 is 13

$$\begin{aligned} \text{no. of pieces} &= \frac{78}{13} + \frac{104}{13} + \frac{117}{13} + \frac{169}{13} \\ &= 6 + 8 + 9 + 13 \\ &= 36 \end{aligned}$$



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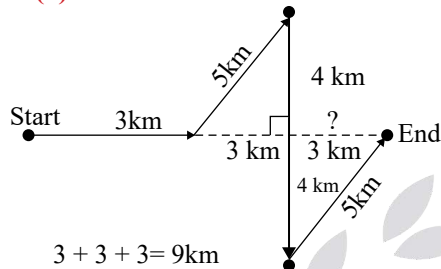
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16. A man walked 3 km towards East, then 5 km towards North-East, then 8 km towards North-East direction. The distance of his present location from the starting point will be  
 (a) 9 km (b) 11 km  
 (c) 15 km (d) 21 km

**16. Ans: (a)**

**Sol:**



17. 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

**17. Ans: (c)**

**Sol:** 1' o clock = 1 time

2' o clock = 2 times

2 (1 + 2 + ..... + 12) (in -24 hrs)

$$= \frac{2(12(12+1))}{2} \quad (\text{Sum of given})$$

$$= 156 \text{ times}$$

18. 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

**18. Ans: (b)**

**Sol:** The natural numbers that are divisible by 5 are 5, 10, .... 100

Required answer = 5 + 10 + 15 + .... 100

The above terms are AP

$$5 + 10 + 15 + ..... + 100 = \frac{n}{2}[a + l]$$

Where n = number of terms

a = first term

l = last term

$$S_{20} = \frac{20}{2}[5 + 100] = 1050$$

19. 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

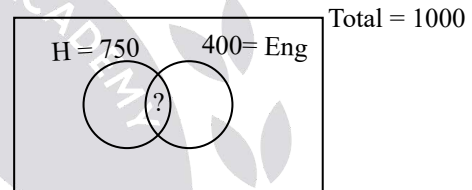
**19. Ans: (c)**

**Sol:** n (Hindi) = 750

n (English) = 400

n (Hindi ∪ English) = 1000

n (Hindi ∩ English) = n (Hindi) + n (English) - n(Hindi ∩ English)



1000 = 750 + 400 - n(Hindi ∩ English)

∴ n(Hindi ∩ English) = 150

Number of only Hindi speaking people = 750 - 150 = 600

20. Consider the following students in an examination:

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

Who scored the lowest?

- (a) E (b) C  
 (c) D (d) F

**20. Ans: (a)**

**Sol:** A > B, C = D, E < F, B > C, F < D

(1) (3) (5) (2) (4)

A > B > C = D > F > E

So, 'E' got lowest score.



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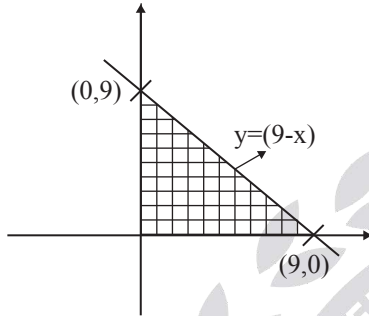


21. Find the absolute maximum and minimum values of  $f(x, y) = 2 + 2x + 2y - x^2 - y^2$  on triangular plate in the first quadrant, bounded by the lines  $x = 0, y = 0$  and  $y = 9 - x$ .

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

**21. Ans: (c)**

**Sol:**



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

$$\frac{\partial f}{\partial x} = 0 \Rightarrow (2 - 2x) = 0$$

$$x = 1$$

$$\frac{\partial f}{\partial y} = 0 \Rightarrow (2 - 2y) = 0$$

$$y = 1$$

∴ Stationary point is  $(x, y) = (1, 1)$

$$r = \frac{\partial^2 f}{\partial x^2} = -2, \quad S = \frac{\partial^2 f}{\partial x \partial y} = 0, \quad t = \frac{\partial^2 f}{\partial y^2} = -2$$

∴ At  $(1, 1) : (rt - s^2) = 4 > 0$

$$r = -2 < 0$$

∴ We set maximum value of  $f(x, y)$  at  $(1, 1)$

$$\text{i.e } f(1, 1) = 4$$

Here the boundary points are  $(0,0), (9,0), (0,9)$

∴ Absolute maximum

$$= \text{Maximum of } \{f(0,0), f(9, 0), f(0, 9), f(1, 1)\}$$

$$= f(1,1) = 4$$

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)  $A^2 + 2A + 6I$

**22. Ans: (b)**

**Sol: Given**  $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$

⇒ The characteristic equation of A is

$$\lambda^2 - (1+3)\lambda + (3 - 8) = 0$$

$$\Rightarrow A^2 - 4A - 5I = 0 \rightarrow (1)$$

$$\text{Now } A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$$

$$= A^3 (A^2 - 4A - 5I) - 2A^3 + 11A^2 - A - 10I$$

$$= (A^3)(0) - 2(4A^2 + 5A) + 11A^2 - A - 10I$$

$$= -8A^2 - 10A + 11A^2 - A - 10I$$

$$= 3(A^2) - 11A - 10I$$

$$= 3(4A + 5I) - 11A - 10I$$

$$= 12A + 15I - 11A - 10I$$

$$= A + 5I$$

∴ Option (b) is correct

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)  $x = \frac{1}{2} \tan^{-1} y + 1 + ce^{-\tan^{-1} y}$

**23. Ans: (b)**

**Sol:** The solution of the D.Eq

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

$$\tan^{-1} y = t$$

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

$$\frac{1}{1 + y^2} dy = dt$$

$$dx = (t-x) dt$$

$$\frac{dx}{dt} = t - x \quad \frac{dx}{dt} + x = t$$

$$\text{IF} = e^{\int 1 dt} = e^t$$

$$x \cdot e^t = \int t \cdot e^t dt + c$$

$$x \cdot e^t = e^t (t - 1) + c$$

$$x = (t - 1) + ce^{-t}$$

$$x = \tan^{-1} y - 1 + ce^{-\tan^{-1} y}$$



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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!)

**24. Ans: (a)**

**Sol:**  $(1 - ax) (1 - bx^2) (1 - cx^3) (1 - dx^4)$   
 $= abcd x^{10} + () x^9 + () x^8 + \dots\dots\dots + 1$   
 $\therefore \Delta^{10} [(1 - ax) (1 - bx^2) (1 - cx^3) (1 - dx^4)]$   
 $= abcd \Delta^{10} (x^{10}) \quad (\because \Delta^{10} (x^n) = 0 \text{ for } n < 10)$   
 $= abcd (10!) \quad (\because \Delta^n (x^n) = n!)$   
 $\therefore$  Option (a) is correct.

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

**25. Ans: (d)**

**Sol:**  $u = \log \left( \frac{x^4 + y^4}{x + y} \right)$   
 $\Rightarrow f(u) = e^u = \frac{x^4 + y^4}{x + y}$   
 Here  $f(u)$  is a homogenous function with degree  
 $n = 4 - 1 = 3$   
 Now,  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = n \frac{f(u)}{f'(u)}$   
 $\Rightarrow x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 3 \frac{e^u}{e^u}$   
 $\therefore x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 3$   
 Hence option (d) is correct

26. The general value of  $\log (1 + i) + \log (1 - i)$  is  
 (a)  $\log 2 - 4 n \pi i$                       (b)  $\log 2 + 4 n \pi i$   
 (c)  $\log 2 + 2n \pi i$                       (d)  $\log 2 - 2n \pi i$

**26. Ans: (b)**

**Sol:** Let  $x + iy = 1 + i$   
 Then  
 $r = \sqrt{x^2 + y^2} = \sqrt{2} = \theta = \tan^{-1} \left( \frac{y}{x} \right) = \tan^{-1} = \frac{\pi}{4}$   
 Let  $x + iy = 1 - i$

Then  $r = \sqrt{x^2 + y^2} = \sqrt{2}$   
 $\& \theta = \tan^{-1} \left( \frac{y}{x} \right) = \tan^{-1} \left( \frac{-1}{1} \right) = -\frac{\pi}{4}$   
 Now,  $\log (1 + i) + \log (1 - i) = \log (re^{i\theta}) + \log (re^{i\theta})$   
 $= \log (\sqrt{2} e^{i\pi/4}) + \log (\sqrt{2} e^{-i\pi/4})$

The general value of  $\log (1 + i) + \log (1 - i)$  is  
 $[2n\pi i + \log \sqrt{2} \cdot e^{i\pi/4}] + [2r\pi i + \log (\sqrt{2} \cdot e^{-i\pi/4})]$   
 $= [4n\pi i] + \left[ \log \sqrt{2} + i \frac{\pi}{4} \log e \right] + \left[ \log \sqrt{2} - \frac{i\pi}{4} \log e \right]$   
 $= 4n\pi i + 2 \log \sqrt{2}$   
 $= 4n\pi i + \log 2$

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)  $\frac{1}{3}$                       (b)  $\frac{1}{4}$   
 (c)  $\frac{5}{12}$                       (d)  $\frac{7}{12}$

**27. Ans: (d)**

**Sol:** By total theorem of probability

$$P(W) = \frac{1}{2} \times \frac{4}{6} + \frac{1}{2} \times \frac{3}{6} = \frac{7}{12}$$

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

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

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

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

The value of k will be

- (a)  $\frac{2}{3}$                       (b)  $\frac{1}{8}$   
 (c) 1                        (d) 8

**28. Ans: (b)**

**Sol:**  $\int_0^6 f(x)dx = 1$

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

$$k [2 - 0] + 2k [4 - 2] + 6k[6 - 4] - \frac{k}{2}[36 - 16] = 1$$

$$2k + 4k + 12k - 10k = 1$$

$$8k = 1$$

$$k = \frac{1}{8}$$

29. The first moment about origin of binomial distribution is

- (a) np                      (b) npq  
(c) n[1-p]                (d) n(1-p)q

**29. Ans: (a)**

**Sol:** The first moment about origin of binomial distribution = mean = np

(or)

$$\mu'_r = E(x-0)^r$$

$$\mu'_1 = E(x) = np$$

30. For the regression equation  $y = 0.516x + 33.73$

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

the mean 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

**30. Ans: (a)**

**Sol:**  $y = 0.516x + 33.73$

$$x = 0.512y + 32.52$$

Satisfy the above equations

Means of x and y

$$\bar{x} - 0.512\bar{y} = 32.52$$

$$-0.516\bar{x} + \bar{y} = 33.73$$

Solving  $\bar{x} = 67.6$

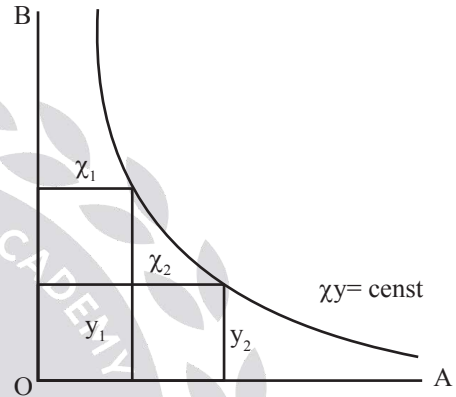
$$\bar{y} = 68.6$$

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

**31. Ans: (a)**

**Sol:**



For rectangular hyperbola

$$xy = \text{constant}$$

$x \rightarrow$  is the distance from one asymptotes (OB)

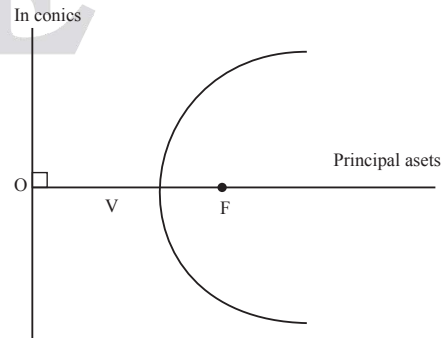
$y \rightarrow$  is the distance from another asymptotes (OA)

32. The line passing through the focus and perpendicular to the directrix is called

- (a) axis    (b) vertex  
(c) eccentricity                                      (d) conic

**32. Ans: (a)**

**Sol:**





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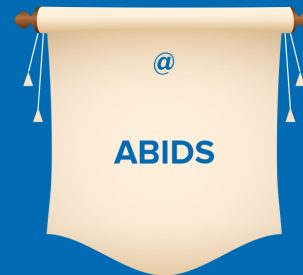
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33. Dimensions in a series may be placed in any one of the following ways, except

- (a) progressive dimensioning
- (b) proportional dimensioning
- (c) continuous dimensioning
- (d) chain dimensioning

**33. Ans: (b)**

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

**34. Ans: (b)**

**Sol:** Among the effects of design specifications on costs, tolerances are perhaps most significant. Tolerances, manufacturing processes, and surface finish are interrelated and influence the producibility of the end product in many ways. Close tolerances may necessitate additional steps in processing and inspection or even render a part completely impractical to produce economically. Tolerances cover dimensional variation and surface-roughness range and also the variation in mechanical properties resulting from heat treatment and other processing operations.

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

**35. Ans: (d)**

**Sol:** To prevent product liability all of the following approaches are recommended

- (i) Analysis and design
- (ii) Quality control
- (iii) Comprehensive testing

Cost is not the approach to prevent product liability.

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

**36. Ans: (d)**

**Sol:** Propagation of dispersion. It talks about FMEA

- Failure Mode and Effects Analysis, where the probability of failure (Risk Priority Number) is dependent on:
- Severity (Propagation of severity)
- Probability (Propagation of uncertainty)
- Defection (Propagation of error).

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

**37. Ans: (a)**

**Sol:** Speed and Ease of operation it helps in preventing the accident or if prevention fails, then it reduces the seriousness of damage.

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

**38. Ans: (a)**

**Sol:** Human engineering deals with the application of physiological and psychological principles between Human Machines Interface.

So, the focus should be on how the worker reacts.



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

**39. Ans: (a)**

**Sol:** Faulty design or construction of machine tool is not an operator error but it leads to accident and mistake.

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

**40. Ans: (c)**

**Sol:** Safety program generally does not talk anything about after effects of accident (compensation and medical payment).

It always focuses on prevention of accidents and how to develop safe working procedures and environment.

41. Which of the following departments ensure the quality of the product?
- Product design and development
  - Marketing and product planning
  - Packaging and shipping
  - Sales
- (a) 1, 2 and 3                      (b) 1, 2 and 4  
 (c) 1, 3 and 4                      (d) 2, 3 and 4

**41. Ans: (a)**

**Sol:** Except sales all of the following ensure quality of the product

- Product design and development
- Marketing and product planning
- Packaging and shipping

42. Which of the following are the general subareas of quality control?

- Off-line quality control
- Sales/market share
- Statistical process control
- Acceptance sampling plans

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

**42. Ans: (b)**

**Sol:** Sales/market share is not sub area of quality control.

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

- Ad hoc committee for the zero defects program
- Cost of quality evaluation
- Quantity measurements
- Supervisor training

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

**43. Ans: ()**

**Sol:** Quantity measurement is not part of crosby's 14 step plan for quality improvement.

(Pg NO: 19, 20 in booklet)

44. An Average Outgoing Quality (AOQ) is

- $\frac{P_a p(N)}{N - n}$
- $\frac{P_a p(N + n)}{N}$
- $\frac{P_a p(N - n)}{N}$
- $\frac{P_a p(N - n)}{N}$

where

$P_a$  = Probability of accepting the lot

$p$  = Incoming lot quality

$N$  = Lot size

$n$  = Sample size

**44. Ans: (d)**

**Sol:**  $AOQ = \frac{P_a P(N - n)}{N}$



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45. 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.

**45. Ans: (a)**

**Sol:** Number of complementary responses based on human traits in delivery of service.

46. 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

**46. Ans: (d)**

**Sol:** 1. Site construction methods  
2. Supervision & Control

Both the above factors affect quality of conformance

47. 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

**47. Ans: (b)**

**Sol:** Because splicing of reinforcement is not provided at joints in prestressed steels in prestressed concrete works.

48. The standard deviation  $\sigma$  for sampling in the case of concrete for construction engineering and management is

- (a)  $\sqrt{\frac{\sum (X + X)^2}{N + 1}}$
- (b)  $\sqrt{\frac{\sum (X - X)^2}{N + 1}}$
- (c)  $\sqrt{\frac{\sum (X + X)^2}{N - 1}}$
- (d)  $\sqrt{\frac{\sum (X - X)^2}{N - 1}}$

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 of series of compressive strength values

**48. Ans: (d)**

**Sol:**  $\sigma = \sqrt{\frac{\sum (X - \bar{X})^2}{n - 1}}$

49. 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

**49. Ans: (a)**

**Sol:** In a piece part production all of the following variations are possible

1. Pie to piece variation
2. Time to time variation
3. Process to process variation.

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

**50. Ans: (b)**

**Sol:**

- One of the objective of attribute charts is to evaluate quality performance of operating and management personnel
- Determining acceptance criteria of a product before production is more relevant to variable control chart

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

**51. Ans: (d)**

**Sol:** Tundra region is also known as cold desert, where extreme conditions exist and it also has a characteristic feature of catastrophes.

52. Which one of the following is an iteratived and evolutionary process for achieving sustainable development ?
- flood Control Management (FCM)
  - Solid Waste Management (SWM)
  - Integrated Coastal Zone Management (ICZM)
  - Natural Ecosystem Zone (NEZ)

**52. Ans: (b)**

**Sol:**

- Any waste management rules in India are based on the principles of sustainable development.
- Integrated coastal management is a sustainable initiative but it is only to the coastal areas.

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

- Soil conservation in catchments of river valley projects and flood-prone rivers
  - Soil and land use surveys
  - Control of shifting cultivation
  - Deforestation
- (a) 1, 2 and 4      (b) 1, 3 and 4  
(c) 2, 3 and 4      (d) 1, 2 and 3

**53. Ans: (d)**

**Sol:** Practices for river basin water resources management are:

- (1) Survey investigation & preparation of master plan
- (2) Anti-erosion work from flood
- (3) Construction of raised platform
- (4) Increases in grass & plant cover
- (5) controlling shifting cultivation practices.

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

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

where

- $d_p$  = Particle diameter
- $\rho_p$  = Density of particle
- $\rho_a$  = Density of air
- $\mu_a$  = Velocity of air
- $P$  = Air pressure
- $C$  = Constant



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**54. Ans: ()**

**Sol:**

• **Dry Deposition**

Particular matter smaller than  $0.1 \mu\text{m}$  often coagulates through mutual collisions and forms larger aggregates which are effectively removed by gravitational settling. Brownian motion is the major mechanism of coagulation, although atmospheric turbulence is particularly effective for coagulating larger particles whose Brownian motion is less pronounced. The rate of settling of the particles depends on their settling velocities according to the Stoke's law:

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

where  $v_t$  = terminal settling velocity

$d_p$  = particle diameter

$\rho_p$  and  $\rho_a$  = density of particle and air, respectively

$\mu_a$  = viscosity of air

$p$  = air pressure

and  $C$  = constant [when  $p$  is given in millibars and  $d_p$  in centimeters]

55. 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)  $20 \frac{Q}{Q_0} + \log_{10} \frac{Q}{Q_0}$  (bels)

Where

$Q$  = Measured quantity of sound pressure or sound intensity

$Q_0$  = Reference standard quantity of sound pressure

**55. Ans: (c)**

**Sol:** Sound level =  $10 \log_{10} \frac{Q}{Q_0}$  in decibels

But the units given are in bels

Hence answer should be  $L = \log_{10} \frac{Q}{Q_0}$  (bels)

56. Which 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

**56. Ans: (b)**

**Sol:** Incineration it is the main waste to energy form of treatment it has following advantage.

- (1) Solid waste can be reduced upto 90% depending upon waste composition and the adopted technology
- (2) Environmental friendly
- (3) Hazardous substances can be tackle effectively.

57. NEPA stands for

- (a) National Ecological Physical Area  
(b) Natural Environmental Policy Act  
(c) National Environmental Policy Act  
(d) Natural Ecological Primary Area

**57. Ans: (c)**

58. Which one at 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

**58. Ans: (c)**

**Sol:**

- Ozone at low conc causes chest pain, coughing, shortness of breath and throat irritation.
- In severe case it causes chronic respiratory diseases such as Asthma.

59. 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

**59. Ans: (b)**

**Sol:** Basel convention is an international convention which provide guidelines. For prohibiting Trans boundary movement of hazardous waste between different countries.

- It is implementing under UNEP.

60. Which of the following are the suggested ways of reducing NO<sub>x</sub> emissions from stationary sources?

1. By reducing the peak temperature
2. By increasing the availability of N<sub>2</sub> for reaction with O<sub>2</sub>
3. By minimizing the availability of O<sub>2</sub> for reaction with N<sub>2</sub>

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

**60. Ans: (b)**

**Sol:** Limiting No<sub>x</sub> emission from stationary sources.

- High Temperature oxidation of the molecular nitrogen in the air used for combustion. As the temperature increases NO<sub>x</sub> level increases (vice versa)
- Formation of Fuel No<sub>x</sub> depends upon the combustion conditions such as oxygen concentration and mixing patterns, on the nitrogen content of the fuel.

61. During an assessment of economic viability of the 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)

**61. Ans: (d)**

**Sol:**

- **A benefit-cost ratio (BCR)** is an indicator showing the relationship between the relative costs and benefits of a proposed project, expressed in monetary or qualitative terms.
- **Net present value (NPV)** is the difference between the present value of cash inflows and the present value of cash outflows over a period of time. NPV is used in capital budgeting and investment planning to analyze the profitability of a projected investment or project.
- **Payback Period (PBP)** refers to the amount of time it takes to recover the cost of an investment. Simply put, the payback period is the length of time an investment reaches a breakeven point. The desirability of an investment is directly related to its payback period.
- **Return on Investment (ROI)** is a ratio between net profit (over a period) and cost of investment (resulting from an investment of some resources at a point in time). A high ROI means the investment's gains compare favorably to its cost. As a performance measure, ROI is used to evaluate the efficiency of an investment or to compare the efficiencies of several different investments.

62. 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

**62. Ans: (b)**

**Sol:**

- Project expeditors : These individuals try to speed up work and are the communication link between senior managers and the project. Their purpose is

to achieve unity of communications . The role is limited to funneling information to executives and making suggestions and, thus, tends to be restricted to small projects with low risk and little at stake.

- **Project coordinators :** Their 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.
- **Matrix managers :** Their purpose is to achieve unity of direction . Although they serve the same purpose as the first two, they also have authority to plan, motivate, direct, and control project work. Matrix managers direct people located administratively in functional departments, and the resulting criss-cross pattern of vertical-functional and horizontal-project reporting relationships create what is called a matrix.
- **Project managers :** These managers direct pure project organizations of people who report directly to them. Their purpose is to achieve unity of command. 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.

63. 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

**63. Ans: (a)**

**Sol:** Attribute listing is a creative means of getting you to focus on as many attributes of a product or problem as possible. In breaking down the elements of a problem or object, you can look at each in turn and generate new ideas. The technique is particularly useful for considering complex products or processes in that it allows you to consider each feature or stage and look at the associated attributes in detail.

64. 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%

**64. Ans: (a)**

**Sol:** Cost of equity capital =

$$\left( \frac{\text{Dividend per share}}{\text{Market price per share}} + \text{grow rate} \right) \times 100$$

$$= \left( \frac{12}{125} + 0.08 \right) \times 100 = 17.6\%$$

65. 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

**65. Ans: (d)**

**Sol:**

- **Investment risk** can be defined as the probability or likelihood of occurrence of losses relative to the expected return on any particular investment.
- **Business risk** is the exposure a company or organization has to factor(s) that will lower its profits or lead it to fail. Anything that threatens a company's ability to meet its target or achieve its financial goals is called business risk.
- **Financial Risk** as the term suggests is the risk that involves financial loss to firms. Financial risk generally arises due to instability and losses in the financial market caused by movements in stock prices, currencies, interest rates and more.
- **Portfolio risk** is a chance that the combination of assets or units, within the investments that you own, fail to meet financial objectives. Each investment within a portfolio carries its own risk, with higher potential return typically meaning higher risk.

Negative correlation is a statistical measure used to describe the relationship between two variables.



When two variables are negatively correlated, one variable decreases as the other increases, and vice versa.

**Negative correlations between two investments are used in risk management to diversify, or mitigate, the risk associated with a portfolio.**

66. 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

**66. Ans: (c)**

**Sol:**

- **Angel investor** (also known as a private investor, seed investor or angel funder) is a high net worth individual who provides financial backing for small start-ups or entrepreneurs, typically in exchange for ownership equity in the company. The funds that angel investors provide may be a one-time investment to help the business get off the ground or an ongoing injection to support and carry the company through its difficult early stages.
- **Corporate Strategic Investor:** Investing firms or individuals who invest with the goal of acquiring strategic advantages rather than financial returns are called 'Strategic Investors' or 'Corporate Investor'. More than the profits, a Strategic Investor wants access to the invested business' technology, ideas, services, or products, to enhance its own business model.
- **Venture capital** is a type of funding for a new or growing business. It usually comes from venture capital firms that specialize in building high risk financial portfolios. With venture capital, the venture capital firm gives funding to the start-up company in exchange for equity in the start-up.

67. 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%

**67. Ans: (b)**

**Sol:**  $R = 12\%$  p.a

$R = 12\%$  per annum (12 months)

$R = 3\%$  per Quarterly (3 months)

Effective rate of interest when compounded Quarterly is

3 months	3 months	3 months	3 months
3%	3%	3%	3%

$$103\% \times 103\% \times 103\% \times 103\%$$

$$= \frac{10609}{10000} \times \frac{10609}{10000} \approx \frac{112550}{100} \approx 112.6\% = 12.6\%$$

68. 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

**68. Ans: (a)**

**Sol:** Compound Quarterly

(Interest added to principal every Quarter)

For 2 years = 24 months,  $R = 10\%$  p.a

$R = 10\%$  per annum

$R = 2.5\%$  per quarterly (3 months)

Rs.1000 After 2 years.

$$\text{Amount} = 1000 \times (102.5\%)^8$$

$$= 1000 \times (1.025)^8$$

$$= 1000 \times 1.2184$$

$$\text{Amount} \approx 1218.4$$

69. 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%

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69. Ans: (c or d)

Sol: Cost of Debentures =

$$\frac{\left[ \text{Interest rate} + \frac{\left( \text{Redemption value} - \left( \frac{\text{Issue rate minus floatation cost}}{\text{No. of years to maturity}} \right) \right)}{2} \right] (1-t)}{\left( \frac{\text{Redemption value} + \text{Issue rate minus floatation cost}}{2} \right)}$$

where → Interest rate = 12%

Redemption value = 105 after 10 years

Issue rate minus floatation cost = 95

No. of years to maturity = 10 years

t → tax rate = 0.4

$$= \frac{\left[ \frac{12 + (105 - 95)}{10} \right] \times (1 - 0.4)}{\left( \frac{105 + 95}{2} \right)} \times 100 = 7.8\%$$

70. A cybernetic control system that acts to reduce deviations from standard is called

- (a) a negative feedback loop
- (b) a positive feedback loop
- (c) a closed loop
- (d) an open loop

70. 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.

71. In which one of the following types of bonds, the bond formation is by free moving electrons in an array of positive ions?

- (a) Homopolar bond
- (b) Electrostatic bond
- (c) Metallic bond
- (d) Covalent bond

71. Ans: (c)

Sol:

• **Metallic Bond:-** In metallic bond, the bond formation is by sharing of many detached electrons between many positive ions

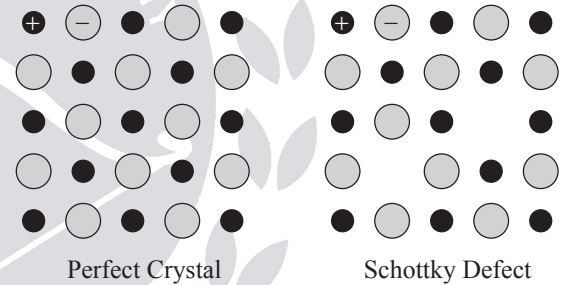
(From ACE ESE Prelims Basic of material Science and Egg Booklet Page No. 1)

72. 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

- (a) Schottky imperfection
- (b) pair of vacancies
- (c) Frenkel defect
- (d) point imperfection

72. Ans: (a)

Sol:



**Schottky Defect:-** It is a type of point defect formed by missing of pair of atoms (one cation and one anion) in an ionic crystal.

(From ACE ESE Prelims Basic of material Science and Egg Booklet Page No. 13)

73. Which of the following are the characteristics of covalent compounds?

1. They are mostly gases and liquids.
2. They are usually electric insulators.
3. They are directional in nature.
4. 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

73. Ans: (d)

Sol: Characteristics of covalent compounds

1. They are mostly gases and liquids
2. They are poor conductors
3. They are directional in nature
4. They are insoluble in polar solvents like water
5. They are soluble in non-polar solvents

(From ACE ESE Prelims Basic of material Science and Egg Booklet Page No. 1)

74. The photoelectric current depends on which of the following factors?

1. The frequency of the incident light
2. The intensity of the incident light
3. The potential difference between the electrodes
4. The photosensitivity of the nonmetal

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

**74. Ans: (d)**

**Sol:** Photo Electric Current

The electric current flowing in a circuit due to photo electrons is called photo electric current

1. The photo electric current depends on the intensity of incident radiation
2. The photo electric current does not depend on frequency of the incident radiation

75. 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.

**75. Ans: (c)**

**Sol:** Ductile fracture

It is a type of fracture characterized by extensive deformation of plastic or up to necking. This usually occurs prior to the actual fracture.

(From ACE Classroom Note Book)

76. 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

**76. Ans: (d)**

**Sol:** Critical shear stress

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

**Factors affecting critical shear**

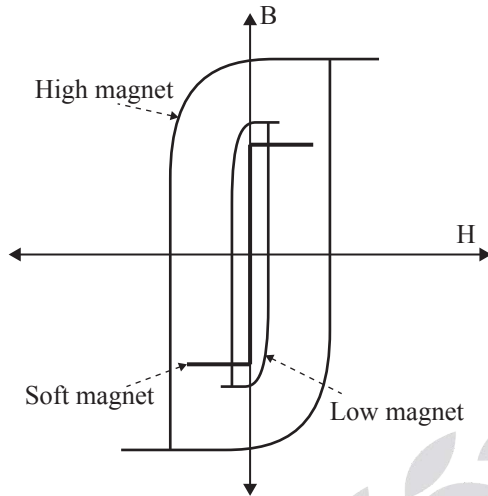
1. Alloy or solid solution increase the critical shear stresses and purity of metals reduce shear stress
2. Surface films like additives enhance critical shear stress
3. Rise in temperature reduce critical shear stress
4. Rate of deformation also help in raising the critical shear stress

77. 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

**77. Ans: (b)**

**Sol:**



**Hard Magnetic Materials**

Hard magnetic materials are vary difficult to magnetise and demagnetise, that require more applied magnetic field

**Properties**

1. High retentivity
2. High coercivity
3. High saturation flux density
4. Low permeability
5. Low susceptibility
6. High hysteresis losses

From ACE Classroom Notebook & Booklet Page No. 47

78. 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) thermo softening polymers
  - (c) thermosetting polymers
  - (d) random polymers

**78. Ans: (c)**

**Sol: Thermosetting polymers**

Thermosetting polymers are formed by condensation polymerization by releasing byproducts like water (or)  $NH_3$

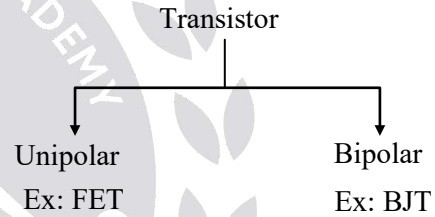
- Ex. Bakelite  
Epoxyes  
Resin

From ACE Classroom Notebook & Booklet Page No. 104

79. 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

**79. Ans: (b)**

**Sol:**



Field effect transistor: Is a semiconductor device with the output current is controlled by an electric field an its current is carried predominantly by one type of carrier, either electron or hole.

80. Which one of the following is the trade name of polycarbonates?
- (a) Alathon
  - (b) Baylon
  - (c) Bexphane
  - (d) Cycolac

**80. Ans: (a)**

**Sol:** Polycarbonates:

Polycarbonates are thermo plastic polymers formed by addition polymerization process

Trade name of polymer	→	Examples
Alathon	→	Polyethylene
Baylon	→	Nylon 6/6
Cycolac	→	Acrylonitrile butadiene styrene
Bexphane	→	Polypropylene

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  - (b) Share-Alike
  - (c) Copyright Infringement
  - (d) No Derivative Works

**81. Ans: (c)**

**Sol:** Creative Commons (CC) is an internationally active non-profit organisation that provides free licences for creators to use when making their work available to the public. These licences help the creator to give permission for others to use the work in advance under certain conditions.

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82. 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

**82. Ans : (a)**

**Sol:** computer networking, Fast Ethernet physical layers carry traffic at the nominal rate of 100 Mbit/s. The prior Ethernet speed was 10 Mbit/s. Of the Fast Ethernet physical layers, 100BASE-TX is by far the most common.

83. 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

**83. Ans : (b)**

**Sol:** Bluetooth is a wireless technology standard used for exchanging data between fixed and mobile devices over short distances using short-wavelength UHF radio waves in the industrial, scientific and medical radio bands, from 2.400 to 2.485 GHz, and building personal area networks (PANs).

84. 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

**84. Ans: (b)**

**Sol:** Peering is a process by which two Internet networks connect and exchange traffic. It allows them to directly hand off traffic between each other's customers, without having to pay a third party to carry that traffic across the Internet for them. Peering is distinct from transit, the more usual way of connecting to the Internet, in which an end user or network operator pays another, usually larger, network operator to carry all their traffic for them.

85. 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



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**85. Ans: (c)**

**Sol:** Department of Telecom has been formulating developmental policies for the accelerated growth of the telecommunication services. The Department is also responsible for grant of licenses for various telecom services like Unified Access Service Internet and VSAT service. The Department is also responsible for frequency management in the field of radio communication in close coordination with the international bodies. It also enforces wireless regulatory measures by monitoring wireless transmission of all users in the country.

86. 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 demand and service on demand
- (c) Free Wi-Fi access
- (d) Digital empowerment of citizens

**86. Ans: (c)**

**Sol:** Digital India is a programme to transform India into digital empowered society and knowledge economy. Its vision is centered on three key areas

- Digital infrastructure as Utility to Every Citizen
- Governance and services on demand
- Digital empowerment of citizens

87. 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

**87. Ans: (a)**

**Sol:** Infrastructure aspects provided by government of India in formation of NeGP Plan for storage of data (State Data Centre) network connectivity (State wide area network) and capacity building (NISG) (National Institute for Smart Government)

88. 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

**88. Ans: (d)**

**Sol:** E governance objectives should follow SMART (SIMPLE MORAL ACCOUNTABLE RESPONSIVE AND TRANSPARENT) and exchange of information with each and every citizen (consciousness)

89. 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

**89. Ans: (b)**

**Sol:** ICT prepares pupils to participated in a rapidly changing world in which work and other detivities are increasingly transformed by access to varied and deveoping technology ICT in education for inventive thinking requires skill adaptability, responsibility curicosity and creativity but not risk taking.

90. 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

**90. Ans: (c)**

**Sol:** They can integrate new forms of technology to teach, like videos, animations, and simulations through sources like Youtube channels, iTunes University, Clikers, and more. Even modern textbooks can incorporate content like video and audio clips, animation, and rich graphics that students can access and annotate. All of this content enhances the experience for students, and particularly benefits students who are struggling. It can also reduce spending, since students have plenty of valuable, real-time updated information at their fingertips for free.

Social media, meanwhile, allows students to develop communities to share experience, discuss theories, and learn from one another. Educators can interact with students beyond the confines of the classroom, too.

91. The basic difference between a professional and an amateur is

- 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
- a professional is clear in thinking and focused on the job, while an amateur is confused and distracted from the job
- a professional does high quality work/job in a specific area, while an amateur is associated with specific area with lowest pay
- a professional remains positive and achieves despite facing grievances, while an amateur does work efficiently due to many imagined grievances

**91. Ans: (a)**

**Sol:** The main attribute of a professional is highly sophisticated skills. These skills at higher order are imparted through a long term education. An amateur on the other hand is probably familiar with the problem and possibly solves the problem. A professional, in addition to identifying and

solving the problem, can take action to prevent that problem from its recurrence in future. Therefore a professional's approach is highly focused.

Ref: ACE Study material. Chapter-I, Page 2 and Class room notes.

92. 'Euthanasia' refers to the

- loyalty of the people that take pride in being part of their organization and care for the organization above their own well-being
- ills in the society that are caused by ignorance and lack of respect for the laws of the land
- emotional intelligence to understand how people perform various functions
- killing of a terminally ill person suffering acutely with no hope of survival

**92. Ans: (d)**

**Sol:** Euthanasia is a practice wherein, an acutely suffering patient who has no hopes of surviving is intentionally killed either directly or indirectly. Direct killing is by administering adverse medical treatment while indirect euthanasia is by stopping treatment and letting the patient die 'natural death'. Further, in direct euthanasia, patient asks to be killed. In indirect euthanasia, the care takers of patient ask for ending the life of the patient.

**Reference:** Class room discussions - Gilligan's Moral Development theory

93. 'Utilitarianism' in the professional ethics is

- an acquired habit that helps to lead a rational life
- a skill to solve a current ethical problem by comparing it with similar problems from the past and their outcome
- a right of activists to decide their own duties
- a judgment of an action by the consequences of that action



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Syllabus for **2<sup>nd</sup> Year Students - Aptitude Paper**

**Engg. Mathematics : 20 Q**

**Numerical Ability : 20 Q**

**Verbal Ability : 10 Q**

Syllabus for **3<sup>rd</sup>/4<sup>th</sup> Year & Passed-out Students - Technical Paper**

EEE		ECE / IN		CS & IT		CE		ME / PI	
Subject	No. of Questions	Subject	No. of Questions	Subject	No. of Questions	Subject	No. of Questions	Subject	No. of Questions
Networks	5 Q	Networks	6 Q	DS, PL & Algorithm	10 Q	SOM	5 Q	SOM	6 Q
Control System	5 Q	Control System	6 Q	DBMS	5 Q	FM & HM	5 Q	FM & HM	5 Q
Analog Electronics	4 Q	Analog Electronics	5 Q	Computer Networks	5 Q	Geo Technical Engg.	7 Q	TOM	6 Q
Digital Electronics	5 Q	Digital Electronics	5 Q	Operating System	6 Q	Environmental	7 Q	Machine Design	4 Q
Electrical Machines	8 Q	Signal & Systems	5 Q	Computer Organization	4 Q	Transportation	4 Q	Thermal	7 Q
Power System	7 Q	EDC & VLSI	5 Q	Theory of Computation	6 Q	RCC & STEEL	6 Q	Heat Mass Transfer	4 Q
Power Electronics	6 Q	Communications	8 Q	Digital Electronics	4 Q	Surveying	6 Q	Production	8 Q
Engg. Maths	5 Q	Engg. Maths	5 Q	Engg. Maths	5 Q	Engg. Maths	5 Q	Engg. Maths	5 Q
Numerical / Verbal Ability	5 Q	Numerical / Verbal Ability	5 Q	Numerical / Verbal Ability	5 Q	Numerical / Verbal Ability	5 Q	Numerical / Verbal Ability	5 Q

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**93. Ans: (d)**

**Sol:** Utilitarianism is a consequentialist ethical theory which is based on the principle of most common good to public. This is done by pre-assessing the benefits and disadvantages in terms of either monetary value (Risk-Benefit) or public served. If the benefits are more than disadvantages or more public gets benefits while a majority is estimated to suffer, the decision is supposed to be correct. Since decision is based on the consequences of action, the guiding principle is stated as end decides means or Consequence decides action

Reference: ACE study material Page no 19 – Utilitarian theory

ACE study material Page no 20 Q No. 5

94. In the professional ethics, the degree of safety proposed to be attained varies with
- design, duration and product
  - cost of risk, design and utility
  - cost of risk, perception and utility
  - product, perception and cost of risk involved

**94. Ans: (b)**

**Sol:** Though risk is a value domain parameter and a factor based on perception, an engineer understands the true meaning of 100% safety and 0% risk. Therefore, the important factors in resolving risk based issues are the cost of risk in terms of loss to life or measuring of death in terms of cost, developing better design and utility of the product are the major factors and safety varies according to these factors

95. 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
  - our actions must result in the least harm to the others
  - we should not impose our views on others
  - our actions must be fair to everyone

**95. Ans: (a)**

**Sol:** Two principles of conduct of engineer are very important; (a) the principle of maleficence and the principle of beneficence. The first principle has its roots in preventive engineering ethics where the focus is on not causing harm. The second principle has its roots in Aspirational Engineering ethics or Positive engineering ethics where the focus is on passing on benefits to others thorough thoughts and actions.

Reference: Class room discussion Chapter 8 Topic: Maxims of ethical governance

96. Which of the following are the main functions of WTO?

- To organize meetings of member countries to arrive at trade agreements covering international trade
  - To ensure that member countries conduct trade practices as per agreements agreed upon and signed by the member countries
  - 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

**96. Ans: (d)**

#### Functions of World Trade Organisation (WTO)

- It shall facilitate the implementation, administration and operation of the WTO trade agreements, such as multilateral trade agreements, plurilateral trade agreements.
- It shall provide forum for negotiations among its members concerning their multilateral trade relations.
- It shall administer the ‘Understanding on Rules and Procedures’ so as to handle trade disputes.

#### 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

97. **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.

97. **Ans: (b)**

**Sol:** In strong matrix, project manager has full authority and control over the project activities hence, Statement-I is correct.

In weak matrix, the functional manager has full authority, whereas project manager has least authority hence, statement-II is correct.

Both the statements are correct individually.

98. **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.

98. **Ans: (c)**

**Traded Goods** – Goods whose prices are set in international markets. Eg: imports and exports and goods produced in domestic markets but are close substitutes for imported goods

**Non-traded Goods** – Goods that do not enter into trade. Eg: services like education, finance, healthcare and goods like fresh food for local use etc.

The **Value to Volume Ratio (VVR)** measures your estimated share of total market gross profits, either for the company overall or a specific product, compared to your share of the total dollar volume

sold in your market or the product category.

VVR determines how efficient operating efforts are compared to the competition.

99. **Statement (I)** : Information Communication (ICTs) Technologies 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.

99. **Ans: (b)**

**Sol:**

- The emergence of Information and communications Technology (ICT) has provided means for faster and better communication, efficient storage, retrieval and processing of data and exchange and utilization of information to its users, be the individuals, groups, businesses, organizations or governments.
- What had begun as a faster, more accurate and simpler means of word-processing quickly lent itself to being used as a tool for processing and tabulating data as an aid in decision making. With growing computerization and increasing internet connectivity, this process has presently reached a stage where more and more users are motivated to modifying their ways of doing things in order to leverage the advantages provided by ICT. In other words, this has led to 'business process re-engineering'. So far as governments are concerned, the coming together of computerization and internet connectivity/web-enablement in association with process re-engineering, promises faster and better processing of information leading to speedier and qualitatively better decision making, greater reach and accountability, better utilization of resources and overall good governance. In the case of citizens, it holds the promise of enhanced access to information and government agencies, efficient service delivery and transparency in dealings and interactions with government.
- But it does not solve all the problems related to society



# Hearty Congratulations to our **GATE-2019 Top Rankers**

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AIR 10		AIR 10		AIR 10		AIR 10		AIR 10		and many more...			
ASIF KHAN CE		MAHESH SINGH YADAV ME		GARVIT GUPTA XE		MANMOHAN ARORA PI		SHUBHAM PANDE PI					

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	5	44	6	60	7	71	9	74	5	28	10	74	10	49						

100. **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.

**100. Ans: (c)**

**Sol:**

- Government agencies throughout the world are considering and conducting e-Governance initiatives with the help of private players; the scene in India is much the same. The development of network-based distributed systems that serve numerous and diverse constituents and improve the overall efficiency and functioning of government is a priority. Considering these requirements, private players such as IT vendors are extending their overall support to realise e-Governance projects for Indian citizens. Not just the central government, state governments are also actively participating in these projects. Today, most states in the country have drafted state-specific IT policies that are in various stages of implementation. The central government has also taken several initiatives to advance ICT usage across all government bodies as this will benefit the common man. These include the roll-out of the National eGovernance Plan (NeGP), the launch of Mission 2007, and the formation of e-Panchayats across the country
- If it is implemented good but not necessarily true  
While statements 2 is false  
Front end is related to what user is seeing like page and buttons which of no use if back end is not working