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ESE 2024 : Prelims Exam | GS & ENGINEERING CLASSROOM TEST SERIES | APTITUDE

Test 17

Full Syllabus Test 1 : (Paper-I)

ANSWER KEY

1. (d)	21. (d)	41. (b)	61. (c)	81. (b)
2. (d)	22. (a)	42. (c)	62. (d)	82. (d)
3. (a)	23. (a)	43. (a)	63. (b)	83. (b)
4. (a)	24. (d)	44. (a)	64. (b)	84. (b)
5. (a)	25. (b)	45. (d)	65. (b)	85. (d)
6. (c)	26. (c)	46. (b)	66. (b)	86. (d)
7. (a)	27. (d)	47. (d)	67. (b)	87. (c)
8. (c)	28. (d)	48. (c)	68. (a)	88. (b)
9. (b)	29. (a)	49. (a)	69. (d)	89. (b)
10. (d)	30. (c)	50. (b)	70. (a)	90. (b)
11. (d)	31. (c)	51. (c)	71. (d)	91. (c)
12. (a)	32. (d)	52. (c)	72. (d)	92. (a)
13. (b)	33. (c)	53. (a)	73. (d)	93. (c)
14. (c)	34. (c)	54. (d)	74. (b)	94. (b)
15. (a)	35. (a)	55. (b)	75. (b)	95. (a)
16. (d)	36. (d)	56. (c)	76. (d)	96. (a)
17. (c)	37. (d)	57. (c)	77. (d)	97. (a)
18. (d)	38. (d)	58. (a)	78. (d)	98. (b)
19. (a)	39. (b)	59. (c)	79. (d)	99. (c)
20. (b)	40. (b)	60. (d)	80. (d)	100. (a)

DETAILED EXPLANATIONS

1. (d)
Exchange rate of a currency may be fixed by a central bank or left to the market forces of demand and supply. When the value is changed by the central bank it is called devaluation. If market forces bring down the value due to demand falling behind supply of the currency, it leads to depreciation.
3. (a)
KONEPS of South Korea is the largest such platform in the world. Currently, GeBIZ of Singapore and GeM of India hold the second and third position respectively.
5. (a)
The mission aims to develop technologies for deep-sea mining and a manned submersible to carry three people to a depth of 6,000 meters in the ocean.
6. (c)
'ATL Marathon is a national-level innovation challenge for young innovators across India who can solve community problems of their choice, and develop innovative solutions in the form of working prototypes.
7. (a)
Normative ethics is concerned with criteria of what is morally right and wrong.
8. (c)
Instrumental value is the value that something has as a means to a desired or valued end. It is always derivative on the value of something else, and it is always conditional.
12. (a)
Ethics are a set of moral principles that determine right or wrong behaviour. Ethics refers to an individual's moral beliefs or principles which govern his or her conduct.
15. (a)
 - **Core Zone:** In the heart of each biosphere reserve lies the strictly protected core zone, providing habitat for flora and fauna, and protecting water, soil, air, and biota as a whole ecosystem.
 - **Buffer zone:** They surround or adjoin the core area, and are used for activities compatible with sound ecological practices that can reinforce scientific research, monitoring, training and education.
 - **Transition zone:** The outermost edge is the transition zone where communities practice socio-culturally and ecologically sustainable human activities.
19. (a)
 - A niche is the unique functional role or place of a species in an ecosystem. It is a description of all the biological, physical and chemical factors that a species needs to survive, stay healthy and reproduce. A niche is unique for a species, which means no two species have exact identical niches.
 - Niche plays an important role in conservation of organisms.

20. (b)

- **Amensalism:** One species is harmed; the other is unaffected.

Example: A large tree shades a small plant, retarding the growth of the small plant. The small plant has no effect on the large tree.

- **Commensalism:** One species benefit, the other is unaffected.

Example: Cow dung provides food and shelter to dung beetles. The beetles have no effect on the cows.

- **Competition:** Both species are harmed by the interaction.

Example: If two species eat the same food, and there isn't enough for both, both may have access to less food than they would if alone. They both suffer a shortage of food.

- **Neutralism:** There is no net benefit or harm to either species. Neutralism is also sometimes described as the relationship between two species inhabiting the same space and using the same resources, but that have no effect on each other.

21. (d)

- Oceans are one of the largest carbon sinks on earth because of their large geographical coverage and presence of rich population of phytoplankton and seagrass, which act as carbon sink.
- Carbon dioxide readily dissolves in water and the oceans provide a huge reservoir of carbon. Across the world's oceans there is a continual cycle of equilibration of dissolved carbon dioxide in water with carbon dioxide in the atmosphere. The difference in partial pressure of the CO_2 between seawater and air facilitate gaseous exchange. This allows atmospheric CO_2 to dissolve in seawater.

23. (a)

Occupational hygiene participate in overall risk analysis and management of an agent, process or workplace, and contribute to the establishing of priorities for risk management.

24. (d)

Failure mode and effects analysis (FMEA) reduces process development time and cost.

25. (b)

Isotonic work is less tiring and more efficient than isometric work. The motion of muscles also help pump blood supplying oxygen and eliminating carbon dioxide.

26. (c)

The ways by which designer can improve fire resistance of materials are:

- (i) Oversizing-deliberately increasing the size of an assembly, so that part of it can be destroyed without affecting the structural performance of the rest.
- (ii) Insulation-providing a layer of insulating materials around the assembly to protect it from the heat of the fire.
- (iii) Dissipation-ensuring that heat applied to the assembly is rapidly dissipated to other materials or to the air, so that the temperature of the assembly is not raised to a critical level.

29. (a)
Perspective projections are not used by engineers for manufacturing, because the perspective view does not reveal the exact size and shape. Perspectives may be used in marketing where a natural view of a product is desirable.
30. (c)
The PDS lays the ground work for all engineering design activities and ensures the all relevant factors are accounted for all stakeholders are heard form. It will get longer and elaborative as more about the design is known.
32. (d)
 - Statement 1 is correct for cost of quality.
 - Statement 1 is correct for value of quality.
33. (c)
Quality loss results from customer's dissatisfaction. The loss is measured in monetary terms and includes all costs in excess of the cost of a perfect product. The Taguchi Loss Function is often associated with quadratic forms, but it can be adapted to other loss shapes based on the specific needs of the optimization problem.
34. (c)
Market value of product decreases with poor quality of product.
36. (d)
Techno-craft paradigm : It seeks to employ the custom-craft paradigm in performance while reducing delivery time. It requires a high level of product process flexibility, which enables the customers to get exactly what they desire. The requirement here is to integrate machine, men and automation.
38. (d)
The following five factors on which the safety stocks required depends:
 1. Reorder frequency
 2. Desired level of service
 3. Demand variability during lead time
 4. Length of the lead time interval
 5. Ability to forecast or control lead times
39. (b)
Defects per million opportunities,

$$\begin{aligned} \text{DPMO} &= \frac{\text{Defects per unit} \times 1000000}{\text{Opportunity for error}} \\ &= \frac{2 \times 1000000}{80} = 25000 \end{aligned}$$

40. (b)

Benefits of ISO Certificate:

- The logo will increase the stature of the company assessed to ISO standard. Company will be able to display the certification body's logo on their correspondence.
- It will open international doors and not just those locally.
- It will satisfy the larger businesses that the company operates and will result in fewer customer audits needed to be carried out to confirm the on-going commitment.
- It will provide an improvement in communications on both internally and to customers.
- Employee will be better aware of their responsibilities and need to satisfy customers.
- Profit of the company increases.

43. (a)

The three primary project constraints are time, cost and scope.

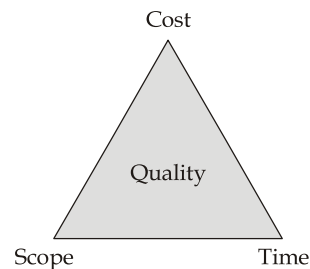


Fig. Project management triangle

44. (a)

Functional organisation structure is suitable only for smaller organizations that offer a limited line of products.

46. (b)

$$\text{Cost of the equity} = \frac{DPS}{MPS} + \gamma$$

where MPS is market price per share and γ is rate of growth.

$$\therefore \text{Cost of the equity} = \left(\frac{15}{150} + 0.08 \right) \times 100\% = 18\%$$

47. (d)

$$\text{Maturity value} = P \left(1 + \frac{i}{t} \right)^{t \cdot n}$$

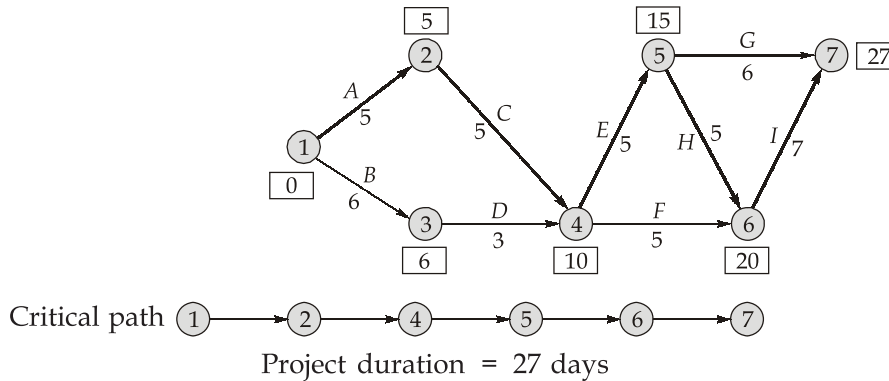
where t represents the number of times interest is compounded in a year. Since, the interest is said to be compounded on half yearly basis, $t = 2$

$$\therefore 400000 = P \left(1 + \left(\frac{0.12}{2} \right) \right)^{2 \times 5}$$

$$P = \frac{400000}{1.79} = 223463.68 \simeq \text{Rs. } 223464$$

48. (c)
Constraints in TOC can also include intangible factors.

49. (a)
For the given activity relationship, following network is prepared.



51. (c)
The computer's start-up routine is stored in ROM which is non-volatile i.e. it retains its contents even if the computer is powered off.
52. (c)
Encoding or scrambling of data before transmission across a network to avoid manipulation by a third party is known as encryption.
53. (a)
The Indian Computer Emergency Response Team works under the Ministry of Electronics and Information Technology (MeitY).
55. (b)
Each track is divided into a number of sectors, each of which can store the same amount of data.
57. (c)
Cookies are small text files stored on the user's computer while browsing the Internet for session management, personalization and tracking purposes, with the purpose of providing better user experience.
58. (a)
Researchers from IIT-Madras have developed origami metamaterials. These combine the Japanese art of paper folding (origami) and the existing material of choice and fold it to obtain desired properties.

60. (d)

Cubic structure	APF
Simple cubic	0.52
Body centered cubic	0.68
Face centered cubic	0.74
Diamond cubic	0.34

61. (c)

Ceramic materials due to their high heat resistance are used as refractories, which are materials that resist the action of hot environments, both liquid and gaseous. Refractories are used widely by the metals, chemical, ceramic and glass industries.

62. (d)

Bakelite and melamine are examples of thermosetting plastics. They are used for making electrical switches, kitchenware, etc..

63. (b)

Bronze is widely used for cast moulding of sculptures as it expands before setting, thereby it can fully fill up the intricate shape of the mould. It is also used for springs, bearing, bushings and fitting of boat and ships.

64. (b)

$$\epsilon_r = \epsilon'_r - j\epsilon''_r$$

Real part ϵ'_r determines the charge storing ability of dielectric.

Imaginary part ϵ''_r determines the energy losses in material as a result of polarization. Energy loss in form of heat per unit volume for an AC signal is given as

$$P = \frac{1}{2} E^2 \omega \epsilon_0 \epsilon''_r$$

65. (b)

Properties of Ferrites

- (1) High resistivity
- (2) High permeability
- (3) Low dielectric losses
- (4) High dielectric constant

66. (b)

Bohr magneton is the unit to measure the magnetic moment of the electron caused by its orbital or spin angular momentum.

67. (b)

Electron concentration is equal to hole concentration in case of intrinsic semiconductor,

$$\text{i.e., } n = p = n_i$$

68. (a)

$$\text{Loss} = \frac{1}{2} \epsilon_0 \epsilon_r \omega E_0^2$$

So, $\text{loss} \propto \omega$

\therefore Loss increases as ω increases.

69. (d)

$$\text{Power of the bulb} = 405\text{W} = 405 \text{ J/s}$$

$$\begin{aligned} \text{Energy of one photon, } E &= \frac{hc}{\lambda} = \frac{(6.6 \times 10^{-34}) \times (3 \times 10^8)}{440 \times 10^{-9}} = \frac{(6.6 \times 3) \times 10^{-26+9}}{4.4 \times 100} \\ &= \left(\frac{3}{2} \times 3\right) \times 10^{-19} = 4.5 \times 10^{-19} \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Number of photons emitted} &= \frac{405}{(4.5 \times 10^{-19})} = 90 \times 10^{19} \\ &= 9 \times 10^{20} \text{ photons/second} \end{aligned}$$

70. (a)

Properties of heating elements:

1. High melting point.
2. High oxidation resistance
3. Ductility
4. High electrical resistivity
5. Low thermal expansion
6. Low temperature coefficient of resistance

71. (d)

- Multiplication of matrices is associative

$$\text{i.e., } (AB)C = A(BC)$$

- Multiplication of matrices is distributive

$$A(B + C) = AB + AC$$

- However, multiplication of matrices is not commutative i.e. $AB \neq BA$

If $A^2 = A$, then the matrix A is called idempotent

$$A^2 = A, \text{ multiply both sides by } A$$

$$A^3 = A^2$$

72. (d)

- Sum, difference, product and quotient of continuous functions are continuous.
- Every differentiable function is continuous, but the converse is not true.

73. (d)

Consider

$$I = \int_0^{\frac{\pi}{2}} \sin^{99} x \cos x \, dx$$

Let

$$u = \sin x$$

$$du = \cos x \, dx$$

$$\begin{aligned} I &= \int_0^1 u^{99} du = \frac{u^{100}}{100} \\ &= \frac{1}{100} \end{aligned}$$

74. (b)

$$\begin{aligned} \text{Laplace transform of } e^{-3t}(2\cos 5t - 3\sin 5t) &= 2L(e^{-3t} \cos 5t) - 3L(e^{-3t} \sin 5t) \\ &= 2 \cdot \frac{s+3}{(s+3)^2 + 5^2} - 3 \cdot \frac{5}{(s+3)^2 + 5^2} \\ &= \frac{2s-9}{s^2 + 6s + 34} \end{aligned}$$

75. (b)

$$\text{P.I.} = \frac{1}{D^2 - 2D + 4} e^x \cos x$$

$$\text{Using } \frac{1}{f(D)} e^{ax} \phi(x) = e^{ax} \frac{1}{f(D+a)} \phi(x), \text{ we get}$$

$$\begin{aligned} \text{P.I.} &= e^x \frac{1}{(D+1)^2 - 2(D+1) + 4} \cos x \\ &= e^x \frac{1}{D^2 + 3} \cos x \end{aligned}$$

$$\text{Using } \frac{1}{f(D)} \cos(ax) = \frac{\cos(ax)}{f(-a^2)}, \text{ we get}$$

$$\text{P.I.} = e^x \frac{1}{-1+3} \cos x = \frac{1}{2} e^x \cos x$$

76. (d)

$$\vec{V} = 2x^2\hat{i} + 5y^3\hat{j} + 3z^4\hat{k}$$

$$\begin{aligned} \vec{\nabla} \cdot \vec{V} &= \left[\frac{\partial}{\partial x} \hat{i} + \frac{\partial}{\partial y} \hat{j} + \frac{\partial}{\partial z} \hat{k} \right] [2x^2\hat{i} + 5y^3\hat{j} + 3z^4\hat{k}] \\ &= 4x + 15y^2 + 12z^3 \end{aligned}$$

At (2, 3, 4)

$$\begin{aligned} \vec{\nabla} \cdot \vec{V} &= 8 + 15(3)^2 + 12(4)^3 \\ &= 8 + 135 + 768 \\ &= 911 \end{aligned}$$

77. (d)

$$\begin{aligned}
 P(E) &= \text{Probability of head appearing in odd number of tosses} \\
 &= P(H) + P(TTH) + \dots \\
 &= \frac{1}{2} + \left(\frac{1}{2}\right)^2 \left(\frac{1}{2}\right) + \dots \\
 &= \frac{1/2}{1 - \frac{1}{4}} = \frac{2}{3}
 \end{aligned}$$

78. (d)

$$\begin{aligned}
 \frac{(\cos \theta + i \sin \theta)^7}{i^4 (\cos \theta + \frac{\sin \theta}{i})^4} &= \frac{(\cos \theta + i \sin \theta)^7}{(\cos \theta - i \sin \theta)^4} = \frac{e^{i7\theta}}{e^{-i4\theta}} \\
 e^{i11\theta} &= \frac{(\cos \theta + i \sin \theta)^7}{[\cos \theta + i \sin \theta]^{-4}} = (\cos 11\theta + i \sin 11\theta)
 \end{aligned}$$

Comparing with $x + iy$, we get

$$\begin{aligned}
 x &= \cos 11\theta \\
 y &= \sin 11\theta
 \end{aligned}$$

79. (d)

$$\begin{aligned}
 12^{33} \times 34^{23} \times 2^{72} &= (2^2 \times 3)^{33} \times (2 \times 17)^{23} \times 2^{72} \\
 &= 2^{66} \times 3^{33} \times 2^{23} \times 17^{23} \times 2^{72} \\
 &= 2^{161} \times 3^{33} \times 17^{23}
 \end{aligned}$$

$$\begin{aligned}
 \text{The number of factors} &= (161 + 1) \times (33 + 1) \times (23 + 1) \\
 &= 132192
 \end{aligned}$$

80. (d)

Let the required number is a

$$a = 11b + 8 \quad \dots(i)$$

$$a = 7c + 6 \quad \dots(ii)$$

Putting value of $b = 1, 2, 3 \dots$ in equation (i), we get

$$a = 19, 30, 41, 52, \dots$$

Putting value of $c = 1, 2, 3 \dots$ in equation (ii), we get

$$a = 13, 20, 27, 34, 41, 48, \dots$$

So, $77n + 41$ (where $n = 1, 2, 3 \dots$) satisfies the given conditions.

Hence, 41, 118 and 195 satisfies above given condition.

81. (b)

$$8 \text{ goats} = 12 \text{ sheeps}$$

$$1 \text{ goat} = \frac{3}{2} \text{ sheeps}$$

$$4 \text{ goats and 18 sheeps} = 4 \times \frac{3}{2} + 18 = 24 \text{ sheeps}$$

As 12 sheep can graze a field in 100 days.
So, 24 sheep can graze same field in 50 days.

82. (d)

The speed of trains are $3 \times 60 = 180$ km/hr and 120 km/hr
The relative speed between the trains $(180 - 120) = 60$ km/hr

Let the length of the slower train is l km, then the time taken to cross = $\frac{\text{Length of train}}{60 \text{ km/hr}}$

$$\frac{l}{60} = \frac{54}{3600}$$

$$l = \frac{54}{3600} \times 60 = 0.9 \text{ km} = 900 \text{ m}$$

83. (b)

No. of ways of selecting two students out of 200 students = ${}^{200}C_2$

But they both send greeting card to each other.

Hence, required number of ways = $2 \times {}^{200}C_2$

84. (b)

In the word 'ABCCDE' the letter 'C' repeated.

So, this word can be arranged in $\frac{6!}{2!} = 360$ ways

Considering the two 'C's as one unit, the number of ways two C's are together = $5! = 120$

Hence, the required number of ways = $360 - 120 = 240$

85. (d)

304, 314 394 (except 344) = 9 numbers
 340, 341 349 (except 344) = 9 numbers
 400, 401 409 (except 404) = 9 numbers
 410, 411 419 (except 414) = 9 numbers
 420, 421 429 (except 424) = 9 numbers
 430, 431 439 (except 434) = 9 members
 440, 441 449 (all discarded) = 0 numbers
 450, 451 459 (except 454) = 9 numbers
 460, 461 469 (except 464) = 9 numbers
 470, 471 479 (except 474) = 9 numbers
 480, 481 489 (except 484) = 9 numbers
 490, 491 499 (except 494) = 9 numbers
 504, 514 594 (except 544) = 9 numbers
 540, 541 549 (except 544) = 9 numbers
 Total = 117 numbers

86. (d)

 $QR : PR = 2 : 5$ i.e. $PQ : PR = 3 : 5$ or we can simply say $PQ = 3$ and $PR = 5$, then

$$QS = PQ = 3$$

The diameter of the larger semicircle $PR = 5$ The sum of the diameters of two smaller semicircles $PQ + QS = 3 + 3 = 6$

$$\text{Ratio of diameters} = 5 : 6$$

This will be the same as the required ratio of circumferences i.e $5 : 6$.

87. (c)

When this figure is folded to form a cube, then the face bearing three dots will lie opposite the face bearing five dots.

93. (c)

- Corals that inhabit the colder deep waters of continental shelves and offshore canyons, ranging from 50 to over 1000m depths lack zooxanthellae and may build reef-like structures or occur solitarily.
- Cold-water corals can be found over a wide range of latitudes, from tropical to Polar Regions, and from the shallow to the deep seas.

94. (b)

The Convention on Biological Diversity (CBD) is not just about the conservation and restoration of ecosystems. It is also about sustainable use of natural resources, and equitable sharing of benefits from the use of these resources.

97. (a)

'Blind carbon copy' is a way of sending emails to multiple people without them knowing who else is receiving the email.

98. (b)

Liquid crystals do not emit light directly, instead use a backlight or reflector to produce images in colour or monochrome.

99. (c)

Whiskers have a higher degree of crystalline perfection and flaw free because of their small size. So, they show exceptionally high strength.

100. (a)

Due to high resistivity, ferrites have a low eddy current loss.

