ESE-2018 PRELIMS TEST SERIES

Date: 24th December, 2017

GS–TEST 13(OBJECTIVE SOLUTION)...

ANSWERS

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

1. (b)

First no. = 2

Second no. = $2+2^2=6$

Third no. = $6+4^2=22$

Fourth No. = $22+6^2=58$

Fifth No. = $58+8^2=122$

Sixth No. = $122+10^2=222$

2. (a)

Let the member be N

$N = 8P + 5$

Also, $N = 12q + 9$

$N = 18r + 15$

Here difference between divisor (8, 12, 18) and remainder (5, 9, 15) is same.

$\Rightarrow$ $8 - 5 = 12 - 9 = 18 - 15 = 3$

Hence required no. N is

$= \text{LCM}(8, 12, 18) - 3$

LCM of 8, 12 and 18

$= 2^3 \times 3^2 = 72$

Hence required No.

$N = 72 - 3$

$= 69$

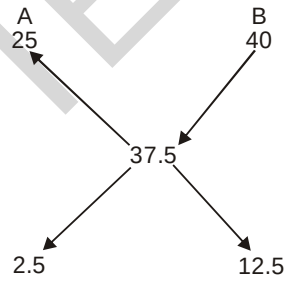
3. (c)

Let the cost price of mix = C

$\therefore \quad \frac{45-C}{C}\times 100 = 20$

$\Rightarrow \quad C = 37.5$ Rs./Kg

Using Allegation,



Ratio of A and B = 2.5 : 12.5 = 1 : 5

4. (a)

Let say pipe A be closed after 'n' hr. i.e. pipe A is operational for n hr and pipe B for all 2 hour.

So, $\frac{n}{2}+\frac{2}{3} = 1$

$\Rightarrow \quad n = \frac{2}{3}\text{hr.} = 40\text{min}$

5. (b)

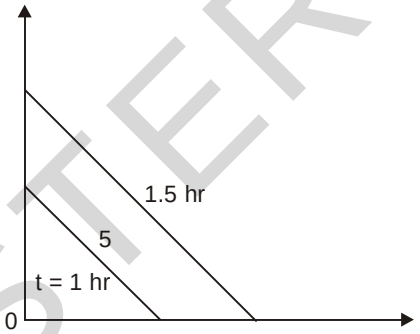
When two different things are sold at the same selling price getting a x% profit on one and x% loss on second, then overall loss in the transaction is $(x/10)^2$%.

Here $x = 15$

Hence overall loss

$= \left(\frac{15}{10}\right)^2 = 2.25\%$

6. (a)



Let the speeds be x and y km/hr.

In one hr, distance covered by them is x km and y km.

So, $x^2+y^2 = 25$ ....(i)

Attar 1.5 hr.

$|1.5x-1.5y| = 1.5$

$|x-y| = 1$ ...(ii)

From (i) and (ii),

$x = 4$ Km/hr

$y = 3$ Km/hr

7. (b)

$x^2+5 < 5x+14$

$\Rightarrow \quad x^2-5x-9 < 0$

Roots of $x^2-5x-9=0$ are

$\frac{5\pm\sqrt{61}}{2} = 6.4, -1.4$

$\Rightarrow \quad (x-6.4)(x+1.4) < 0$

$\Rightarrow \quad -1.4 < x < 6.4$

8. (a)

In order to go from one station to another and come back to starting point, we need 2 tickets.

No. of ways to select two stations

$= {}^{12}C_2$

No. of different tickets required

$= {}^{12}C_2 \times 2$

$= \frac{12 \times 11}{2} \times 2 = 132$

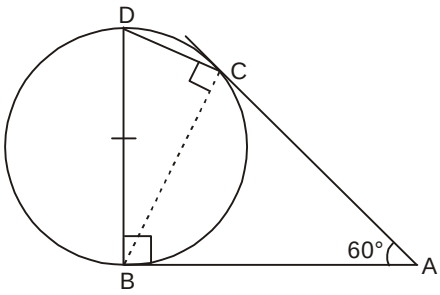
9. (b)

Treating all the vowles as one entity = $\boxed{A\ A\ O}$ one

Remaining = K L K T = 4

Hence total no. of ways = $\frac{5! \times 3!}{2!\ 2!} = 180$

10. (c)



$\angle ABC = \angle ACB \ [\because AB = AC]$

$\therefore \quad \angle ABC = 60°$

Since $\angle DBA = 90°$

$\angle DBC = 90 - 60 = 30°$

Since $\angle DCB = 90°$

[Angle subtended by diameter on circle]

$\therefore \quad \angle BDC = 180 - 90 - 30$

$= 60°$

11. (d)

Life cycle target of product basically includes useful life and shelf life, cost of installation and its operation, maintenance schedule and location altogether.

12. (a)

Synectics (meaning joining together of different things into unified connection) is a methodology for creativity based on reasoning by analogy. It assumes that the psychological components of the creative processes are more important in generating new and inventive ideas than intellectual process.

14. (c)

In detail design product data management softwares provide the link between product design and manufacturing. Manufacturing process management bridge the gap between product design and production control.

15. (b)

Fidelity : Accuracy with which model of design represents the proposed final design in terms of material and construction.

Story boarding : It is a variation of brainstorming. Here ideas are recorded and written on card.

16. (c)

$HaZOP_s$ have the same weakness as FMEAs. Both does not consider human error into equation. $HaZOP_s$ primarily used for process industries (refinery, petrochemical etc.)

Human error analysis is used to predict human error, not review what has occured.

19. (c)

Silicon increase the fluidity of alloy of aluminium. In case of grey cast iron it imparts fludity, lubricating nature and machinability.

20. (b)

Monel is an important alloy containing 68% Nickel. It has strength of steel and corrosion resistance of copper. It is stronger than mild steel even when annealed. It is used for high temperature application except in the SO_2 or oxidizing environments.

It is difficult to cast due to blow holes.

24. (a)

The most commonly used photovoltaic cells are barrier-layer type like Iron-Sellanium cells or Cu-CuO_2 cells. In the Iron-Sellenium cells, Sellenium layer is placed on an iron disc then on extremely thin transparentlayer of gold or silver is formed on the selenium to act as a front electrode. The barrier layer is formed by Cathode-sputtering the semi transparent film on the Sellenium. When luminus flux radiant flux falls on the semi conductor, it ejects electron which travel from selenium to the front silver electrode

through barrier layer. The flow in opposite direction is not permitted by the barrier because it act as a rectifier. (For information only)

25. (b)

Hetropolar bond is ionic bond in which two different pole is formed after the complete transfer of electrons.

26. (b)

Superlattice alloys are alloys of platinum formed with iron or cobalt. Since Pt is of FCC type, Fe is BCC and Co is HCP. Therefore, the alloys formed by them of special character when heated for hardening and then cooled, they form superlattice of FCC and BCC or FCC and HCP configuration.

Pyrolitic graphite is an artificial graphite whose strength at 2200°C is much higher than natural graphite. It is highly anisotropic and used in rocket nozzles and its insert.

Ruby crystal is a crystal of aluminium oxide in which some aluminium atoms are replaced by chromium atom. Cr^{3+} ions are active material in ruby rod which is an essential part in ruby laser. A ruby crystal containing about 0.5% chromium is of pink color.

Magnetic Annealing is a heat treatment process which is performed to improve ductility, enhance machinability, refining the grains and softening the metals. It is performed in presence of magnetic field and in absence of it, it is known as mechanical annealing. The damagnetizing and magnetization force of ALNICO increases considerably on magnetic field.

28. (d)

The Turn-Key Contract

In a turn-key project a single contractor has complete responsibility to supply the owner a plant which is complete and ready for the owner to operate by simply turning the key. Turn-key, thus, is an expression for the extent of responsibility that a contractor undertakes; it is not to be mixed up with the commercial and payment terms. Turn-key would not necessarily mean a fixed price contract, it is quite possible to enter into a turn-key reimbursible contract. This definition makes it possible for engineering consultancy organizations to undertake turn-key responsibilities for projects even without having capabilities of supply and finance. On the othr hand, in a lumpsum turn-key contract a contractor offers the owner a complete plant for a single price.

29. (a)

Task Force Organization :

An alternative arrangement which clearly accords authority to the project manager and avoids disillusionment of either the project manager or the functional manager due to maloperation of the matrix is a *task force*. In this arrangement, the project manager is delegated the full authority to make decisions for the project, but he would be required to operate within the functional organization's policies and procedures. There is clearly no intervention from the various functional departments, no dual decision making and no dual reporting relationship for the working force; the project manager makes all the decisions but within the policies and procedures laid down for him.

31. (a)

Project Manager as a Staff Assistant to the Chief Executive :

A project manager may be positioned in many situations, and in each case the authority he can wield and consequently the end results he can produce will be different. Figure shows one arrangement in which the project manager virtually has no authority. He serves, at best, as a staff assistant to the chief executive. The project manager, in this position, does not make any decision for the project, nor does he provide any staff service to the functional departments who make all the decisions relating to the project. The project manager merely collects information – collects and communicates the same to the chief executive.

This arrangement may work for very small projects. It cannot work for large projects even if the project manager is provided with supporting staff since the real person, who in this arrangement wields authority and can, therefore, coordinate and expedite the project is the chief executive who, as stated earlier, may not have much time for the project.

33. (c)

Monitoring Contracts:

Information capture and its processing to feed all levels of management is a speciality service. This requires knowledge of the project management process and information processing on the computer. The project manager for this purpose can either hire a specialist staff or engage a monitoring agency on contract.

34. (c)

Triple C Model :

The Triple C model is an effective project planning tool. The model states that project management can be enhanced by implementing it within the integrated functions of

- Communication
- Cooperation
- Coordination

The model facilitates a systematic approach to project planning, organizing, scheduling and control. The Triple C model is distinguished from the 3C approach commonly used in military operations. The military approach emphasizes personnel management in the hierarchy of command, control and communication. This places communication as the last function. The Triple C, by contrast, suggests communication as the first and foremost function. The Triple C model can be implemented for project plan.

35. (b)

Project Modeling :

Schedule optimization is often the major focus in project management. While heuristic scheduling is very simple to implement, it does have some limitations. The limitations of heuristic scheduling include subjectivity, arbitrariness, and simplistic assumptions. In addition, heuristic scheduling does not handle uncertainty very well. On the other hand, mathematical scheduling is difficult to apply to practical problems. However, the increasing access to low-cost high-speed computers has facilitated increased use of mathematical scheduling approaches that yield optimal project schedules. the advantages of mathematical scheduling include the following facts :

- It provides optimal solutions.
- It can be formulated to include realistic factors influencing a project.
- Its formulation can be validated.
- It has proven solution methodologies.

41. (b)

$$EOQ = \sqrt{\frac{2DC_0}{C_C}} = \sqrt{\frac{2\times 9000\times 100}{2}}$$

$$= 300$$

$$\therefore \text{ No. of orders} = \frac{D}{EOQ} = \frac{9000}{300} = 30$$

42. (b)

$$\frac{{}^{49}C_{15} + {}^{49}C_{14} + {}^{1}C_{1}}{{}^{50}C_{15}} = 1$$

45. (b)

$$UCL = \bar{\bar{X}} + \frac{3\sigma}{\sqrt{n}} = \frac{400}{10} + \frac{3\times 0.08}{\sqrt{4}} = 40.12$$

46. (a)

Deontological ethics or deontology is the normative ethical position that judges the morality of an action based on rules. It is sometimes described as “duty-” or “obligation-” or “rule-” based ethics, because rules “bind you to your duty”.

47. (b)

A categorical imperative, denotes an absolute, unconditional requirement that must be obeyed in all circumstances and is justified as an end in itself. It is best known in Kant's first formulation:

Act only according to that maxim whereby you can, at the same time, will that it should become a universal law.

48. (c)

A moral agent is "a being who is capable of acting with reference to right and wrong". Hence a moral agent is a competent and reasonably mature human being.

49. (c)

Ethics seeks to resolve questions of human morality by defining concepts such as good and evil, right and wrong, virtue and vice, justice and crime, duties etc.

51. (a)

Natural obligation is one which in honor and conscience binds the person who has contracted it, but which cannot be enforced in a court of justice.

Pure obligation is an obligation which is not subjected to any condition and no specific date is mentioned.

52. (b)

Preventive ethics deals with what as an engineer we must not do. The overall goal of preventive ethics is to improve quality by identifying, prioritizing, and addressing ethics quality gaps on a systems level.

53. (a)

Enforcement is the process of ensuring compliance with laws, regulations, rules, standards, or social norms. By enforcing laws and regulations, governments attempt to effectuate successful implementation of policies.

54. (c)

Communication that cuts across functions and levels in an organization is called as diagonal communication. Diagonal communication refers to communication between managers and workers located in different functional divisions.

55. (b)

Our fundamental ethical duty is to treat other human beings as autonomous persons who may choose their own ends and purposes, not simply as means for the ends of others is Kant's categorical imperative. A categorical imperative denotes an absolute, unconditional requirement that must be obeyed in all circumstances.

56. (a)

A Cryogenic rocket stage is more efficient and provides more thrust for every kilogram of propellant it burns compared to solid and earth-storable liquid propellant rocket stages.

The combination of liquid hydrogen fuel and the liquid oxygen oxidizer is one of the most widely used.

57. (b)

Chikungunya is an infection caused by the Chikungunya virus. It features sudden onset fever usually lasting two to seven days, and joint pains typically lasting weeks or months but sometimes years. The virus is passed to humans by two species of mosquito of the genus Aedes: A. albopictus and A. aegypti. The strain of Chikungunya spreading to the US from the Caribbean is most easily spread by A. aegypti.

58. (d)

"Afghan-India Friendship Dam is a multipurpose project planned for generating 42 MW of power, irrigating 75000 hectares of land, water supply and other benefits to the people of Afghanistan. Salma Dam is a landmark infrastructure project undertaken by Government of India on river Hari Rud, in Herat province of Afghanistan.

The project was executed and implemented by WAPCOS Ltd., a Government of India Undertaking under Ministry of Water Resources, River Development and Ganga Rejuvenation."

59. (c)

In 1999, National Agriculture Insurance Scheme was launched. This scheme was open to all farmers but was made compulsory for loaner farmers.

Pradhan Mantri Fasal Bima Yojana (PMFBY) is the new crop damage insurance scheme that has been approved by the Union Cabinet in January 2016. It is open to all farmers but not mandatory to anyone. The farmers' premium has been kept at a maximum of 2 per cent for food grains and up to 5 per cent for annual commercial horticulture crops. This scheme provides full coverage of insurance. It also covers the localized risks such as hailstorm, landslide, inundation etc. Earlier schemes did not cover inundation. It provides post-harvest coverage.

The NAIS did not cover while the modified NAIS covered only coastal regions. Under PMFBY all farmers including sharecroppers and tenant farmers growing the notified crops in the notified areas are eligible for coverage.

Coverage of Crops under PMFBY are: 1) Food crops (Cereals, Millets and Pulses) 2) Oilseeds 3) Annual Commercial/Annual Horticultural crops

60. (d)

The primary objective of the PMGSY is to provide Connectivity, by way of an All-weather Road (with necessary culverts and cross-drainage structures, which is operable throughout the year), to the eligible unconnected Habitations in the rural areas, in such a way that all Unconnected Habitations with a population of 1000 persons and above and all Unconnected Habitations with a population of 500 persons and above are covered.

With respect to the Hill States (North-East, Sikkim, Himachal Pradesh, Jammu & Kashmir, Uttaranchal) and the Desert Areas (as identified in the Desert Development Programme) as well as the Tribal (Schedule V) areas, the objective would be to connect Habitations with a population of 250 persons and above.

62. (d)

The Indira Gandhi Matritva Sahyog Yojana

It is a conditional cash transfer scheme applicable to pregnant and lactating women of ages 19 and above for up to 2 living children.

All women are eligible, unless they have already received paid leave and maternity benefits from their employers in the private or government sector.

The scheme is aimed at arresting high maternal mortality rates by encouraging institutional delivery and ensuring proper nutrition for the mother and child.

63. (c)

It's a health insurance scheme to provide coverage against several critical illnesses.

Aim : To make quality health care affordable to every individual member of a family in the state.

It will offer coverage against 437 illnesses in six disease groups, namely, cardio-vascular, cancer, kidney, neo-natal, neuro-logical conditions and burns.

Both Below Poverty Line (BPL) and Above Poverty Line (APL) families, with annual income below Rs 5 lakh, are eligible for the scheme.

A separate society will also be set up under the Department of Health and Family Welfare which will be responsible for administration of the scheme.

64. (b)

In its simplest expression, a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive.

Organic Farming involves the use of bio-fertilizers and hence reduces the usage of hydrocarbons used in fertilizer manufacturing (Naphtha and Natural Gas). Solar Energy, Nuclear energy and electric vehicles are part of Green economy.

65. (c)

It was governance-cum-social engineering measure which was enacted on November 8, 2016. The two largest denomination notes, Rs 500 and Rs 1000; together comprising 86 percent of all the cash in circulation-were "demonetized" with immediate effect, ceasing to be legal tender except for a few specialized purposes.

These notes were to be deposited in the banks by December 30, while restrictions were placed on cash withdrawals. In other words, restrictions were placed on the convertibility of domestic money and bank deposits.

The aim of the action was fourfold that is to curb corruption, counterfeiting, the use of high denomination notes for terrorist activities, and especially the accumulation of black money, generated by income that has not been declared to the tax authorities.

66. (a)

LEDs use significantly less energy than even CFLs, and do not contain mercury, phosphorous and sulphur. But LEDs contain lead, arsenic and a dozen other potentially dangerous substances like nickel. It also contains copper.

Some of the worst offenders were low-intensity red LEDs, which were found to contain up to eight times the amount of lead, a known neurotoxin.

68. (d)

Researchers in India have found that mice and rats exposed to endosulphan suffer from DNA damage and genomic instability, and impaired DNA damage response.

Endosulfan is used as an insecticide on a variety of crops, including many food crops such as teas, grains, fruit, vegetables, and also on non-food crops such as tobacco and cotton. It is also used as a wood preservative.

Endosulfan is an off-patent organochlorine insecticide and acaricide that is being phased out globally. The Stockholm Convention's Persistent Organic Pollutants Review Committee (POPRC) in 2009 agreed that endosulfan is a persistent organic pollutant and that global action is warranted; setting the stage (but not legal ban) of a global ban but still use and manufactured country specifically.

The Supreme Court of India banned manufacture, sale, and use of toxic pesticide endosulfan in India in 2011.

70. (a)

Unlike the burning of coal, which releases sulphur and mercury, biomass burning does not release them. It however releases nitrogen contained within the biomass.

72. (b)

Effects of Depletion of the Ozone Layer:

With the depletion of ozone layer, more UV radiation filters into troposphere. UV radiations lead to ageing of skin, cataract, sunburn, skin cancer, killing of many phyto-plankton, damage to fish productivity etc. It has also been reported that plant proteins get easily affected by UV radiations which leads to the harmful mutation of cells.

It also increases evaporation of surface water through the stomata of the leaves and decreases the moisture content of the soil. Increase in UV radiations damage paints and fibres, causing them to fade faster.

73. (b)

BOD refers to the amount of oxygen that would be consumed if all the organic matter in one litre of water were oxidized by bacteria. Thus higher the BOD higher is the organic impurities in the water. Hence water is treated till the BOD is reduced.

75. (d)

Grassoline:

a. It is a sustainable energy resource, a biofuel derived from grass that could power aircraft.

b. The grass is pre-treated to improve its biodegradability and then bacteria are added which convert the sugars in the grass into lactic acid.

c. This lactic acid can serve as an intermediate chemical to produce other compounds such as biodegradable plastics (PLA) or fuels.

d. The lactic acid is then converted into caproic acid, which is further converted into Decane which can be used in aviation fuel.

e. Right now the amount of biofuel that can be made from grass is still limited to a few drops.

f. The current process is very expensive, and engines should be adapted to this new kind of fuel.

77. (d)

It moves west to east in equatorial plane.

It revolves at 22,236 miles (35,786 kilometers) above Earth's surface.

78. (c)

Near Field Communications (NFC) is a short-range wireless connectivity technology that provides intuitive, simple and safe communication between electronic devices. Communication occurs when two NFC-compatible devices are brought within four centimeters of each other.

Data transfer rates are slow as compared to conventional broadband internet.

Benefits of NFC for Individuals:

1. Contactless Payments
2. Information Sharing
3. Transportation
4. Health Care
5. Social Networking

79. (a)

Google is to roll out a comprehensive public Wi-Fi platform in India, as part of its bid to get more people using its services. Dubbed as Google Station, the service will see Wi-Fi hotspots rolled out in stations, with plans to expand this to shopping malls and cafes at some point.

80. (b)

PSLV is a four-staged launch vehicle with first and third stage using solid rocket motors and second and fourth stages using liquid rocket engines.

83. (a)

ICANN:

It is a not-for-profit partnership of people from all over the world dedicated to keeping the Internet secure, stable and interoperable. It promotes competition and develops policy on the Internet's unique identifiers.

It doesn't control content on the Internet. It cannot stop spam and it doesn't deal with access to the Internet. But through its coordination role of the Internet's naming system, it does have an important impact on the expansion and evolution of the Internet.

84. (d)

Applications of GPS:

Civilian Applications

Navigation – Used by navigators for orientation and precise velocity measurements.

Geotagging – Map overlays can be created by applying location coordinates to photographs and other kind of documents.

Surveying – Surveyors create maps and verify the boundaries of the property.

Map-making – Used by civilians and military cartographers.

Tectonics – Detect the direct false motion measurement in earthquakes.

Military Applications

Navigation – Soldiers can find objectives in the dark and unknown regions with the help of GPS.

Search and Rescue – Knowing the position of a downed pilot, its location can be traced out easily.

Reconnaissance – Patrol movement can be handled.

Target tracking – Military weapon systems use GPS to track air targets and potential ground before they are flagged as hostile.

Missile and projectile guidance – Targets military weapons such as cruise missiles, precision – guided munitions.

85. (c)

$$\lim_{n\to\infty}\left(\frac{1}{n^4+1}+\frac{8}{n^4+1}+\cdots+\frac{n^3}{n^4+1}\right)$$

$$= \lim_{n\to\infty}\frac{1}{n^4+1}\sum_{k=1}^{n}n^3$$

$$= \lim_{n\to\infty}\frac{1}{n^4+1}\left[\frac{n^2(n+1)^2}{4}\right]$$

$$= \lim_{n\to\infty}\frac{\left(1+\frac{1}{n}\right)^2}{4\left(1+\frac{1}{n^4}\right)}$$

$$= \frac{1}{4}$$

86. (d)

$$a + b + c = 18$$

$$\Rightarrow \frac{a}{3}+\frac{a}{3}+\frac{a}{3}+\frac{b}{2}+\frac{b}{2}+c = 18$$

Now, A.M $\geq$ G.M

$$\frac{18}{6} \geq \left(\frac{a^3b^2c}{108}\right)^{1/6}$$

Hence, maximum value of $a^3 b^2 c$ is 78732

87. (c)

$f(x, y, z) = x^2y + 9xy^2 + 10z^2$

$$\nabla f = \left(2xy+9y^2\right)\hat{i}+\left(x^2+18xy\right)\hat{j}+(20z)\hat{k}$$

Given point is (1, – 2, – 1)

$$\nabla f \equiv 32\hat{i}-36\hat{j}-20\hat{k} \text{ at } (1, -2, -1)$$

$$\frac{df}{ds} = \left(32\hat{i}-36\hat{j}-20\hat{k}\right)\frac{\left(2\hat{i}-\hat{j}-2\hat{k}\right)}{\sqrt{5}}$$

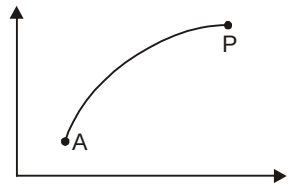
$$= \frac{64+36+40}{\sqrt{5}}$$

$$= \frac{140}{\sqrt{5}}$$

88. (c)

Stream function is defined by

$$\psi = \int_A^P (u\,dy - v\,dx)$$



or, $\vec{v} = \frac{\partial \psi}{\partial y}\hat{i} - \frac{\partial \psi}{\partial x}\hat{j}$

by option matching, we get, answer to be 3 xy

89. (c)

By cauchy's integral formula

$$f(a) = \frac{1}{2\pi i}\oint \frac{f(z)}{(z-a)}dz$$

Also 2 lies inside $|z| = 4$

By comparison $f(z = 2z^2 - z - 2$

$$\therefore\ g(2) = 2\pi i\ f(2)$$

$$= 2\pi i\ [8 - 2 - 2]$$

$$= 8\pi i$$

90. (b)

This problem can be solved by exact differential method.

$M = 3y^3\ e^{3xy} - 1$

$My = 9y^2\ e^{3xy} + 9xy^3\ e^{3xy}$

$N = 2y\ e^{3xy} + 3xy^2\ e^{3xy}$

$Mx = 9y^2\ e^{3xy} + 9xy^3\ e^{3xy}$

$\therefore$ It is exact

$$\varphi(x, y) = \int (3y^3 e^{3xy} - 1)dx$$

$$= y^2\ e^{3xy} - x + h(y) \quad ...(1)$$

Differentiating (1) w.r.t. y and comparing to N, we get

$$h(y) = 0$$

$\Rightarrow$ $h(y) =$ constant

Therefore solution is,

$$y^2 e^{3xy} - x = c$$

Applying the given condition,

$$c = 1$$

$\therefore$ Final solution is $\boxed{y^2 e^{3xy} - x = 1}$

92. (b)

$$Y = \frac{(s^2 - 3s + 1)}{(s-1)^3} + \frac{2}{(s-1)^6}$$

$$= \frac{1}{s-1} - \frac{1}{(s-1)^2} - \frac{1}{(s-1)^3} + \frac{2}{(s-1)^6}$$

$$Y = e^t - te^t - \frac{t^2 e^t}{2} + \frac{t^5 e^t}{60}$$

93. (d)

$$\begin{bmatrix} \omega & \omega^2 \\ 1 & \omega \\ \omega^2 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \end{bmatrix} \times \begin{bmatrix} 1 \\ \omega \\ \omega^2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

94. (b)

Coin has 1/2 probability of getting heads,

$\therefore$ $P(H) = 0.5$

$P(x = 3) = {}^4C_3(0.5)^3(0.5)^1$

$= \frac{1}{4}$ [Binominal distribution]

96. (d)

For successful safety program within an organization the safety responsibility does not rest only with the safety group alone but also with group such as production, personnel, R&D, plant engineering, purchasing, records, employee relations, legal, plant maintenance, medical and security.

97. (b)

Platinum is used in thermometer due to following favourable features :

It resistance increase uniformly with rise in temperature 200°C to 1200°C and because of this it offers a high accuracy in temperature measurement.

Statement II tells about behaviour of it beyond 1200°C.

98. (b)

In sealant material, co-efficient of thermal and electrical expansion must be considered. Because of this Ferrous alloys containign 35 to 45% Ni with slight addition of Si, Oo, Mn is used. So, Statement I is correct but Statement II tells about the reason for using Si, Mo, Mn not about co-efficient expansion. So, it is not correct explanation of I but it is true.

100.(a)

TV transmission satellite is in a geo-stationary orbit. Geostationary orbits can only be accomplished with equatorial orbits, and since India is in the northern hemisphere this means the satellite will always be in south direction.

Very few communication satellites use polar orbits, or any orbit inclined out of the equatorial plane for that matter, to prevent the need for constant reaming of the receiver dish.