Mock Test 1

Number of Questions: 65 **Total Marks: 100**

Wrong answer for MCQ will result in negative marks, (-1/3) for 1 Mark Questions and (-2/3) for 2 Marks Question.

General Aptitude

Number of Questions: 10 **Section Marks: 15**

Direction for question 1: Fill in the blank with the suitable word/phrase:

1. There are _____candidates opting for Home Science today as a course of study at the college level.
(A) smaller (B) less
(C) fewer (D) lesser

Directions for questions 2 and 3: Select the correct alternative from the given choices.

2. The average weight of a class increases by 1 kg, when *A* joins the class. Later when *B* also joins, the average weight further increases by 1/2 kg. If the number of students now in the class is 14, the difference in the weights of *A* and *B* _____.

3. Every Saturday evening from 6 pm to 7 pm a game known as "FAMILY FORTUNES" is telecast on 'XTV' channel. The mode of the game is as follows.
A table containing prices of different articles is present on the monitor. The anchor asks questions regarding the prices of different articles. If you are able to answer these questions correctly, the corresponding article is yours.
Be the lucky winner by answering the questions that follow the table given below:

2500	3000	1500	3500
2750	1750	3200	2800
2400	3600	4000	2200
1800	1200	1600	2250
3800	3400	3100	2000

A discount of 10% is offered on 'Ultra Microwave Oven' and in the above price table, the list price and the sale price of the above said article are adjacent to each other, not necessarily in the same order. What is its sale price?
(A) `4000 (B) `3600
(C) `1800 (D) `2000

Direction for question 4: Select the statement in which the underlined word is used correctly:

4. (A) These insects **adapted** themselves very easily to new environments.
(B) That woman has **adapted** a child from an orphanage.
(C) That Telugu family **immigrated** to Australia last year.
(D) People who have **emigrated** to the U.S have had to deal with tougher labour laws.

Directions for question 5: Select the correct alternative from the given choices.

5. In a certain code language, if REPTILE is coded as 49 and CROCODILE is coded as 81, then how is ALLIGATOR coded in that language?
(A) 95 (B) 100
(C) 49 (D) 81

Direction for question 6: Out of the following four sentences, select the most suitable sentence with respect to grammar and usage:

6. (A) We took a month and a few days to get acclimated to our new teacher, who is from Baroda.
(B) We will take month and few days to get acclimated to our new teacher, who is from Baroda.
(C) We have taken month and a fewer days to get acclimated to our new teacher, who is from Baroda.
(D) We took a month few days to get acclimated to our new teacher, who is from Baroda.

Directions for question 7: Select the correct alternative from the given choices.

7. If $|x| < 1$ and $1 + 3x + 5x^2 + 7x^3 + 9x^4 + \ldots\infty = 3$, find x.
(A) 1/2 (B) 1/3
(C) 1/4 (D) 1/5

Direction for question 8: In the following question, the first and the last sentences of a passage are in order and numbered 1 and 6. The rest of the passage is split into 4 parts and numbered as 2, 3, 4 and 5. These 4 parts are not arranged in the proper order. Read the sentences and arrange them in a logical sequence to make a passage and choose the correct sequence from the given order:

8. (1) A classic example of how the "get what you want by helping others get what they want" approach works is the result that a major automaker got when it came out with a new design.
(2) After all, the person turning the wrench knows more about the way it really works on the assembly line than the engineers who designed the wrench.

(3) Before making these changes, the management asked the employees who would actually be building the new vehicles whether they had any ideas for making the assembly lines more effective.
(4) The workers had dozens of marvelous ideas.
(5) This design necessitated the construction of new plants and the retooling of existing ones.
(6) First, the employees explained that when they had to go down the steps into the pit to work on the underside of a car, they sometimes slipped and fell, injuring themselves.

(A) 5, 3, 4, 2 (B) 3, 4, 2, 5
(C) 2, 5, 4, 3 (D) 4, 3, 2, 5

Directions for questions 9 and 10: Select the correct alternative from the given choices.

9. In a parking lot six buses are parked in front of bus number 25 and fifteen buses are parked behind bus number 45. If six buses are parked between bus numbers 25 and 45, then how many buses are there in the parking lot?

(A) 29 (B) 26
(C) 15 (D) Cannot be determined

10. Jane Davis, founder of Get Into Reading, which has helped Clare Ross so much, discovered the healing power of books by accident. An English lecturer at Liverpool University, England, she also taught literature courses in her community. In the process she discovered that people derived consolation from great writers and the support network the group provided. So she set up Get Into Reading, which now has more than 135 groups.

Which of the statement(s) below is/are logically valid and can be inferred from the above statements?

(i) Reading gives multiple benefits, both unexpected and wholesome.
(ii) Reading helps everyone to set up an association like Get Into Reading.
(iii) Reading is just a waste of time which makes one hope for an unattainable goal.
(iv) Reading gives not only help from great writers but also support from other sources.

(A) (i) and (iii) (B) (i) and (iv)
(C) (ii) and (iii) (D) (ii) and (iv)

MECHANICAL ENGINEERING

Direction for questions 1 to 55: Select the correct alternative from the given choices

11. If $z = x + iy$ is a complex number, then the complex mapping $w = \frac{1}{z}$ maps the points in the interior of the circle $|z| = 4$ to the _____

(A) points in the exterior of the circle $|w| = \frac{1}{4}$
(B) points in the interior of the circle $|w| = \frac{1}{4}$
(C) points in the exterior of the circle $|w| = \frac{1}{16}$
(D) points in the interior of the circle $|w| = \frac{1}{16}$

12. The order of convergence of secant method in the process of finding a root of the equation $f(x) = 0$ is ____

13. The order and degree of the differential equation $\frac{d^3y}{dx^3} + 2xy^2 = (2x - 3\frac{dy}{dx})^{5/4} - \sqrt{xy}$ respectively are

(A) 3 and 1 (B) 3 and 4
(C) 3 and 5 (D) 5 and 3

14. The unit outward drawn normal to the surface $z = x^2 + y^2 - 25$ at the point P (4, 2, –5) is ____

(A) $\frac{1}{3}(4i + 3\bar{j} - \bar{k})$ (B) $\frac{1}{6}(8i + 4\bar{j} - 2\bar{k})$
(C) $\frac{1}{9}(8i + 4\bar{j} - \bar{k})$ (D) $\frac{1}{9}(8i + \bar{j} + 4\bar{k})$

15. The value of $\underset{x \to 2}{Lim} \frac{(x^3 - 2x^2 - 9x + 18)}{(x^4 - 5x^2 + 4)}$ is _____

16. A statically determinate plane truss has seven (7) number of joints (j) in it. The number of members (m) in the truss is

(A) 10 (B) 11
(C) 12 (D) 9

17. Poisson's ratio of an elastic material is 0.35. The ratio of bulk modulus to modulus of elasticity is _____.

18. The device which can convert a rotational motion into a translational motion is

(i) Rack and pinion gears
(ii) Double helical gears
(iii) Scotch Yoke mechanism
(iv) Oldham coupling
(v) Worm gears

The correct answer is

(A) (i) and (iv) (B) (i) and (v)
(C) (i) and (iii) (D) (ii) and (iii)

19. The upper critical temperature of steel

(A) depends on the rate of heating
(B) is constant
(C) varies according to the carbon content in the steel
(D) None of the above

20. The maximum acceleration of a point mass, executing simple harmonic motion at a frequency of 10 Hz, is 79 m/s^2. The amplitude of oscillation (in mm) is _____ .

21. Catalog rating of a roller bearing is 15 kN. If the bearings are rated for a life of 10^6 revolutions, life of the bearing for the design load of 2 kN (in million revolutions) is _____ .

22. With the increase in temperature, the thermal conductivity of gases and non-metallic liquids (with the exception of water) respectively

(A) decreases, decreases (B) decreases, increases
(C) increases, increases (D) increases, decreases

23. A reversed Carnot cycle refrigerator is used to maintain a temperature of −6°C. The refrigerator absorbs heat at a rate of 2.5 kJ/s. If the atmospheric temperature is 33°C, power (in watt) required to pump out this heat is _____ .

24. If a flow field is having only convective acceleration, then the flow is

(A) an unsteady non-uniform flow
(B) a steady non-uniform flow
(C) an unsteady uniform flow
(D) a steady uniform flow

25. Examine the following statements given below

(i) Reynold's number is the ratio of buoyancy to viscous force.
(ii) Biot number is the ratio of momentum to thermal diffusivities.
(iii) Grashof number is the ratio of inertia force to viscous force.
(iv) Prandtl number is the ratio of internal thermal resistance to boundary layer thermal resistance.

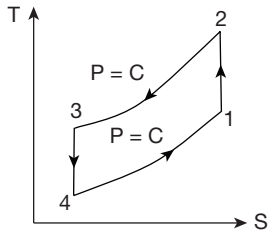
The number of correct statement(s) in the above list is

(A) 1 (B) 2
(C) 3 (D) 0

26. A Kaplan turbine can be used

(A) when head available in more than 100 m specific speed is between 300 and 500.
(B) when head available is less than 10 m and specific speed is between 300 and 500
(C) when specific speed is less than 100 and head available is more than 100 m
(D) when specific speed is less than 100 and head available is less than 10 m

27.



The temperature (T) entropy (S) diagram shown above represents a

(A) vapour compression cycle
(B) vapour absorption cycle
(C) reversed Carnot cycle
(D) reversed Brayton cycle

28. Total number of decision variables in the objective function of an assignment problem with n jobs and n machines is

(A) $2n - 1$ (B) n^2
(C) $2n$ (D) n

29. The probabilities of demand during lead time is given as follows

Demand (units)	60	70	80	75	85
Probability	0.20	0.18	0.22	0.19	0.21

Expected demand in number of units during lead time is _____ .

30. Preheating before welding is done to

(A) make steel softer
(B) prevent plate distortion
(C) prevent cold cracks
(D) burn away oil, grease etc

31. A slot is milled using a side and face milling cutter with 10 teeth and of diameter 150 mm. If the cutting speed is 110 rpm and feed is 0.25 mm/tooth, table feed in mm/min is

(A) 250 (B) 265
(C) 275 (D) 285

32. Material removal rate in electrochemical machining is based on

(A) Ohm's law (B) Kirchhoff's law
(C) Faraday's law (D) Fick's law

33. The effect of rake angle on the mean friction angle in machining can be explained by

(A) sticking and then sliding model friction
(B) sliding and then sticking model friction
(C) sliding model friction
(D) sticking friction

34. Match the terms used in connection with heat treatment of steel (Group A) with microstructural/physical characteristics (Group B)

Group A

P. Pearlite
Q. Martensite
R. Austenite
S. Eutectoid

Group B

I. Extremely hard and brittle phase
II. Alternate layers of cementite and ferrite
III. Equilibrium between 3 solid phases
IV. Can exist only above 723°C

V. Equilibrium between one liquid and two solid phases

(A) P - I, Q - II, R - V, S - IV
(B) P - I, Q - II, R - IV, S - V
(C) P - II, Q - I, R - IV, S - V
(D) P - II, Q - I, R - IV, S - III

35. In a rolling process, maximum reduction in thickness of the metal sheet rolled depends upon
P – strength of the work material
Q – roll radius
R – roll velocity
S – coefficient of friction
T – strain
(A) Q, S (B) Q, P
(C) R, S (D) Q, R

Questions 26 to 55 carry Two Marks each.

36. If $f(t) = 4 \sin^2 3t$, then the Laplace Transform of $\frac{f(t)}{t}$ is

(A) $\ln\left(\frac{s^2}{s^2+36}\right)$ (B) $\ln\left(\frac{s^2+36}{s^2}\right)$

(C) $\ln\left(\frac{s}{s^2+9}\right)$ (D) $\ln\left(\frac{s^2+9}{s}\right)$

37. The value of $\int_0^3 \frac{dx}{(4x+5)}$, when evaluated by Simpson's Rule with step size $h = 0.5$ is
(A) 0.4352 (B) 0.4765
(C) 0.3061 (D) 0.3846

38. A stationary value of a function $f(x)$ is a value of x, where $f^1(x) = 0$. The number of distinct stationary values of $f(x) = 8x^5 - 15x^4 + 10x^2$, where $f(x)$ has neither maximum nor minimum is ____

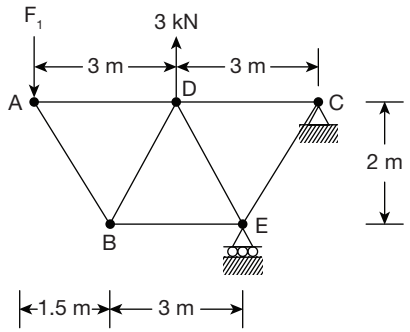
39. If X is a random variable that follows rectangular distribution in [1, 9], then the ratio of the mean and variance of X is ____.
(A) 15 : 16 (B) 3 : 4
(C) 2 : 3 (D) 1 : 2

40. Which of the following statements is/are NOT TRUE?
I. The product of two symmetric matrices A and B is symmetric if and only if $AB - BA = O$
II. The product of two skew–symmetric matrices A and B is skew–symmetric if and only if $AB + BA = O$
III. The eigenvectors corresponding to two distinct eigenvalues of a matrix are linearly independent
IV. The eigenvectors corresponding to two distinct eigenvalues of a real symmetric matrix are orthogonal
(A) Only (I) (B) Only (II)
(C) Both (III) and (IV) (D) None of these

41. When a shaft was subjected to pure torsional moment, maximum shear stress developed in the shaft was 80 MPa. The yield and ultimate strengths of the shaft material in tension are 300 MPa and 450 MPa respectively. Using maximum distortion theory, the factor of safety is_____.

42. A cylindrical pressure vessel of 300 cm diameter is subjected to an internal pressure of 2 MPa. If the maximum permissible working stress is restricted to 160 MPa, the minimum wall thickness of the vessel for safe design (in mm) is_____.

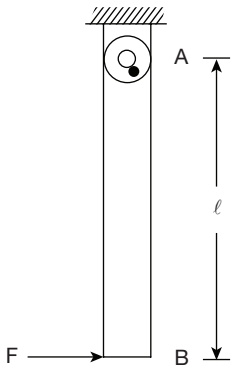
43.



For the truss shown in figure, the force (in kN) in member BD is 11.25 (tension). The load F1 (in kN) is
(A) 9 (B) 3
(C) 13.5 (D) 11.25

44. A 19 tooth pinion meshes with a 37 tooth gear. If the gears are twenty degree full depth involute profiled and with 5 mm module, the centre distance between the gear and pinion is
(A) 300 mm (B) 280 mm
(C) 160 mm (D) 140 mm

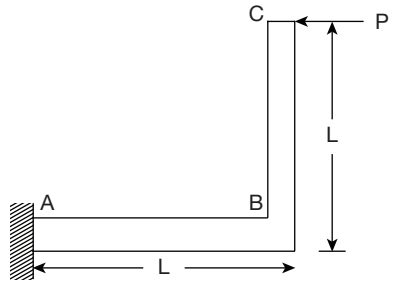
45.



A thin uniform rod AB of mass m and length ℓ is hinged at end A and hanging vertically as shown in figure. The hinge A is smooth. At the instant when a horizontal force F is applied at end B of the rod, the magnitude of horizontal reaction developed at hinge A is
(A) zero (B) F
(C) $\frac{F}{2}$ (D) $\frac{3F}{2}$

46. A bolt of major diameter 12 mm is used to clamp two steel plates. The grip length of the bolt includes 32 mm of the threaded portion and 8 mm of the unthreaded portion. Cross sectional area of the threaded portion is 84.2 mm^2. Modulus of elasticity of the material is 2×10^5 MPa. Effective stiffness of the bolt (in MN/m) in the clamped zone is _____ .

47.

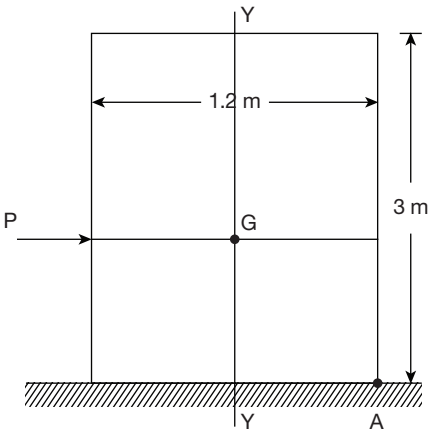


A L-shaped frame subjected to a load P is shown in the figure. The frame has a constant flexural rigidity EI. Neglecting the effect of axial loading, deflection at the point C is

(A) $\frac{4}{3}\frac{PL^3}{EI}$ (B) $\frac{PL^3}{3EI}$

(C) $\frac{2}{3}\frac{PL^3}{EI}$ (D) $\frac{1}{3}\frac{PL^3}{EI}$

48.



A steel almirah (of mass 200 kg, height 3 m, width 1.2 m, depth 1 m), symmetric about $Y - Y$ axis stands on a rough level floor as shown in figure. When horizontal force P was applied at mid height of the almirah, it is about to tip about point A without slipping. The minimum value of force P(in newton) and minimum value of coefficient of friction (μ) between floor and almirah are respectively.

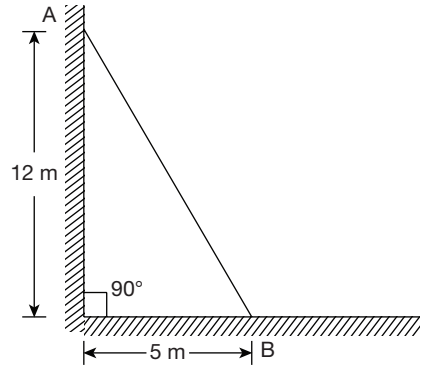
(A) 981 and 0.5 (B) 785 and 0.4

(C) 200 and 0.3 (D) 785 and 0.6

49. On a flywheel of mass moment of inertia 30 kg-m^2 about its axis of rotation, a constant torque T produces a change in angular speed from 15 rad/s to 20 rad/s in one-quarter of a rotation. The magnitude of the torque T (in N/m) is _____ .

50. A single degree of freedom system has a mass of 2 kg, stiffness 18 N/m and viscous damping ratio 0.03. The dynamic magnification factor at an excitation frequency of 2 rad/s is _____

51.



A ladder AB is leaning against a rough vertical wall and placed on a rough horizontal floor. At the position shown, it is just on the verge of slipping. The coefficient of static friction for all contact surfaces is 0.2 and the weight of ladder is 500 N. The frictional force (in N) on the end A at that instant is _____ .

52. A closed system contains 14 kg of saturated liquid nitrogen at 12°C. The entropy of the saturated liquid is 0.865 kJ/kg K. In order to convert this saturated liquid into saturated vapour at constant pressure, heat addition of 13.6 MJ is required. The entropy (in kJ/kg K) of the saturated vapour is .

53. A steady heat flux of 3200 W/m^2 is required to be maintained through a plane wall, having a thermal conductivity of 1.21 W/m K. If the inner surface of wall is at 1225°C and outer surface is at 400°C, then the design thickness (in metre) of the wall is .

54. Consider the following statements with respect to streak line.

(i) Streak line is a curve which gives an instantaneous picture of location of fluid particles, which have passed through a given point.

(ii) In the case of steady flow a streak line coincides with a stream line always.

(iii) In the case of steady flow a streak line coincides with path line, if they orginate at same point.

(iv) A streak line can be described by the equation. $\frac{dx}{u} = \frac{dy}{v} = \frac{dz}{w}$

Which one of the following is the true combination of statements?

(A) (ii) and (iv) (B) (i), (ii) and (iii)

(C) (i) and (ii) only (D) (i) and (iii) only

55. Consider the velocity field represented by $\vec{V} = K\left(y\vec{i} + x\vec{k}\right)$

Rotation about z-axis is

(A) $\frac{K}{2}$ (B) $-\frac{K}{2}$

(C) K (D) $-K$

56. Water flows through a tube of diameter 30 mm at an average velocity of 1.5 m/s. The properties of water are $\rho = 1000$ kg/m^3, $\mu = 7.25 \times 10^{-4}$ N s/m^2, $k = 0.625$ W/m K, $Pr = 5.18$. Using $Nu = 0.023\, Re^{0.8} Pr^{0.4}$, the convective heat transfer coefficient (in W/m^2 K) is .

57. Air in a room is at 35°C. The relative humidity is 60%. Pressure in the room is 0.1 MPa. Saturation pressure of water at 35°C is 5.63 kPa. Specific humidity of the air (in gram/kg of dry air) is .

58. Steam with specific enthalpy (h) 3627 kJ/kg enters an adiabatic turbine operating at steady state with a flow rate of 12 kg/s. As it expands, at a point where h is 3153 kJ/kg, 3.5 kg/s of steam is extracted for heating purposes. The remaining steam further expands to the turbine exit, where h = 2291 kJ/kg. Neglecting changes in kinetic and potential energies, the net power output (in kW) of the turbine is .

59. Two long parallel surfaces, each of emissivity 0.6 are maintained at different temperatures and it is desired to reduce 80% of the radiation heat transfer between them by inserting thin parallel shields of equal emissivity on both sides. Then, the number of shields required is

(A) 4 (B) 5

(C) 3 (D) 8

60. In a compression ignition engine, the inlet air pressure is 1 bar and the pressure at the end of isentropic compression is 48.503 bar. The expansion ratio is 12. Assuming ratio of specific heats (γ) as 1.4, the air standard efficiency (in percent) is .

61. The precedence relations and duration (in days) of the activities of a project network are shown below. Total float and free float of the activity C, (in days) respectively are

Activity	Predecessors	Duration(days)
A	–	2
B	–	4
C	A	1
D	B	0
E	B	3
F	C, D	2
G	C, D	4
H	E, F	7

(A) 2, 2 (B) 2, 1

(C) 1, 1 (D) 2, 0

62. At a work station, 6 jobs arrive at every minute. The mean time spent on each job in the work station is $\frac{1}{8}$ minute. Expected waiting time for the job (in min) is .

63. A hole of nominal diameter 30 mm with tolerance ±0.016 mm is to be checked using a GO NO-GO plug gauge. If gauge tolerance is 10 % of work tolerance and no wear allowance is given, dimension of the GO plug gauge as per the bilateral tolerance system (in mm) is

(A) $29.984^{\pm 0.0016}$ (B) $29.9856^{\pm \frac{0.0016}{0.000}}$

(C) $29.9872^{\pm \frac{0.0016}{0.000}}$ (D) $29.9856^{\pm 0.0016}$

64. For a steel casting of 9 cm × 8 cm × 2 cm, a cylindrical riser of 6 cm diameter and 6 cm height was used. The solidification time for the casting was 1.384 minutes. Solidification time (in minute) for the riser is .

65. A cast iron block of 250 mm length is machined in a shaping machine with a feed of 0.3 mm/ stroke and depth of cut 3 mm. Specific energy consumption for the shaping machine is 1.5 J/mm^3. If number of cutting strokes is 60 per min., average power consumption (in watt) is.

Answer Keys

1. C	**2.** 5	**3.** B	**4.** A	**5.** D	**6.** A	**7.** B	**8.** A	**9.** A	**10.** B
11. C	**12.** 1.615 to 1.625	**13.** B	**14.** C	**15.** –0.44 to –0.39			**16.** B	**17.** 1.05 to 1.15	
18. C	**19.** C	**20.** 19.90 to 20.10		**21.** 824 to 826		**22.** D	**23.** 364 to 366		**24.** B
25. D	**26.** B	**27.** D	**28.** B	**29.** 71.5 to 76.5		**30.** C	**31.** C	**32.** C	**33.** B
34. D	**35.** A	**36.** B	**37.** C	**38.** 1	**39.** A	**40.** D	**41.** 2.1 to 2.2		
42. 18 to 19		**43.** A	**44.** D	**45.** C	**46.** 440 to 450		**47.** A	**48.** B	
49. 1670.50 to 1672.50			**50.** 1.785 to 1.805		**51.** 19.10 to 19.30		**52.** 4.200 to 4.300		
53. 0.300 to 0.320	**54.** D	**55.** B	**56.** 6300.00 to 6330.00				**57.** 21 to 22		
58. 13000 to 13050	**59.** A	**60.** 63.5 to 65.5		**61.** B	**62.** 0.35 to 0.40		**63.** A		
64. 2.9 to 3.1	**65.** 335 to 340								

Hints and Explanations

1. The grammatically correct choice is (*C*) "fewer". The reason is "fewer" is used when the noun is countable; "Less" is used for uncountable things, as illustrated in "there's less dust on the furniture today; there was less noise in the class, there is less milk in the fridge." "Smaller" and "lesser" are irrelevant. Choice (C)

2. Let the weight of *A* be *a* kg and that of *B* be *b* kg.
After *A* and *B* join, total number of students in the class is 14.
∴ Before *A* and *B* joined, the strength of the class was 12. If we assume that the average weight of the 12 students is n, then after *A* joins, it is $\frac{12n+a}{13}$

$\frac{12n+a}{13} = n+1,$

$\Rightarrow \quad 12n + a = 13n + 13 \qquad$ —— (1)

$\Rightarrow \quad a = n + 13$

After *B* joined, the average increases by 1/2.

$\therefore \quad \frac{12n+a+b}{14} = n + 1 + \frac{1}{2},$

$\Rightarrow \quad 12n + a + b = 14n + 14 + 7 \qquad$ —— (2)

(2) – (1) gives $b = n + 8$ and $a = n + 13$

$\therefore \quad a - b = 5.$ Ans: 5

3. Since 90% of 4000 = 3600 and both 3600 and 4000 are adjacent to each other the sale price of the article should be = ₹3600. Choice (B)

4. Sentences (*B*) to (*D*) are all wrong for several reasons. The grammatically correct sentence is (*A*). The verb "adapt" is rightly used and therefore it is syntactically correct. In sentence (*B*) the correct word is "adopt", not "adapt". Childless women or couples adopt others' child or children. In sentence (*C*) the appropriate word is "emigrated", not "immigrated". In sentence (*D*) the wrong word is "emigrated". The correct word is "immigrated". Choice (A)

5. The Number of letters in the word REPTILE is 7 and $7^2 = 49$. Similarly the number of letters in the word CROCODILE is 9 and $9^2 = 81$.
The number of letters in the word ALLIGATOR is 9 and $9^2 = 81$.
∴ 81 is the code for the word ALLIGATOR.
Choice (D)

6. The correct sentence with respect to grammar and usage is sentence (*A*). In sentences (*B*), (*C*) and (*D*) the article "*a*" is omitted before 'few' and that is what makes them wrong and unacceptable. Choice (A)

7. $S = 1 + 3x + 5x^2 + 7x^3 + 9x^4 + \ldots\ldots \rightarrow (1)$

$Sx = x + 3x^2 + 5x^3 + 7x^4 + \ldots\ldots \rightarrow (2)$

$(1) - (2) \Rightarrow S(1-x) = 1 + 2x + 2x^2 + 2x^3 \ldots\ldots\ldots\infty$

$= 1 + 2x(1 + x + x^2 + \ldots\ldots\infty)$

$= 1 + \frac{2x}{1-x}$

$S(1-x) = \frac{1+x}{1-x}$

$S = \frac{1+x}{(1-x)^2} = 3$

$3x^2 - 7x + 2 = 0$

$(3x - 1)(x - 2) = 0 \Rightarrow x = \frac{1}{3}$ (or) $x = 2$

But $|x| < 1 \Rightarrow x = \frac{1}{3}$

Choice (B)

8. Sentences (1) and (6) remain constant and unchanged while the following and preceding four sentences will be shuffled and rearranged in their proper and logical sequence. Sentence (1) says the passage illustrates how an approach was adopted by an automaker to arrive at a new design for an automobile. The new design entailed constructing new plants (5). In the second sentence (3) the management invited the employees' ideas. In the third sentence (4) the employees were forthcoming with their ideas. In the fourth sentence (2) the author agrees that the workers know better if the wrench works well or not. The logical sequence of the sentences is (A) 5, 3, 4, 2. Choice (A)

9. According to the given information the possible arrangement is as follows.
6 bus 25 6 bus 45 15
∴ The total number of buses in the parking lot is 29.
Choice (A)

10. The above short passage is exclusively about the varied and unforeseen benefits of reading. Though the benefits can be denied or disputed by some, they are nonetheless real and verifiable. The passage says reading provided healing power by accident to some people. Not only that, reading affords consolation and support to those who are sincerely devoted to reading. Belittling it is of no consequence. The answer choices are (i) and (iv), that is (B). Choice (B)

11. We have $w = \frac{1}{z} \rightarrow (1)$

Let $w = u + iv \Rightarrow |w| = \sqrt{u^2 + v^2}$

$\therefore \quad w = \frac{1}{z} \Rightarrow z = \frac{1}{w}$

The interior of the circle $|z| = 4$ is $|z| < 4$

$\therefore \quad |z| < 4 \Rightarrow \left|\frac{1}{w}\right| < 4 \Rightarrow \frac{1}{|w|} < 4$

$\Rightarrow \quad |w| > \frac{1}{4}$

$\Rightarrow \quad \sqrt{u^2+v^2} > \frac{1}{4}$

$\Rightarrow \quad u^2+v^2 > \frac{1}{16}$

Hence the interior points of $|z| = 4$ are mapped to the exterior points of the circle $|w| = \frac{1}{16}$

Choice (C)

12. Standard Result Ans: 1.615 to 1.625

13. Given differential equation is $\frac{d^3y}{dx^3} + 2xy^2$

$= (2x - 3\frac{dy}{dx})^{5/4} - \sqrt{xy} \rightarrow (1)$

$\Rightarrow$ Order of (1) = The order of the highest ordered derivative
= 3
Rewriting (1),

$$\frac{d^3y}{dx^3} + 2xy^2 + \sqrt{xy} = \left(2x - 3\frac{dy}{dx}\right)^{\frac{5}{4}}$$

$$[\frac{d^3y}{dx^3} + 2xy^2 + \sqrt{xy}\,]^4 = [2x - 3\frac{dy}{dx}]^5 \rightarrow (2)$$

$\therefore$ The degree of (1) = The degree of $\frac{d^3y}{dx^3}$ in (2) = 4

$\therefore$ Order is 3; degree is 4. Choice (B)

14. Given surface is $z = x^2 + y^2 - 25$
i.e., $x^2 + y^2 - z - 25 = 0$
Let $f(x, y, z) = x^2 + y^2 - z - 25 = 0$
The normal to the surface $f(x, y, z) = 0$ is ∇f = grad

$$f = \frac{\partial f}{\partial x}i + \frac{\partial f}{\partial y}\bar{j} + \frac{\partial f}{\partial z}\bar{k} = 2x\,i + 2yj - \bar{k}$$

$\therefore$ The normal to the surface $f(x, y, z) = 0$ at $P(4, 2, -5)$ is
∇f at $P(4, 2, -5) = (8i + 4j - \bar{k})$

$\therefore$ The unit outward drawn normal to the surface is

$$\frac{\nabla f}{\nabla f} = \frac{8i + 4\bar{j} - \bar{k}}{\sqrt{8^2 + 4^2 + (-1)^2}} = \frac{1}{9}(8i + 4\bar{j} - \bar{k})$$

Choice (C)

15. We have $\underset{x \to 2}{Lim} \frac{(x^3 - 2x^2 - 9x + 18)}{(x^4 - 5x^2 + 4)}$

$= \underset{x \to 2}{Lim} \frac{(3x^2 - 4x - 9)}{(4x^3 - 10x)}$ (By L Hospital's Rule)

$= \frac{-5}{12} = -0.4167$ Ans: –0.44 to –0.39

16. For a statically determinate plane truss $m = 2j - 3$
$= 2 \times 7 - 3 = 11$. Choice (B)

17. Poisson's ratio $\mu = 0.35$
$E = 3K(1 - 2\mu)$
where E = modulus of elasticity and K = bulk modulus

$\therefore \quad \frac{K}{E} = \frac{1}{3(1-2\mu)} = \frac{1}{3(1-2\times 0.35)} = 1.11.$

18. Rack and pinion can convert rotational motion into translational motion. Also Scotch-Yoke mechanism, which is an inversion of double slider crank chain, can also convert rotational motion into linear SHM.
Choice (C)

19. The upper critcal temperature decreases upto the evtectoid point where it is minimum and then increases.
Choice (C)

20. When acceleration is maximum,

$a = A\omega^2 \rightarrow A = \frac{a}{\omega^2} = \frac{a}{(2\pi f)^2}$

$= \frac{79}{(2\pi \times 10)^2} = 0.02\,\text{m} = 20\,\text{mm}.$ Ans: 19.90 to 20.10

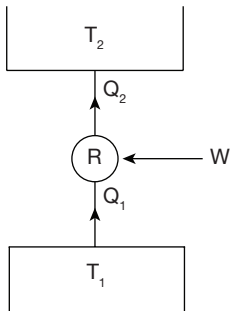
21. For roller bearings $\frac{L_2}{L_1} = \left(\frac{P_1}{P_2}\right)^{\frac{10}{3}}$ where L = life and P = load

$\therefore \quad \frac{L_2}{10^6} = \left(\frac{15}{2}\right)^{\frac{10}{3}}$

$\Rightarrow \quad L_2 = 825.79 \times 10^6 = 825.79$ million rev.

22. For gases, $K\ \mu\ \sqrt{\frac{T}{M}}$, where T = absolute temperature of gas and M = molar mass of gas. Hence K for gases increase with increase in temperature. However, for non-metallic liquids, thermal conductivity tends to decrease with increase in temperature, exception being water. The thermal conductivity of water, in general, with the rise in temperature may increase or decrease depending on temperature. Choice (D)

23.



$T_1 = 273 - 6 = 267$ K
$T_2 = 273 + 33 = 306$ K

$Q_1 = 2.5$ kJ/s $= 2.5 \times 10^3$ W

$$\text{COP} = \frac{T_1}{T_2 - T_1} = \frac{\text{Refrigerating effect/s}}{\text{Work done/s}}$$

$$\therefore \quad \frac{267}{33-(-6)} = \frac{2.5\times10^3}{P}$$

$\Rightarrow \quad P = 365.17$ W.

24. $a_x = u\,\dfrac{\partial u}{\partial x} + v\dfrac{\partial u}{\partial y} + w\dfrac{\partial u}{\partial z} + \dfrac{\partial u}{\partial t}$

$\dfrac{\partial u}{\partial t}$ is local acceleration and the remaining terms correspond to convective acceleration. If local acceleration is zero, the flow is steady and if convective acceleration is zero, the flow is uniform. So the given flow field is non-uniform and steady. Choice (B)

25. None of the given statements are correct. Reynold's number is ratio of inertia force to viscous force.
Biot number is ratio of internal thermal resistance to boundary layer thermal resistance.
Grashof number is ratio of buoyancy force to viscous force. Prandtl number is ratio of momentum to thermal diffusivities. Choice (D)

26. Kaplan turbine is best suited for low heads and high specific speeds. Choice (B)

27. Choice (D)

28. $\ln\left(\dfrac{S^2}{S^2+36}\right)^{-1}$ Choice (B)

29. Expected demand

$$= \frac{(60\times0.20)+(70\times0.18)+(80\times0.22)+(75\times0.19)+(85\times0.21)}{0.20+0.18+0.22+0.19+0.21} = 74.3 \text{ units.}$$

30. Choice (C)

31. Table feed, $F = f_t \times z \times N$
where f_t = feed / tooth
z = No. of teeth
N = r.p.m
$\therefore \quad F = 0.25 \times 10 \times 110$
$= 275$ mm/min. Choice (C)

32. Choice (C)

33. Choice (B)

34. Choice (D)

35. $h = \mu^2 R$ Choice (A)

36. Given $f(t) = 4\cos^2 3t$

$$\therefore \quad L\left[\frac{f(t)}{t}\right] = L\left[\frac{4\cos^2 3t}{t}\right] = L\left[\frac{2(1+\cos 6t)}{t}\right]$$

$$= 2\int_s^\infty L[1+\cos 6t]\,ds = 2\int_s^\infty \left(\frac{1}{s} + \frac{s}{s^2+36}\right) ds$$

$$= \int_s^\infty \left(\frac{2}{5} + \frac{2s}{s^2+36}\right) ds$$

$$= 2\ln s + \ln(s^2+36)]_s^\infty$$

$$= \ln s^2 + \ln(s^2+36)]_s^\infty$$

$$= \ln\left(\frac{s^2}{s^2+36}\right)_s^\infty = \ln\left(\frac{1}{1+\frac{36}{s^2}}\right)_s^\infty$$

$$= \ln\left(\frac{1}{1+0}\right) - \ln\left(\frac{1}{1+\frac{36}{S^2}}\right) = 0 - \ln\left(\frac{S^2}{S^2+36}\right)$$

$$= \ln\left(\frac{S^2+36}{S^2}\right)$$ Choice (B)

37. Let $y = f(x) = \dfrac{1}{4x+5}$

$h = 0.5$; $a = 0$ and $b = 3$

$x = x_0$	0	0.5	1.0	1.5	2.0	2.5	3.0
$y = y_0$	0.2000	0.1429	0.1111	0.0909	0.0769	0.0667	0.0588

By Simpson's Rule, we have

$$\int_a^b y\,dx = \int_0^3 \frac{dx}{4x+5} = \frac{h}{3}\,[(y_0 + y_6) + 4(y_1 + y_3 + y_5) + 2(y_2 + y_4)]$$

$$= \frac{0.5}{3}\,[(0.2000 + 0.0588) + 4(0.1429 + 0.0909 + 0.0667) + 2(0.1111 + 0.0769)] = 0.3061$$ Choice (C)

38. Given $f(x) = 8x^5 - 15x^4 + 10x^2$
$f'(x) = 40x^4 - 60x^3 + 20x$
$f'(x) = 0 \Rightarrow 40x^4 - 60x^3 + 20x = 0$
$\Rightarrow \quad x(x-1)^2(2x+1) = 0$
$\Rightarrow \quad x = 0; x = 1, 1$ and $x = \dfrac{-1}{2}$

$\therefore$ The stationary values of $f(x)$ are 0, 1 and $\dfrac{-1}{2}$

$f''(x) = 160x^3 - 180x^2 + 20$
At $x = 0$; $f''(x) = 20 > 0$
$\therefore \quad f(x)$ has a minimum at $x = 0$
At $x = \dfrac{-1}{2}$, $f''(x) = -45 < 0$

$\therefore \quad f(x)$ has a maximum at $x = \dfrac{-1}{2}$

At $x = 1$; $f''(x) = 0$
$f'''(x) = 480x^2 - 360x$
At $x = 1$; $f''(x) = 120 \neq 0$
$\therefore \quad f(x)$ has neither maximum nor minimum at $x = 1$

$\therefore$ The number of stationary values where $f(x)$ has neither maximum nor minimum = 1 Ans: 1

39. As X follows rectangular distribution in [1, 9]

Mean = $\mu = \dfrac{1+9}{2} = 5$

Variance = $\sigma^2 = \dfrac{(9-1)^2}{12} = \dfrac{16}{3}$

$\therefore$ Mean : Variance = $\mu : \sigma^2 = 5 : \dfrac{16}{3}$

$\Rightarrow$ $\mu : \sigma^2 = 15 : 16$ Choice (A)

40. Standard Results Choice (D)

41. Maximum shear stress $\tau_{max} = 80$ MPa

$$\tau_{max} = \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau^2} = \sqrt{0+\tau^2} = \tau$$

$\therefore$ $\tau = \tau_{max} = 80$ MPa

Principal stresses

$$\sigma = \left(\frac{\sigma_x + \sigma_y}{2}\right) \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau^2}$$

$$= 0 \pm \sqrt{0+\tau^2} = \pm\tau$$

ie, $\sigma_1 = 80$ MPa

$\sigma_2 = -80$ MPa

According to maximum distortion theory,

$$\sqrt{\sigma_1^2 + \sigma_2^2 - \sigma_1\sigma_2} \le \left(\frac{S_{yt}}{FOS}\right)$$

$\therefore$ $\sqrt{80^2 + 80^2 + 80^2} = \dfrac{300}{FOS}$

$\Rightarrow$ FOS = 2.165

42. Diameter = 300 cm = 3000 mm

Maximum permissible working stress $\sigma = 160$ MPa

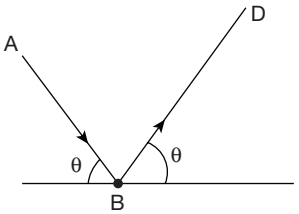
Internal pressure $P = 2$ MPa

σ = hoop stress = $\dfrac{pd}{2t}$

$\therefore$ $160 = \dfrac{2\times3000}{2\times t}$

$\Rightarrow$ $t = 18.75$ mm

43.



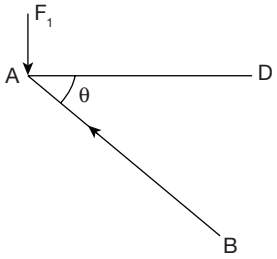
Joint B

BD in tension $F_{BD} = 11.25$ kN (data)

$\theta = \tan^{-1}\left(\dfrac{2}{1.5}\right)$ (from figure) = 53.13°

$\therefore$ $\sin\theta = 0.8$ and $\cos\theta = 0.6$

For vertical equilibrium of joint B, AB is a strut and $F_{AB} = 11.25$ kN(compressive)



Joint A

$F_{AB}\sin\theta = F_1 \rightarrow F_1 = 11.25 \times 0.8 = 9$ kN. Choice (A)

44. Centre distance = $\dfrac{m(T_P + T_G)}{2} = \dfrac{5(19+37)}{2}$

= 140 mm. Choice (D)

45. Initial torque about hinge A, $T = F\ell$

α = Initial angular acceleration = $\dfrac{T}{I_A} = \dfrac{F\ell}{\left(\frac{m\ell^2}{3}\right)} = \dfrac{3F}{m\ell}$

Initial acceleration of centre of mass,

$a_{CM} = a\dfrac{\ell}{2} = \dfrac{3F}{m\ell}\cdot\dfrac{\ell}{2}$

i.e. $a_{CM} = \dfrac{3F}{2m}$

If F_A is the horizontal reaction at A, then $\dfrac{F+F_A}{m} = a_{CM}$

$\Rightarrow$ $\dfrac{F+F_A}{m} = \dfrac{3F}{2m}$

$\Rightarrow$ $F_A = \dfrac{F}{2}$. Choice (C)

46. Major diameter $d = 12$ mm

Area of cross section of the unthreaded portion

$$A_1 = \frac{\pi d^2}{4} = \frac{\pi\times12^2}{4} = 113.1 \text{ mm}^2$$

Length of the unthreaded portion $L_1 = 8$ mm

Length of threaded portion $L_2 = 32$ mm

Area of the threaded portion $A_2 = 84.2$ mm^2

Modulus of elasticity $E = 2 \times 10^5$ MPa

$= 2 \times 10^5$ N/mm^2

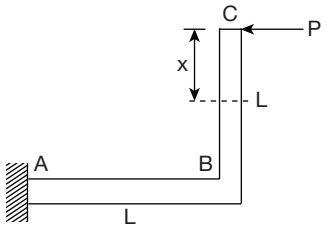
Stiffness k = $\dfrac{P}{\delta} = \dfrac{P}{\frac{PL}{AE}} = \dfrac{AE}{L}$ $\dfrac{1}{k} = \dfrac{1}{k_1} + \dfrac{1}{k_2}$

$$= \frac{L_1}{A_1E} + \frac{L_2}{A_2E} = \frac{8}{113.1E} + \frac{32}{84.2E}$$

$= 2.254 \times 10^{-6}$ mm/N

$\Rightarrow$ $k = 443{,}674$ N/mm = 443.674 MN/m

47.



For BC, bending moment at a distance x from $C = Px$
For AB bending moment $= PL$

$$\text{Total strain energy} = \int_0^L \frac{(Px)^2}{2EI}dx + \int_0^L \frac{(PL)^2}{2EI}dx$$

$$= \left[\frac{P^2x^3}{6EI}\right]_0^L + \left[\frac{P^2L^2x}{2EI}\right]_0^L$$

$$= \frac{P^2L^3}{6EI} + \frac{P^2L^3}{2EI}$$

$$= \frac{8}{6}\frac{P^2L^3}{2EI} = \frac{1}{2}P\delta$$

$$\Rightarrow \quad \delta = \frac{4}{3}\frac{PL^3}{EI}.$$ Choice (A)

48. Taking moments of forces about point A,

$$P\left(\frac{h}{2}\right) = Mg\left(\frac{w}{2}\right)$$

$$\Rightarrow \quad P = \frac{Mg\,w}{h} = \frac{200\times 9.81\times 1.2}{3} = 784.8 \text{ N}$$

$P \le$ limiting friction $= \mu\, Mg$

$$\therefore \quad \mu \ge \frac{P}{Mg} \text{ i.e., } \mu \ge \frac{784.8}{200\times 9.81}$$

i.e $\mu \ge 0.4 \Rightarrow \mu_{min} = 0.4$. Choice (B)

49. $$\Delta KE = \frac{1}{2}\mathrm{I}\left(\omega_2^{\,2} - \omega_1^{\,2}\right)$$

$$= \frac{1}{2}\times 30\times\left(20^2 - 15^2\right) = 2625 \text{ J}$$

But $\Delta KE = T\theta$, where $\theta = \frac{1}{4}\times 2\pi = \frac{\pi}{2}$ rad

$$\therefore \quad T = \frac{\Delta KE}{\theta} = \frac{2625}{\left(\frac{\pi}{2}\right)} = \frac{2\times 2625}{\pi} = 1671.13 \text{ Nm}.$$

50. m = 2 kg; s = 18 N/m; $\xi = 0.03$

$$\omega_n = \sqrt{\frac{s}{m}} = \sqrt{\frac{18}{2}} = 3 \text{ rad/s}$$

$\omega = 2$ rad/s

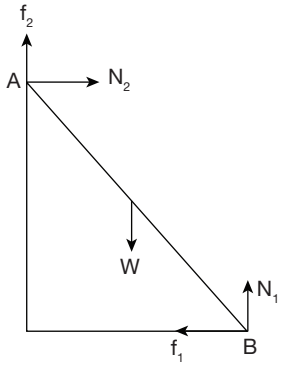
$$\text{Magnification factor} = \frac{1}{\sqrt{\left[1-\left(\frac{\omega}{\omega_n}\right)^2\right]^2 + \left(2\xi\frac{\omega}{\omega_n}\right)^2}}$$

$$= \frac{1}{\sqrt{\left[1-\left(\frac{2}{3}\right)^2\right]^2 + \left(2\times 0.03\times\frac{2}{3}\right)^2}}$$

$$= \frac{1}{\sqrt{(0.5556)^2 + (0.04)^2}} = \frac{1}{\sqrt{0.3086 + 0.0016}}$$

$$= \frac{1}{\sqrt{0.3102}} = \frac{1}{0.55696} = 1.795.$$

51.



$N_2 = f_1 = \mu N_1$ ------(i)
$W = N_1 + f_2 = N_1 + \mu N_2$
$= N_1 + \mu(\mu N_1) = (1 + \mu^2)\, N_1$

$$\therefore \quad N_1 = \frac{W}{\left(1+\mu^2\right)} = \frac{500}{1+(0.2)^2} = \frac{500}{1.04} = 480.77 \text{ N}$$

$f_1 = \mu N_1 = 0.2 \times 480.77$ N
$= 96.154$ N
$\therefore \quad N_2 = f_1 = 96.154$ N
$\therefore \quad f_2 = \mu N_2 = 0.2 \times 96.154$
$= 19.231$ N.

52. $s_f = 0.865$ kJ/kg K (data)
$T = 12°C = 12 + 273 = 285$ K
$Q = 13.6$ MJ $= 13.6 \times 10^3$ kJ
Mass, $m = 14$ kg

$$\therefore \quad \Delta s = \frac{Q}{mT} = \frac{13.6\times 10^3}{14\times 285} = 3.41 \text{ kJ/kg K}$$

$$\therefore \quad s_g = s_f + \Delta s = 0.865 + 3.41 = 4.275 \text{ kJ/kg K}.$$

53. $$\dot{Q} = \frac{kA\Delta\theta}{L}$$

$$\Rightarrow \quad L = \frac{kA\Delta\theta}{\dot{Q}} = \frac{k\Delta\theta}{\left(\frac{\dot{Q}}{A}\right)}$$

$$= \frac{1.21\times(1225-400)}{3200}$$

$$= \frac{1.21\times 825}{3200}$$

$$= 0.312 \text{ m}.$$

54. Choice (D)

55. $\vec{V} = K\left(y\vec{i} + x\vec{k}\right)$

$\therefore \quad u = Ky,\ v = 0,\ w = Kx$

Rotation $\omega_z = \frac{1}{2}\left(\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}\right)$

$= \frac{1}{2}(0 - K)$

$= \frac{-K}{2}$ Choice (B)

56. $Re = \frac{\rho VD}{\mu} = \frac{1000 \times 1.5 \times 30 \times 10^{-3}}{7.25 \times 10^{-4}}$

$= 62{,}068.97$

$Pr = 5.18$

$\therefore \quad Nu = 0.023 \times (62{,}068.97)^{0.8}\,(5.18)^{0.4} = 303.221$

$\therefore \quad \frac{hD}{k} = 303.221$

$\Rightarrow \quad h = \frac{303.221 \times k}{D} = \frac{303.221 \times 0.625}{30 \times 10^{-3}}$

$= 6317.10\ \text{W/m}^2\text{K}$

57. Dry bulb temperature = 35°C

Relative humidity (ϕ) = 60%

$P_{atm} = P_t = 0.1$ MPa = 100 kPa

$P_{vs} = 5.63$ kPa

$\phi = \frac{P_v}{P_{vs}} = \frac{P_v}{5.63} = 0.6$

$\Rightarrow \quad P_v = 5.63 \times 0.6 = 3.378$ kPa

Specific humidity $w = 0.622\frac{P_v}{P_t - P_v}$

$= \frac{0.622 \times 3.941}{100 - 3.941}$

$= 0.0217$ kg/kg of dry air

$= 21.7$ gram/kg of dry air

58. Power $P = 8.5\left(\frac{\text{kg}}{s}\right)(3627 - 2291)\left(\frac{\text{kJ}}{\text{kg}}\right) +$

$3.5\left(\frac{\text{kg}}{s}\right)[3627 - 3153]\left(\frac{\text{kJ}}{\text{kg}}\right)$

$= 8.5 \times 1336 + 3.5 \times 474$

$= 11356 + 1659 = 13015$ kW.

59. $\frac{\dot{Q}_{with\ shields}}{\dot{Q}_{without\ shields}} = \frac{100 - 80}{100} = 0.2 = \frac{1}{N+1}$

$\therefore \quad N + 1 = \frac{1}{0.2} = 5$

$\therefore \quad N = 5 - 1 = 4$

Hence number of shields needed is 4.

Choice (A)

60. $\left(\frac{V_1}{V_2}\right)^{\gamma} = \left(\frac{P_2}{P_1}\right) = \frac{48.503}{1}$

$\therefore \quad \left(\frac{V_1}{V_2}\right) = (48.503)^{\frac{1}{\gamma}} = (48.503)^{\frac{1}{1.4}} = 16$

$r = \left(\frac{V_1}{V_2}\right); = 16$

$\frac{V_4}{V_3}$ = expansion ratio = $V_e = 12$ (data)

But $r = V_e \times \rho$, where ρ = cut off ratio

$\therefore \quad \rho = \frac{r}{Ve} = \frac{16}{12} = \frac{4}{3}$

$\eta_{diesel} = \left[1 - \frac{1}{\gamma\left(r^{\gamma-1}\right)}\frac{\left(\rho^{\gamma-1}\right)}{(\rho - 1)}\right]$

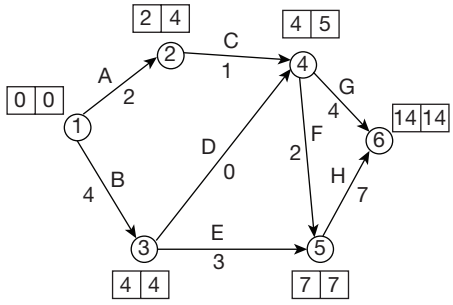
$= 1 - \frac{1}{1.4 \times 16^{(1.4-1)}} \times \frac{\left[\left(\frac{4}{3}\right)^{1.4} - 1\right]}{\left(\frac{4}{3} - 1\right)}$

$= 1 - \frac{1}{1.4 \times 3.0314} \times \frac{(1.4959 - 1)}{(1.3333 - 1)}$

$= 1 - \frac{1 \times 0.4959}{1.4 \times 3.0314 \times 0.3333}$

$= 1 - 0.3505 = 0.6495 = 64.95\%$.

61.



Total float for activity (2 – 4)

$= LT\,4 - ET2 - t = 5 - 2 - 1 = 2$ days

Free float for activity (2 – 4)

$= ET4 - ET2 - t = 4 - 2 - 1 = 1$ day Choice(B)

62. Arrival rate $\lambda = 6$/min

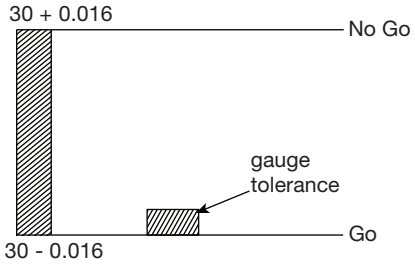
Service time = $\frac{1}{8}$ min

Service rate $\mu = \frac{1}{\frac{1}{8}} = 8$/min

Expected waiting time = $\frac{\lambda}{\mu(\mu - \lambda)} = \frac{6}{8(8-6)}$

$= 0.375$ min

63.



Hole dimension = 30 ± 0.016 mm.
Work tolerance = 0.016 × 2 = 0.032 mm
Gauge tolerance = 0.032 × 0.1 = 0.0032 mm
Go gauge dimension = 30.000 – 0.016 = 29.984 mm
Dimension in bilateral system = $29.9856^{\pm 0.0016}$

Choice(A)

64. Solidification time $t = C\left(\frac{V}{A}\right)^2$

For the plate, $1.384 = C\left[\frac{(9\times8\times2)}{2(9\times8+8\times2+2\times9)}\right]^2$

$\Rightarrow C = 3$

$\frac{V}{A}$ for the ($D = H$) riser $= \frac{D}{6} = \frac{6}{6} = 1$ cm

Solidification time for the riser $= C\left(\frac{V}{A}\right)^2 = 3 \times 1^2$

= 3 minutes

65. Length of work = 250 mm
Depth of cut (d) = 3 mm
Feed (f) = 0.3 mm/stroke
Specific energy = 1.5 J/mm^3
Chip volume/min = $LNfd$
= 250 × 60 × 0.3 × 3
= 13500 mm^3/min

Average power consumption $= \frac{13500\times1.5}{60}$ J/s or W

= 337.5 W