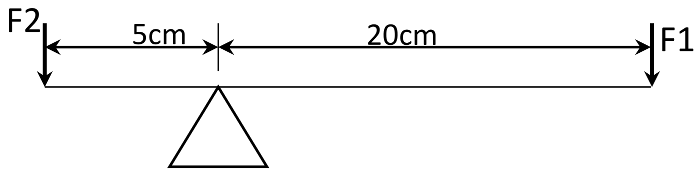
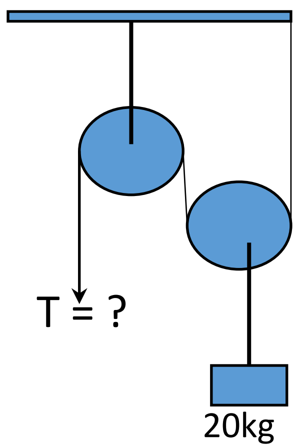
1. What would be the value of F1 to balance the system if F2=20N?

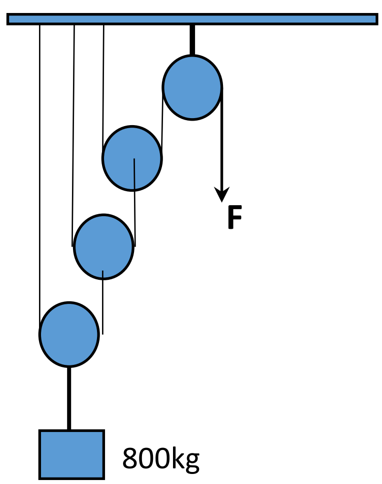


   (a) 3 N
   (b) 5 N
   (c) 4N
   (d) None of the above
2. The stress in a wire of diameter 2 mm, if a load of 100 gram is applied to the wire is
   (a) 3.1×10^5 N/m^2
   (b) 6.2×10^5 N/m^2
   (c) 1.5×10^5 N/m^2
   (d) 12.4×10^5 N/m^2
3. In the pulley system, shown here what should be the tension T in order to lift the weight of 20kg?



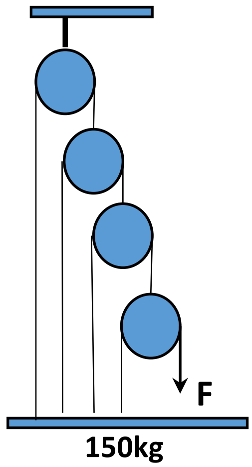
(a) 40kg
(b) 30kg
(c) 20kg
(d) 10kg

4. Figure here shows a pulley system. What would be the value of F to lift up the load



(a) 100kg
(b) 200kg
(c) 800/3 kg
(d) 400kg

5. What would be the value of F to lift up the load as shown in figure.



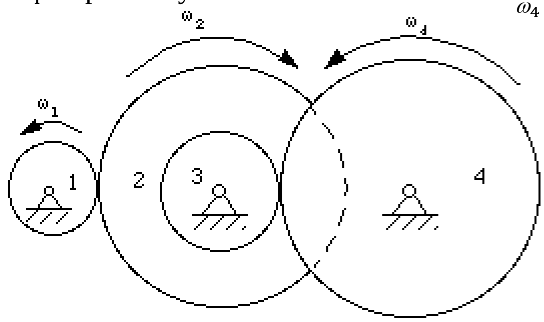
(a) 30kg
(b) 10kg
(c) 15kg
(d) 20kg

6. The diameter of a screw is 5mm add the lead of the screw thread (pitch) is 1mm. What is the mechanical advantage of the screw?
(a) 3.141
(b) 9.42
(c) 12.56
(d) 15.71

7. Two shafts are neither parallel nor intersecting. If we intend to transmit power between the two then which type of gear is mostly preferred?
(a) Straight bevel
(b) Worm and worm
(c) Double helical herringbone
(d) Crossed helical

8. Two spur gears have pitch circle diameters of 10cm and 2cm. The larger gear has a rotational speed of 100RPM. Then what is the rotational speed of the smaller one?
(a) 200RPM
(b) 500RPM
(c) 1000RPM
(d) 400RPM

9. Figure shows a compound gear train, where the number of teeth in gears 1, 2, 3 and 4 are $N1, N_2, N_3 and\ N_4$ respectively. What would be the ration $\frac{\omega_1}{\omega_4}$ in terms of the teeth?

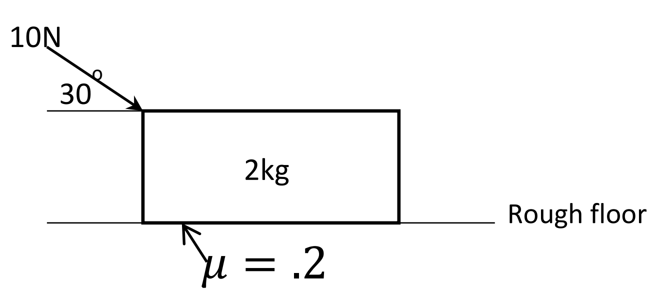


(a) $\frac{N_1}{N_4}$
(b) $\frac{N_1 N_4}{N_3 N_2}$
(c) $\frac{N_2 N_4}{N_1 N_3}$
(d) $\frac{N_1 N_3}{N_2 N_4}$

10. Two wires A and B have same dimensions (area and length same) and are stretched by the same amount of force. Young's modulus of A is twice that of B. The relation $\frac{\Delta l_2}{\Delta l_1}$ would be equal to :
(a) 1
(b) ½
(c) 2
(d) ¼

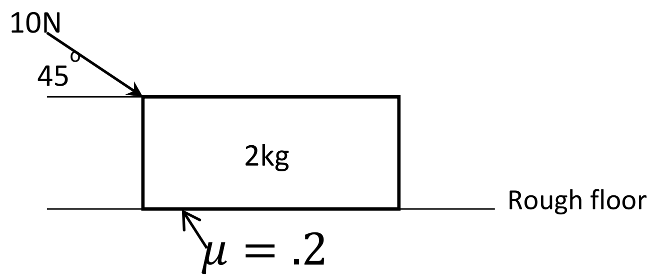
11. Practical value of Poisson's ratio for a steel wire subjected to a longitudinal force can be within:
(a) 0 to .5
(b) -.5 to 0
(c) -1 to .5
(d) -.5 to .5

12. Figure here shows a weight of 2kg resting on a rough floor which is acted upon by a force of 10N as shown. If the coefficient of friction between the floor and the mass is 0.2 then would system start to move? Assume g=10m/s^2.



(a) Yes
(b) No
(c) Information insufficient
(d) Problem cannot be solved

13. In the figure shown a weight of 2kg resting on a rough floor which is acted upon by a force of 10N as shown. The coefficient of friction between the floor and the mass is 0.2. Assume g=10m/s^2.

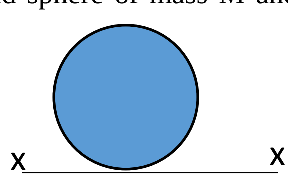


If the force applied is at an angle of 45^0 then what would be the acceleration of the mass?
(a) 1.657 m/s^2
(b) .828 m/s^2
(c) 3.51 m/s^2
(d) None of the above

14. A uniform cube of side *a* and mass *m* rests on a rough horizontal plane surface. A horizontal force *F* is applied normal to one face at a point that is directly above the center of the face at a height of *a/4* above the center. The minimum value of F for which the cube begins to topple about an edge without slipping is:
(a) mg/4
(b) 2mg
(c) 2mg/3
(d) Mg/2

15. Three rods of mass *m* and length *l* are joined together to form an equilateral triangle. What would be the moment of inertia of the system about an axis passing through its center of mass and perpendicular to the plane of the triangle?
(a) $\frac{ml^2}{2}$
(b) $\frac{ml^2}{6}$
(c) $\frac{ml^2}{12}$
(d) $\frac{ml^2}{2}$

16. What is the moment of inertia of a solid sphere of mass M and radius R about an axis XX as shown in the Figure?



(a) $\frac{2}{5}MR^2$
(b) $\frac{9}{10}MR^2$
(c) $\frac{7}{5}MR^2$
(d) $\frac{8}{5}MR^2$

17. A uniform rod has mass *m* and length *2l*. Two particles of mass *m* each are placed at its two ends. What is the moment of inertia of the system about the center of mass of the system?
(a) $\frac{25ml^2}{12}$
(b) $\frac{4ml^2}{3}$
(c) $\frac{5ml^2}{3}$
(d) $\frac{7ml^2}{3}$

18. Two circular disks of the same weight and thickness are made from metals having different densities ρ1 and ρ2 such that ρ2 > ρ1. The moment of inertia of the disks about their central axis can be written as:
(a) $I_1 > I_2$
(b) $I_2 > I_1$
(c) $I_1 = I_2$
(d) It cannot be told

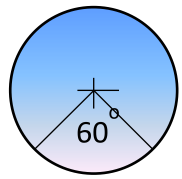
19. If $I_1$is the moment of inertia of a thin rod about an axis perpendicular to its length and passing through the center of mass and I_2 the moment of inertia of the ring formed by the same rod about an axis passing through the center of the mass of the ring and perpendicular to the plane of the ring. Then the ratio I_1/I_2 is:
(a) $\pi^2/12$
(b) $\pi^2/6$
(c) $2\pi^2/3$
(d) $\pi^2/3$

20. A non-uniform rod AB has a mass *M* and length $2l$. The left end of the rod is designated as A and the right end as B. The mass per unit length of the rod is *mx* at a point of the rod distant *x* from A. The moment of inertia of this rod about an axis perpendicular to the rod through A would be:
(a) Ml^2
(b) $2Ml^2$
(c) $Ml^2/3$
(d) $Ml^2/12$

21. A non-uniform rod AB has a mass *M* and length $2l$. The left end of the rod is designated as A and the right end as B. The mass per unit length of the rod is *mx* at a point of the rod distant *x* from A. what would be the moment of inertia of the rod about the mid-point of AB?
(a) $2Ml^2/3$

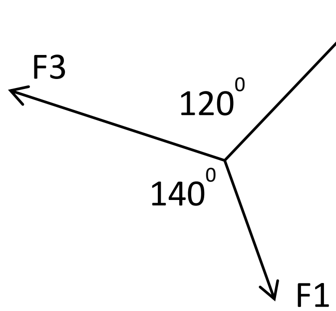
(b) $4Ml^2/3$
(c) $Ml^2/3$
(d) $Ml^2/12$

22. A uniform circular disk has a moment of inertia of 1.2 $kg.m^2$ about its central axis which is perpendicular to the plane of the disk. If a segment of 60^0 is cut out from the disk then the moment of the inertia of the remaining disk about the same old axis is:



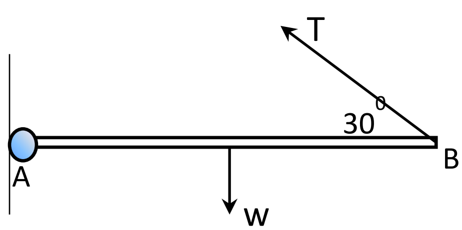
(a) 0.6 *kg m*^{2}
(b) 1.2 kg m^2
(c) 1.0 kg m^2
(d) 0.5 kg m^2

23. Three co-planner forces F1, F2 and F3 are in equilibrium. If F1=20N then how much is F2?



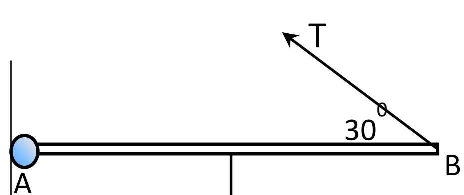
(a) 10.23N
(b) 26.94 N
(c) 18.14N
(d) 14.84N

24. A uniform rod AB of weight W is hinged to a fixed point at A. It is held in horizontal position by a string, one end of which is attached to B as shown. The tension in the string in terms of W is:



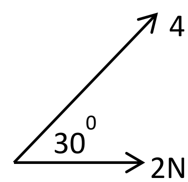
(a) T = W
(b) T =2W
(c) T=3W/2
(d) None of the above

25. A uniform rod AB of weight W is hinged at a fixed point A. It is held in horizontal position by a string, one end of which is attached to B as shown. Reaction at A can be R_x and R_y which can be written in terms of W. The expression for R_y in terms of W is:



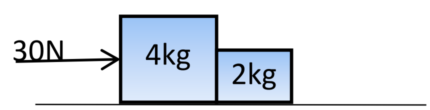
(a) $R_y = \sqrt{3}W/2$
(b) $R_y = W$
(c) $R_y = W/4$
(d) $R_y = W/2$

26. The Figure shows two concurrent forces acting at a point. The magnitude of the resultant force is?



(a) 4.472N
(b) 5.818N
(c) 5.73N
(d) None of the above

27. Two blocks of mass 4kg and 2kg are placed side by side on a smooth floor. A horizontal force of 30N is acting on the 4kg block. The normal reaction between the two blocks is:



(a) 30N
(b) 20N
(c) 10N
(d) 12N

28. The center of mass of a uniform semi-circular disk of radius *R* lies on the axis of symmetry at a distance of *h* from the center. The expression for *h* is:
(a) $h = R/2$
(b) $h = 3R/\pi$
(c) $h = 3R/2\pi$
(d) $h = 4R/3\pi$

29. The center of mass of a solid hemisphere of radius *R* lies at a distance of *h* from its center on the axis of symmetry. The expression for *h* is:
(a) $h = 3R/8$
(b) $h = 2R/5$

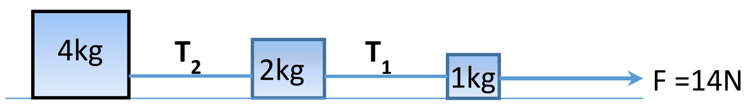
(c) $h = 4R/13$
(d) $h = 3R/4$

30. Two particles of mass 1kg and 2kg are placed at *x=0* and *x=3m* on the *x*-axis. The center of mass of the two particles is located at:
(a) x=1m
(b) x=2m
(c) x=2.5m
(d) x=1.5m

31. The position of a particle executing SHM can be described by $x = 10\sin\left(\pi t + \frac{\pi}{6}\right)$ in SI units. The time period of the particle is:
(a) 4s
(b) 1s
(c) 2s
(d) 3.141s

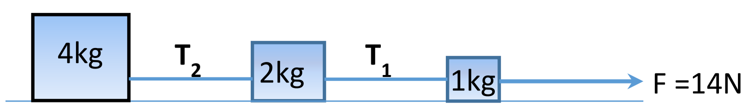
32. The position of a particle executing SHM can be described by $x = 10\sin\left(\pi t + \frac{\pi}{6}\right)$ in SI units. The maximum velocity of the particle is:
(a) $5\pi\ m/s$
(b) $4\pi\ m/s$
(c) $2\pi\ m/s$
(d) $10\pi\ m/s$

33. The figure shows three blocks connected by two light and inextensible strings placed on a smooth horizontal surface acted upon by a force of 14N. The tension T_2 in the string is:



(a) 6N
(b) 4N
(c) 8N
(d) 14N

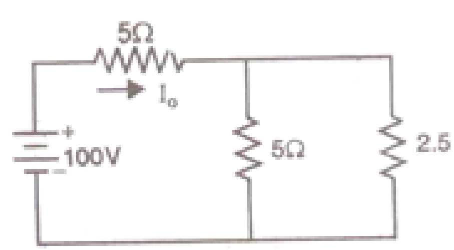
34. The figure shows three blocks connected by two light and inextensible strings placed on a smooth horizontal surface acted upon by a force of 14N. The tension T_1 in the string is:

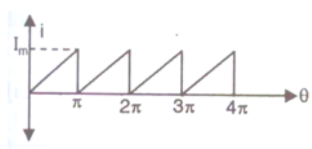


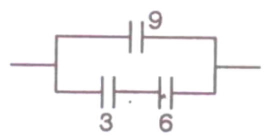
(a) 8N
(b) 12N
(c) 1N
(d) 2N

35. A stone is thrown at an angle of 45^0 to the horizontal with kinetic energy K. The kinetic energy at the highest point is:
(a) $K/2$
(b) $K/\sqrt{2}$
(c) K
(d) Zero
36. A ball is thrown vertically upward with a velocity of 10 m/s. It returns to the ground with a velocity of 9 m/s. If g =9.8m/s^2 , then the maximum height attained by the ball is nearly: (Assume air resistance to be uniform)
(a) 5.1m
(b) 4.1m
(c) 4.61m
(d) 5.0m
37. A spring-mass system oscillates such that the mass moves on a rough surface having coefficient of friction μ. It is compressed by a distance *a*, from its normal length and, on being released, it moves to a distance *b* from its equilibrium position. The decrease in amplitude for one-half cycle (-a to b) is:
(a) $\mu mg/K$
(b) $2\mu mg/K$
(c) $\mu g/K$
(d) $\mu mg/2K$
38. A particle of mass 0.01kg travels along a space curve with velocity 4i+16k m/s. After some time its velocity becomes 8i+20j m/s due to the action of a conservative force. The work done on the particle during this interval of time is:
(a) 0.32J
(b) 6.9J
(c) 9.6J
(d) 0.96J
39. A body is attached to the lower end of a vertical spring and it is gradually lowered to its equilibrium position. This stretches the spring by a length *d*. If the same body attached to the same spring is allowed to fall suddenly, what would be the maximum stretching in this case?
(a) d
(b) 2d
(c) 3d
(d) d/2
40. What is the fractional decrease in kinetic energy of a particle of mass m_1 when it makes a head on elastic collision with a particle of mass m_2 kept at rest.
(a) $4m_1m_2/(m_1+m_2)^2$
(b) $2m_1m_2/(m_1+m_2)^2$
(c) $(m_1-m_2)^2/(m_1+m_2)^2$
(d) $m_1m_2/(m_1+m_2)^2$

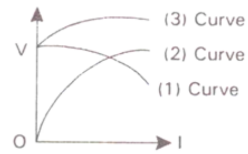
Basic Electrical Engineering

1.	An emf of 8V is induced in a coil of inductance 4H. The rate of change of current must be (a) 32 A/sec (b) 0.5 A/sec (c) 2 A/sec (d) 1 A/sec	( )
2.	Two coils have self inductance of 5H and 1H, the mutual inductance being zero. If the two coils are connected in series, ,the total inductance will be (a) 4H (b) 5H (c) 3H (d) 6H	( )
3.	Four resistors 5 Ohm, 10 Ohm ,20 Ohm and 40 Ohm are connected in parallel across 20V battery. The highest power will be dissipated in (a) 5 Ohm (b) 10 Ohm (c) 20 Ohm (d) 40 Ohm	( )
4.	Two inductors carrying current in opposite direction are connected in series. The total inductance is (a) $L_1 + L_2 + 2M$ (b) $L_1 + L_2 - 2M$ (c) $\frac{L_1 L_2 - M^2}{L_1 + L_2 + 2M}$ (d) $\frac{L_1 L_2 - M^2}{L_1 + L_2 - 2M}$	( )
5.	The current I_0 in the circuit given below will be  (a) 4 A (b) 7.5 A	( )

	(c) 10 A (d) 15 A	
6.	A constant current of 5mA charges a 10 µF capacitor for 1sec. The voltage across the capacitor is (a) 50V (b) 250V (c) 500V (d) 1000V	( )
7.	The direction of the induced emf is found by (a) Fleming's right hand rule (b) Lenz's law (c) Fleming's left hand rule (d) Biot-savart law	( )
8.	The angular velocity of a sine wave of 50 Hz is (a) 50π (b) 100π (c) π/50 (d) π/150	( )
9.	RMS value of current wave in the given figure is  (a) $\frac{I_m}{\sqrt{2}}$ (b) $\frac{8\,I_m}{\pi}$ (c) $\frac{I_m}{\sqrt{3}}$ (d) $\frac{I_m}{2}$	( )
10.	An alternating current has a peak value of 2A. If its peak factor is $\sqrt{2}$ and its form factor is $\frac{\pi}{2\sqrt{2}}$, its average value is (a) $\frac{8}{\pi}A$ (b) $\frac{4}{\pi}A$ (c) $\frac{\pi}{4}A$	( )

	(d) $\frac{\pi}{2}A$	
11.	The power factor of a circuit comprising R and X in series is given by (a) $\frac{R}{\sqrt{R^2+X^2}}$ (b) $\frac{X}{R^2+X^2}$ (c) $\frac{R}{R^2+X^2}$ (d) $\frac{X}{\sqrt{R^2+X^2}}$	( )
12.	The equivalent capacitance(in µF) of the circuit shown in figure is  (a) 6 (b) 4.5 (c) 3 (d) 11	( )
13.	The X_L offered by an inductance of 1H to a current I_mSin10πt is (a) 100 Ω (b) 50 Ω (c) 31.4 Ω (d) 314 Ω	( )
14.	In a R-L-C circuits, v(t)=20 sin(314t+5π/6) and i(t)= 10 sin(314t+2π/3). The power factor of the circuit is (a) 0.5 lead (b) 0.866 lag (c) 0.866 lead (d) 0.5 lag	( )
15.	The device which recovers a part of heat from the flue gases is (a) Condenser (b) Evaporator (c) Draft tube (d) Economiser	( )
16.	Steam power plants work closely on (a) Binary vapour cycle (b) Bragtn cycle (c) Rankine cycle (d) Carnot cycle	( )
17.	Ash handling plant is located in between (a) Boiler & Ash storage	( )

	(b) Boiler & Chimney (c) Boiler & Super heater (d) Boiler & Coal storage	
18.	The electrical power developed by an hydro electric plant in kW is given by the expression (a) $N_s = N.\sqrt{P}/H^{0.75}$ (b) $N_s = \sqrt{N}.P/H^{3/2}$ (c) $N_s = N.\sqrt{P}/H^{1.25}$ (d) $N_s = N.\sqrt{P}/H^{2/3}$	( )
19.	If H is the head in meters, w is the specific gravity in Kg/m^3, Q is discharge in m^3/sec and η is efficiency then power output of Hydro Electric Plant is (a) $\frac{wQH}{\eta}$ (b) $\frac{wQ}{H} \text{X} \, \eta$ (c) $wQH \text{ X } \eta$ (d) $\frac{QH}{w} \text{X} \, \eta$	( )
20.	Control rods for nuclear reactor are made of (a) Graphite (b) Cadmium (c) Concrete (d) Lead	( )
21.	Which of the following material is used a moderator (a) Graphite (b) Boron (c) N_a k liquid (d) Plutonium	( )
22.	The equivalent resistance of a transformer referred to secondary is given by (a) $r_1 + r_2 \left(\frac{N_1}{N_2}\right)^2$ (b) $r_2 + r_1 \left(\frac{N_1}{N_2}\right)^2$ (c) $r_2 + r_1 \left(\frac{N_2}{N_1}\right)^2$ (d) $r_1 + r_2 \left(\frac{N_2}{N_1}\right)^2$	( )
23.	The purpose of laminating the transformer core is (a) To minimize the eddy current loss (b) To increase the cross-sectional area of the core (c) To increase the flux density in the core (d) To increase the weight of the transformer	( )
24.	The following figure shows the external (V-I) characteristics of three types of	( )

	generator having the same rating . Curve 2 represents for ___________ generator  (a) Shunt (b) Series (c) Compound (d) None	
25.	If W_c is the constant loss and R_a is the armature resistance of a dc generator then load current I_L corresponding to maximum efficiency is (a) $I_L = \sqrt{\frac{R_a}{W_c}}$ (b) $I_L = \frac{W_c}{\sqrt{R_a}}$ (c) $I_L = \frac{R_a}{\sqrt{W_c}}$ (d) $I_L = \sqrt{\frac{W_c}{R_a}}$	( )
26.	A 6-pole lap wound generator has 300 conductors, the e.m.f induced per conductor being 5V. The generated voltage of the generator is ________ (a) 60 V (b) 1500 V (c) 360 V (d) 250 V	( )
27.	In a DC series motor, if the armature current is reduced by 50%, the torque of the motor will be equal to (a) 100% of the previous value (b) 50% of the previous value (c) 25% of the previous value (d) 12.5% of the previous value	( )
28.	If Bmax is the maximum flux density, then eddy current loss will vary as (a) B_{max} (b) $(B_{max})^2$ (c) $(B_{max})^{1.6}$ (d) $(B_{max})^{3.2}$	( )
29.	A 3-point starter is used to start ____________ motor (a) Shunt (b) Series (c) Compound (d) Differential compound	( )

30.	Three phase four wire energy meter is used to measure (a) Three phase balanced energy only (b) Three phase unbalanced energy only (c) Both (a) and (b) (d) Two phase energy	( )
31.	To measure insulation resistance of insulators, the instrument required is (a) Ohm meter (b) Meggar (c) Ammeter (d) Voltmeter	( )
32.	If n similar cells, each of e.m.f volts and internal resistance r ohms are connected in series, then the amount of current flow in an external resistance of R ohms will be equal to (a) $\frac{nE}{R}$ (b) $\frac{nE}{R+r}$ (c) $\frac{nE}{R+nr}$ *(d)* nE	( )
33.	Devices used for large soldering are 1. Soldering iron 2. Blow lamp 3. Ladle 4. Pot (a) 1 (b) 2,3,4 (c) 1,2,3,4 (d) 2,3	( )
34.	In concealed conduit wiring, the switches used are (a) Flush switches (b) Tumbler switches (c) Knife switches (d) Iron clad switches	( )
35.	Lakin Hickey is used to (a) Cut the metal (b) Make holes in wood (c) Fixing conduit (d) Bending conduit	( )
36.	The most economical wiring used in public buildings is (a) C.T.S wiring (b) Conduit wiring (c) Casing and capping wiring (d) None	( )

37.	Fusing factor is given by (a) Element rating / Minimum fusing current (b) Minimum fusing current / Element rating (c) Element rating (d) None	( )
38.	Energy produced by fission reaction is given by (a) ½ m^2c (b) ½ mc^2 (c) ½ cv^2 (d) mc^2	( )
39.	The function of a dry cell is to convert : (a) chemical energy to mechanical energy (b) chemical energy to electrical energy (c) electrical energy into mechanical energy (d) electrical energy into magnetic energy	( )
40.	Distilled water is used in electrolytes because it : (a) prevents or slows down local action (b) speeds up electrochemical action (c) improves specific gravity (d) prevents polarization	( )

1. $\lim_{x \to 0} \frac{1-\cos\ 2x}{x}$ is

(A) 0 (B) 1 (C) -1 (D) does not exist

2. The value of a for which $f(x) = \begin{cases} ax+1 & if\ x \le 3 \\ \frac{x}{3}+3 & if\ x > 3 \end{cases}$ which is continuous at $x = 3$ is

(A) 3 (B) 4 (C) 2 (D) 1

3. $\frac{d}{dx} sin^{-1}\left(\frac{2x}{1+x^2}\right)$ is

(A) $\frac{2}{1+x^2}$ (B) $\frac{2x}{1+x^2}$ (C) $\frac{2x}{(1+x^2)^2}$ (D) 1

4. Derivative of $cos^2 x$ w.r.t. $e^{\sin x}$ is

(A) $\frac{-2\cos x}{e^{\sin x}}$ (B) $\frac{2\cos x}{e^{\sin x}}$ (C) $\frac{2\sin x}{e^{\sin x}}$ (D) $\frac{-2\sin x}{e^{\sin x}}$

5. Which of the following function is strictly decreasing on $\left(0, \frac{\pi}{2}\right)$

(A) $2\cos x$ (B) $\cos 3x$ (C) $\tan x$ (D) none of these

6. The maximum value of $|\sin 4x\ + 2|$ is

(A) 4 (B) 1 (C) 3 (D) does not exist

7. $\int \sec 2x$ is

(A) $\frac{1}{2} ln|\cos 2x + \tan 2x| + C$ (B) $\frac{1}{2} ln|\sec 2x + \tan 2x| + C$

(C) $\frac{1}{2} ln|\sec 2x - \tan 2x| + C$ (D) $\frac{1}{2} ln|\cos 2x - \tan 2x| + C$

8 . $\int_0^1 \frac{dx}{1+x^2}$ equals

(A) $\frac{\pi}{3}$ (B) $\frac{2\pi}{3}$ (C) $\frac{\pi}{4}$ (D) 0

9. $\int_{-1}^{1} x^{15} \cos^4 x$ equals

(A) 0 (B) $\frac{1}{15}$ (C) $-\frac{1}{15}$ (D) $\frac{1}{3}$

10. The number of points at which the function $f(x) = |x - 0.5| + |x - 1|$ does not have a derivative in $(0,3)$ is

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

11. If $f(x) = \int_0^x \cos 2t\, \mathrm{e}^{\mathrm{t}}\, dt$, then $f'(0)$ is

(A) 0 (B) 1 (C) e (D) $\frac{1}{e}$

12. Which of the following is true

(A) Every continuous function is differentiable

(B) $f(x)$ is differentiable implies $f'(x)$ is continuous

(C) Every differentiable function is not continuous

(D) $f(x) = x|x|$ is differentiable at $x = 0$

13. The area bounded by the curve $y = \cos x$ between $x = 0$ and $x = \frac{\pi}{2}$ is

(A) 1 (B) 2 (C) $\frac{1}{2}$ (D) $\frac{\pi}{2}$

14. The order of the differential equation $\left(\frac{dy}{dx}\right)^4 + 6y\frac{d^2y}{dx^2} = 0$ is

(A) 4 (B) 2 (C) 1 (D) 3

15. A solution to the differential equation $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$ with $y(0) = \frac{\pi}{4}$

(A) $y - x = \frac{\pi}{4}$ (B) $tan^{-1}y = \frac{\pi}{4}$

(C) $tan^{-1}y - tan^{-1}x = \frac{\pi}{4}$ (D) $tan^{-1}y + tan^{-1}x = \frac{\pi}{4}$

16. The algebraic sum of the deviation from mean is

(A) maximum (B) least

(C) zero (D) none of these

17. Three identical dice are rolled. The probability that the same number will appear on each of them is

(A) $\frac{1}{6}$ (B) $\frac{1}{18}$ (C) $\frac{1}{36}$ (D) none of these

18. Ram, his wife and 8 delegates are to be seated on a round dining table at random. The

probability that the host and his wife sit together is

(A) $\frac{1}{9}$ (B) $\frac{2}{9}$ (C) $\frac{1}{5}$ (D) $\frac{1}{10}$

19. The value of determinant $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+x & 1 \\ 1 & 1 & 1+y \end{vmatrix}$ is

(A) 1 (B) 0 (C) x (D) xy

20. If $A = \begin{bmatrix} 1 & -2 & 1 \\ 2 & 1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 1 \\ 3 & 2 \\ 1 & 1 \end{bmatrix}$ then, AB equals

(A) $\begin{bmatrix} -3 & -2 \\ 10 & 7 \end{bmatrix}$ (B) $\begin{bmatrix} -3 & 10 \\ -2 & 7 \end{bmatrix}$ (C) $\begin{bmatrix} -3 & 10 \\ 7 & -2 \end{bmatrix}$ (D) $\begin{bmatrix} 3 & 10 \\ 2 & 7 \end{bmatrix}$

21. If A is any square matrix, then $A + A^T$ is

(A) Identity matrix (B) zero matrix

(C) skew-symmetric matrix (D) symmetric matrix

22. If $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$ then angle between $\vec{a}$ and $\vec{b}$ is

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$ (C) 0 (D) $\frac{\pi}{3}$

23. The projection of the vector $\vec{i} - 2\vec{j} + \vec{k}$ on the vector $\overrightarrow{4i} - 4\vec{j} + 7\vec{k}$ is

(A) $\frac{\sqrt{5}}{2}$ (B) $\frac{\sqrt{6}}{16}$ (C) $2\frac{1}{9}$ (D) $\frac{9}{19}$

24. Let $\vec{a}$ and $2\vec{b}$ denotes the diagonals of a parallelogram. Then the area of the parallelogram is given by

(A) $\frac{1}{2}|\vec{a} \times \vec{b}|$ (B) $|\vec{a} \times \vec{b}|$ (C) $2|\vec{a} \times \vec{b}|$ (D) None of these

25. In a ΔABC, $\cot\frac{1}{2}A + \cot\frac{1}{2}B + \cot\frac{1}{2}C$ equals

(A) 1 (B) 0 (C) $\cot\frac{1}{2}A \cot\frac{1}{2}B \cot\frac{1}{2}C$ (D) None of these

26. If $sin\left\{\frac{1}{2}\cos^{-1} x\right\} = 1$, then x equals

(A) -1 (B) 1 (C) 0 (D) $\frac{1}{5}$

27. The equation $\cos x + \sin x = 2$ has

(A) only one solution (B) two solutions

(C) infinite number of solutions (D) no solution

28. If the r^{th} term in the expansion of $\left(\frac{x}{3}-\frac{2}{x^2}\right)^{10}$ contains x^4, then r is equal to

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

29. The product of r consecutive positive integers, divided by $r!$ is

(A) a proper fraction (B) equal to r

(C) a positive integer (D) none of these

30. If ω is a cube root of unity , then $(4+\omega+4\omega^2)^4$ equals

(A) 27 (B) 81ω (C) 27ω (D) 81

31. Which of the following is correct

(A) $3+4i>2+3i$ (B) $6+2i>3+3i$

(C) $5+9i>5+8i$ (D) none of these

32. The area of the triangle with vertices $(-4,-1),(1,2)$ and $(4,-3)$ is

(A) 17 (B) 16 (C) 15 (D) 14

33. The equation of the line through $(2,-4)$ parallel to $x-$ axis is

(A) $y=-4$ (B) $y=2$ (C) $x=2$ (D) $x=-4$

34. P and Q are the points on the line joining $A(-2,5)$ and $B(3,1)$ such the $AP=PQ=QB$. Then the mid-point of PQ is

(A) $\left(\frac{1}{2},4\right)$ (B) $(2,3)$ (C) $\left(\frac{1}{2},3\right)$ (D) $(-1,4)$

35. Two circles $x^2 + y^2 = 6$ and $x^2 + y^2 - 6x + 8 = 0$ are given. Then the equation of the circle through their points of intersection and the point $(1, 1)$ is

(A) $x^2 + y^2 - 6x + 4 = 0$ (B) $x^2 + y^2 - 3x + 8 = 0$

(C) $x^2 + y^2 - 4y + 2 = 0$ (D) none of these

36. Foot of perpendicular down from $(0, 5)$ to the line $3x - 4y - 5 = 0$ is

(A) $(1, -1)$ (B) $\left(2, \frac{1}{4}\right)$ (C) $\left(\frac{5}{3}, 0\right)$ (D) $(3,1)$

37. The angle between the two plane $4x + 8y + z - 8 = 0$ and $y + z - 4 = 0$ is

(A) 90° (B) 45° (C) 60° (D) 30°

38. The distance between the two planes $2x + 3y + 4z = 4$ and $2x + 3y + 4z = 6$ is

(A) 2 (B) 4 (C) $\frac{2}{\sqrt{29}}$ (D) 8

39. A sphere is uniquely known if we know it, by knowing the following number of points

(A) one (B) two (C) three (D) four

40. The image of the point $(6, 3, -4)$ with respect to $yz-$ plane is

(A) $(-6,3,-4)$ (B) $(6,-3,4)$ (C) $(-6,-3,-4)$ (D) $(6,0,-4)$