PART II — BASIC ENGINEERING AND SCIENCES

(Common to all candidates)

(All correct answers upto a maximum number of 20 will be given credit, but all wrong answers will be taken into account for negative marking)

21. _____ law defines the absolute zero of entropy

a. Zeroth law
b. First law
c. Second law
d. Third law

22. Streamline, pathline and streakline are identical when the flow is

a. steady
b. uniform
c. unsteady
d. neither steady nor uniform

23. _____ relates to the United Nations Framework Convention on Climate Change by committing industrialized countries and economies to limit and reduce greenhouse gases (GHG) emissions.

a. Montreal protocol
b. Nagoya protocol
c. Kyoto protocol
d. Cartegena protocol

24. When the length of the conductor is doubled and the area of cross-section remains the same then its resistivity

a. Remains the same
b. Will be doubled
c. Will become half
d. Will increase by four times

25. The variables which can be accessed by all modules in a program are called

a. external variables
b. local variables
c. internal variables
d. global variables

26. How many memory locations would be reserved for the following program?

```
main()
{
    int i[10];
    char c[10];
    long l[10];
}
```

a. 90
b. 30
c. 70
d. 50

27. Find the output of the C code.

```
#include <stdio.h>
int main()
{
    const int ary[4] = {1, 2, 3, 4};
    int *p;
    p = ary + 3;
    *p = 5;
    printf("%d\n", ary[3]);
}
```

a. 4
b. 5
c. Compile time error
d. 3

28. Find the output of the C code.

```
#include <stdio.h>
void main()
{
    int h = 8;
    int b = h++ + h++ + h++;
    printf("%d\n", h);
}
```

a. 9
b. 10
c. 12
d. 11

29. The reason for the implementation of the cache memory is
    a. To increase the internal memory of the system
    b. The difference in speeds of operation of the processor and memory
    c. To reduce the memory access and cycle time
    d. All of the above

30. The contents of the EPROM are erased by
    a. Overcharging the chip
    b. Exposing the chip to UV rays
    c. Exposing the chip to IR rays
    d. Discharging the Chip

31. A coal containing high amount of volatile matter will have
    a. Very little ash content
    b. Low ignition temperature
    c. High fusion point of its ash
    d. Low adiabatic flame temperature

32. Consider a reaction aC + bD → Products. When the concentration of both the reactants C and D is doubled, the rate increases eight times. However, when the concentration of C is doubled, keeping the concentration of D fixed, the rate is doubled. The overall order of the reaction is
    a. 0
    b. 1
    c. 2
    d. 3

33. 10800 C of electricity passed through the electrolyte deposited 2.977 g of metal with atomic mass 106.4 g mol^{-1}. The charge on the metal cation is
    a. +4
    b. +3
    c. +2
    d. +1

34. Two sounds differ in sound level by 1.00 dB. The ratio of the greater intensity to the smaller intensity is
    a. 10
    b. 100
    c. $10^{0.1}$
    d. $10^{0.01}$

35. The maximum spectral radiancy for a black body at 2000 K lies in the infrared region. _____ in the _____ of that black body shifts the maximum into the visible range.
    a. An increase, temperature
    b. Decrease, temperature
    c. An increase, pressure
    d. Decrease, pressure

36. Lasers used in CD and DVD players are
    a. He-Ne laser
    b. CO_2 laser
    c. Semiconductor lasers
    d. Dye lasers

37. A typical relative refractive index difference between the core and the cladding of an optical fiber designed for long distance transmission is 1%. The numerical aperture for the fiber when the core index is equal to 1.46 is
    a. 0.21
    b. 0.15
    c. 0.10
    d. 0.03

38. The coordination number and the atomic packing factor for the HCP structure are
    a. 8 and 0.68, respectively
    b. 8 and 0.74, respectively
    c. 12 and 0.68, respectively
    d. 12 and 0.74, respectively

39. The ductile and brittle fractures occur because of

a. crack propagation only
b. plastic deformation only
c. plastic deformation and crack propagation, respectively
d. crack propagation and plastic deformation, respectively

40. In a ferromagnetic material, susceptibility is

a. very large and negative
b. very large and positive
c. zero
d. negative

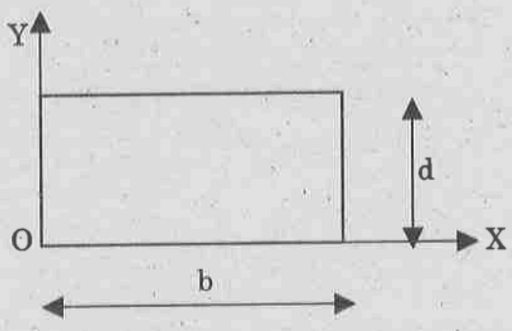
41. Fermi level for extrinsic semiconductor depends on

a. Donor element
b. Impurity concentration
c. Temperature
d. All of the above

42. Three forces A, B, and C of magnitude 8 N, 12 N and 20 N acting on a particle are in equilibrium. It can be concluded that

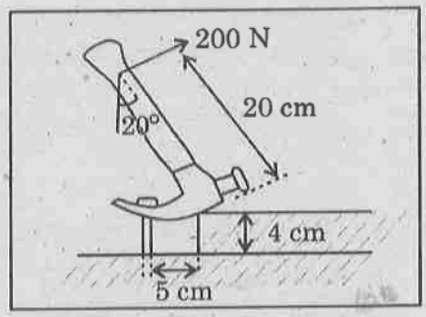
a. A and B act at 90°
b. One of the forces is non-coplanar
c. B and C act in opposite directions
d. One of the forces is non-concurrent

43. Polar moment of inertia of given rectangular area is



a. $(bd^3 + db^3) / 12$
b. $(bd^3 + db^3) / 3$
c. $bd^3/12$
d. $db^3 / 12$

44. The extraction of a nail is greatly facilitated by a block placed under the head of a claw hammer. Consider a 200 N pull on the handle, which is required to pull the nail. Calculate the tension in the nail.

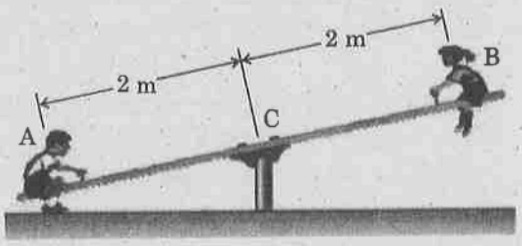


a. 800 N
b. 200 N
c. 400 N
d. 1000 N

45. Consider a particle moving along 1 dimension (X coordinate) with an acceleration $a(t) = 3t^2 + 5t + 1$ m/s², where "t" is time in seconds. At t = 0, velocity (v) = 4 m/s. What is the velocity (v) in m/s at t = 3 s?

a. 5.65 m/s
b. 65.5 m/s
c. 56.5 m/s
d. 6.55 m/s

46. The weight of two children sitting at ends A and B of a seesaw are 420 N and 320 N respectively. Where should a third child sit so that the resultant of the weights of the three children will pass through C if she weighs 300 N?



a. 0.5 m
b. 1 m
c. 1.5 m
d. 0.667 m

47. The ideal gas is characterized by

a. finite intermolecular forces and molecules are made of point masses.

b. negligible intermolecular forces and molecules are made of point masses.

c. finite intermolecular distances and molecules are made of point masses.

d. finite intermolecular forces and molecules are made of infinitesimal masses.

48. While pressurising the air in a cycle pump, 100 kJ of work is supplied and 20 kJ of heat is rejected, the change in internal energy is

a. –120 kJ

b. +120 kJ

c. – 80 kJ

d. +80 kJ

49. Thermal equilibrium of a system is analysed based on the

a. first law of thermodynamics

b. second law of thermodynamics

c. third law of thermodynamics

d. zeroth law of thermodynamics

50. An ideal engine operates between 327 deg.C and 27 deg.C. If the engine produces, 300 kJ of work, the heat rejected by the engine is

a. 0 kJ

b. 100 kJ

c. 200 kJ

d. 300 kJ

51. SCR (Short Circuit Ratio) of a synchronous machine is defined as:

a. $\frac{1}{\text{Xs(Unsaturated)}}$

b. $\frac{1}{\text{Xs(Unsaturated)(per unit)}}$

c. $\frac{1}{\text{Xs(saturated)(per unit)}}$

d. $\frac{1}{\text{Xs(saturated)}}$

52. In a cylindrical rotor synchronous machine, the phasor summation of stator MMF and rotor MMF is possible because:

a. The two MMF are rotating in opposite directions

b. Two MMF are rotating in same direction

c. One MMF is stationary and the other is rotating

d. Two MMF are stationary with respect to each other

53. A 250V, DC shunt motor having armature and field resistances of 0.05Ω and 50Ω, respectively, delivers 17.5kW output while drawing 20kW as input. What will be its armature copper loss when maximum efficiency is obtained?

a. 2219 W

b. 2500 W

c. 2469 W

d. 2782 W

54. The number of parallel paths in lap-wound armature are

a. Equal to the number of poles of the machine

b. Equal to two, irrespective of the number of poles

c. Equal to the number of commutator segments

d. Equal to the number of armature conductors

55. When the machine operates as a generator at load, the relation between induced EMF and terminal voltage is:

a. $E_g > V$

b. $E_g < V$

c. $E_b = V$

d. $E_b = 1$