PhD Entrance Examination – Jan 21

Mechanical Engineering

Marks: **50**

1. A body of weight W is required to move up on rough inclined plane whose angle of inclination with the horizontal is α. The effort applied parallel to the plane is given by (where μ = tanφ = Coefficient of friction between the plane and the body.)
   A. $P = W \tan\alpha$
   B. $P = W \tan(\alpha + \varphi)$
   C. $P = W (\sin\alpha + \mu\cos\alpha)$
   D. $P = W (\cos\alpha + \mu\sin\alpha)$
2. Moment of inertia of a rectangular section having width (b) and depth (d) about an axis passing through its C.G. and parallel to the depth (d), is
   A. $db^3/12$
   B. $bd^3/12$
   C. $db^3/36$
   D. $bd^3/36$
3. A spring used to absorb shocks and vibrations is
   A. Conical spring
   B. torsion spring
   C. leaf spring
   D. disc spring
4. The neutral axis of the cross-section a beam is that axis at which the bending stress is
   A. zero
   B. minimum
   C. maximum
   D. infinity
5. A thin spherical shell of diameter (d) and thickness (t) is subjected to an internal pressure (p). The stress in the shell material is
   A. pd/t
   B. pd/2t
   C. pd/4t
   D. pd/8t
6. The contact ratio is the ratio of
   A. length of pair of contact to the circular pitch
   B. length of arc of contact to the circular pitch
   C. length of arc of approach to the circular pitch
   D. length of arc of recess to the circular pitch
7. If the rotating mass of a rim type flywheel is distributed on another rim type flywheel whose mean radius is half the mean radius of the former, then energy stored in the latter at the same speed will be
   A. four times the first one
   B. same as the first one
   C. one fourth of the first one
   D. one and a half times the first one
8. The rolling contact bearings are known as
   A. thick lubricated bearings
   B. plastic bearings
   C. thin lubricated bearings
   D. antifriction bearings
9. The difference between the tooth space and the tooth thickness as measured on the pitch circle, is called
   A. working depth
   B. clearance
   C. face width
   D. backlash
10. Strain energy is the
   A. energy stored in a body when strained within elastic limits
   B. energy stored in a body when strained upto the breaking of a specimen
   C. maximum strain energy which can be stored in a body
   D. proof resilience per unit volume of a material
11. For a perfect incompressible liquid, flowing in a continuous stream, the total energy of a particle remains the same, while the particle moves from one point to another. This statement is called
   A. continuity equation
   B. Bernoulli's equation
   C. Pascal's law
   D. Archimede's principle

12. The buoyancy depends upon the
    A. weight of the liquid displaced
    B. pressure with which the liquid is displaced
    C. viscosity of the liquid
    D. compressibility of the liquid
13. Froude's number is the ratio of inertia force to
    A. pressure force
    B. elastic force
    C. gravity force
    D. surface tension force
14. A heat pump working on a reversed Carnot cycle has a C.O.P. of 5. It works as a refrigerator taking 1 kW of work input. The refrigerating effect will be
    A. 1 kW
    B. 2 kW
    C. 3 kW
    D. 4 kW
15. A vapour absorption refrigerator uses _____ as a refrigerant.
    A. water
    B. ammonia
    C. Freon
    D. aqua-ammonia
16. For the same compression ratio, the efficiency of dual combustion cycle is
    A. greater than Diesel cycle and less than Otto cycle
    B. less than Diesel cycle and greater than Otto cycle
    C. greater than Diesel cycle
    D. less than Diesel cycle
17. Otto cycle consists of
    A. two constant volume and two isentropic processes
    B. two constant pressure and two isentropic processes
    C. two constant volume and two isothermal processes
    D. one constant pressure, one constant volume and two isentropic processes
18. Which of the following is correct?
    A. Absolute pressure = Gauge pressure + Atmospheric pressure
    B. Gauge pressure = Absolute pressure + Atmospheric pressure
    C. Atmospheric pressure = Absolute pressure + Gauge pressure
    D. Absolute pressure = Gauge pressure - Atmospheric pressure
19. Which of the following is the correct statement?
    A. All the reversible engines have the same efficiency.
    B. All the reversible and irreversible engines have the same efficiency.
    C. Irreversible engines have maximum efficiency.
    D. All engines are designed as reversible in order to obtain maximum efficiency.
20. According to Stefan-Boltzmann law, the total radiation from a black body per second per unit area is directly proportional to the
    A. absolute temperature
    B. square of the absolute temperature
    C. cube of the absolute temperature
    D. fourth power of the absolute temperature
21. A taper provided on the pattern for its easy and clean withdrawl from the mould is known as
    A. machining allowance
    B. draft allowance
    C. shrinkage allowance
    D. distortion allowance
22. The rake angle required to machine brass by high speed steel tool is
    A. 0°
    B. 10°
    C. 20°
    D. -10°
23. In welding copper alloys with TIG arc welding
    A. direct current with straight polarity is used
    B. direct current with reversed polarity is used
    C. alternating current is used
    D. any one of these
24. The lip angle of a single point tool is usually
    A. 20° to 40°
    B. 40° to 60°
    C. 60° to 80°
    D. none of these

25. The fullers are used
A. for finishing flat surfaces
B. for necking down a piece of work
C. for punching a hole
D. to finish the punched hole

26. The centrifugal casting method, is used for casting articles of
A. symmetrical shape about vertical axis
B. symmetrical shape about horizontal axis
C. irregular shape
D. non-ferrous metal only

27. The blank diameter used in thread rolling will be
A. equal to minor diameter of the thread
B. equal to pitch diameter of the thread
C. a little larger than the minor diameter of the thread
D. a little larger than the pitch diameter of the thread

28. Side rake angle of a single point cutting tool is the angle
A. by which the face of the tool is inclined towards back
B. by which the face of the tool is inclined sideways
C. between the surface of the flank immediately below the point and a plane at right angles to the centre line of the point of the tool
D. between the surface of the flank immediately below the point and a line drawn from the point perpendicular to the base

29. Crater wear occurs mainly on the
A. nose part, front relief face and side relief face of the cutting tool
B. face of the cutting tool at a short distance from the cutting edge only
C. cutting edge only
D. front face only

30. Value of minimum interference is given by
A. Size of smallest hole – size of biggest hole
B. Size of smallest shaft + size of biggest hole
C. Size of smallest shaft – size of biggest hole
D. None of the mentioned

31. A constraint that does not affect the feasible region is a
A. non-negativity constraint.
B. redundant constraint.
C. standard constraint.
D. slack constraint.

Answer: Option B

32. The interval in which the Lagrange's theorem is applicable for the function $f(x) = 1/x$ is
A. [-3, 3]
B. [-2, 2]
C [2, 3]
D. [-1, 1]

33. A bag contains 2 red, 3 green and 2 blue balls. Two balls are drawn at random. What is the probability that none of the balls drawn is blue?
A. 10/21
B. 11/21
C. 2/7
D. 5/7

34. What is the probability of getting a sum 9 from two throws of a dice?
A. 1/6
B. 1/8
C. 1/9
D. 1/12

35. Number in form $z = a + bi$ where $a, b \in R$ and $i = \sqrt{-1}$ is called a
A. rational number
B. complex number
C. integer
D. prime number

36. The system of linear equations
$(4d - 1)x + y + z = 0$
$-y + z = 0$
$(4d - 1)z = 0$ has a non-trivial solution, if d equals
A. 1/2 B. 1
C. 3/4 D. 1/4

37. The rank of a 3 x 3 matrix C (= AB), found by multiplying a non-zero column matrix A of size 3 x 1 and a non-zero row matrix B of size 1 x 3, is
A. 0 B. 3
C. 2 D. 1

38. The function $f(x) = x^3 - 6x^2 + 9x + 25$ has
A. a maxima at x= 1 and a minima at x = 3
B. a maxima at x = 3 and a minima at x = 1
C. no maxima, but a minima at x = 1
D. a maxima at x = 1, but no minima

39. Directional derivative of $f(x, y, z) = x^2 + y^2 + z^2$ at the point (1, 1, 1) in the direction i - k is
A. 0 B. 1
C. $\sqrt{2}$ D. $2\sqrt{2}$

40. Linear second order ordinary differential equation is non homogeneous if
A. there is no constant in equation B. solution is zero
C. solution has some value D. independent variable is present

PAPER SETTER ID-No: ME1812101

PhD Entrance Examination - Answer Key

Mechanical Engineering

1.	C
2.	A
3.	C
4.	A
5.	C
6.	B
7.	C
8.	D
9.	D
10.	A
11.	B
12.	A
13.	C
14.	D
15.	D
16.	A
17.	A
18.	A
19.	C
20.	D
21.	B
22.	A
23.	A
24.	C
25.	B
26.	B
27.	C
28.	B
29.	B
30.	C
31.	B
32.	C
33.	A
34.	C
35.	B
36.	D
37.	D
38.	A
39.	A
40.	C