

MECHANICAL ENGINEERING

Paper : I

Grade : V(B)

Full Marks – 200

Time – Three hours

The figures in the margin indicate full marks for the questions.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

15×6=90

Each question carries 6 marks.

Answer all questions.

1. (a) Why turning is produced on a surface ?
(b) How it is produced on a lathe ? 3+3=6
2. (a) What are the influences of cutting tool angles on machining ?
(b) Briefly state the effect of rake angle during cutting. 3+3=6
3. (a) What is reamer ?
(b) List various types of reamer. 2+4=6

[Turn over

4. How the size of a drilling machine is specified?
Discuss briefly. 6
5. Discuss how cutting force changes with variation of speed and rake angle of a milling cutter. 6
6. (a) Compare between plain and universal milling machine.
(b) How milling differs from turning in lathe ?
3+3=6
7. (a) To what type of flow is the concept of velocity potential and stream function applicable ?
(b) Differentiate between the rotational and irrotational flows. 3+3=6
8. Explain the following types of equilibrium of floating bodies 2×3=6
(i) Stable equilibrium
(ii) Unstable equilibrium
(iii) Neutral equilibrium
9. (a) Distinguish between path lines, stream lines and streak lines.
(b) Sketch the velocity distribution for uniform irrotational flow. 3+3=6

10. Derive a relation for the slope and deflection of a simply supported beam subjected to a uniformly distributed load of W/m length. 6

11. (a) What are helical springs ?

(b) Differentiate between a closely coiled helical spring and an open coiled helical spring.

2+4=6

12. (a) What is the necessity of riveted joint ?

(b) Explain the difference between the strength of riveted joint and efficiency of a riveted joint.

2+4=6

13. (a) What are the main environmental effects of air pollution ?

(b) What is particulate matter ?

4+2=6

14. (a) Where does water pollution come from ?

(b) What causes white deposit on showers and bathroom walls ?

3+3=6

15. (a) What are the effects of noise pollution ?

(b) What are the laws regarding noise pollution ?

3+3=6

Answer *all* questions.

Each question is provided with four alternatives. Choose the correct answer and write in your answer script.

16. Natural sources of air pollution come from

- (a) Internal combustion engines
- (b) Coal fired electrical plants
- (c) Salt from sea spray, cattle, soil dust, volcanic dust
- (d) Birds

17. All are particulate pollutant except

- (a) dust
- (b) ozone
- (c) soot
- (d) smoke

18. Which of the following is secondary pollutant ?

- (a) CO_2
- (b) CO
- (c) O_3
- (d) SO_2

19. Noise is measured using sound meter and the unit is

- (a) hertz
- (b) decibel
- (c) joule
- (d) sound

20. Which is the main water polluting material ?

- (a) Plastic
- (b) Cloth
- (c) Oil spill
- (d) None of these

21. Which of the following air pollution control devices is suitable for removing the finest dust from the air ?

- (a) Cyclone separator
- (b) Electrostatic precipitator
- (c) Fabric filter
- (d) Wet scrubber



22. If the radius of wire stretched by a load is doubled, then its Young's modulus will be

- (a) doubled
- (b) halved
- (c) become four times
- (d) remain unaffected.

23. Which of the following has not unit ?

- (a) Kinematic viscosity
- (b) Elasticity
- (c) Strain
- (d) Surface tension

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(5)

[Turn over

24. In a thin shell, the ratio of longitudinal stress to the circumferential stress is

(a) $\frac{1}{2}$

(b) $\frac{3}{4}$

(c) 1

(d) 2

25. In a riveted joints, when the number of rivets decreases from the innermost to the outer most row, the joint is said to be

(a) Chain

(b) Zig-zag riveted

(c) Diamond riveted

(d) None of these

26. The object of caulking in a riveted joint is to make the joint

(a) free from corrosion

(b) stronger in tension

(c) free from stresses

(d) leak proof

27. When a closely coiled spring is subjected to an axial load, it is said to be under

(a) bending

(b) shear

(c) torsion

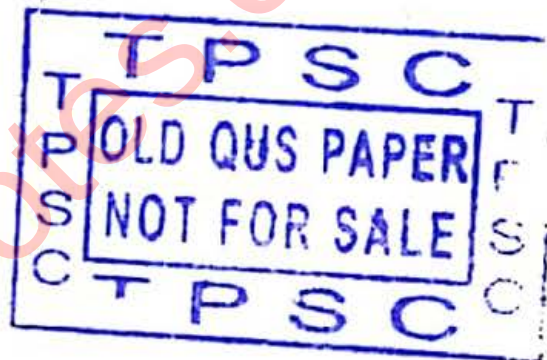
(d) All of these

28. Elasticity of fluids is measured in terms of

- (a) Young's modulus of elasticity
- (b) Shear modulus of elasticity
- (c) Bulk modulus of elasticity
- (d) None of the above

29. The printer's ink is an example of

- (a) Newtonian fluid
- (b) Non-newtonian fluid
- (c) Elastic solid
- (d) None of these



30. Flow between parallel plates of infinite extent is an example of

- (a) One dimensional flow
- (b) Two dimensional flow
- (c) Three dimensional flow
- (d) Compressible flow.

31. The concept of stream function which is based on the principle of continuity is applicable to

- (a) Irrotational flow only
- (b) Two dimensional flow only
- (c) Three dimensionanl flow
- (d) Uniform flow only

32. An ice-cube is floating in a glass of water as the cube melts the water level

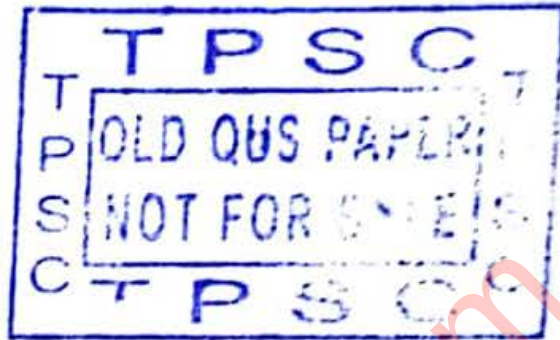
- (a) Remain constant
- (b) Falls
- (c) Rises
- (d) None of the above

33. If the position of the metacentre M remains lower than c.g. of the body G, the body will remain in a state of

- (a) Stable equilibrium
- (b) Unstable equilibrium
- (c) Neutral equilibrium
- (d) Any of the above

34. Mercury does not wet glass. This is due to property of liquid known as

- (a) Adhesion
- (b) Cohesion
- (c) Surface tension
- (d) Viscosity



35. Viscosity of water in comparison to mercury is

- (a) higher
- (b) lower
- (c) same
- (d) unpredictable

36. For manometer, a better liquid combination is one having

- (a) higher surface tension
- (b) lower surface tension
- (c) high density and viscosity
- (d) low density and viscosity

37. Specific weight of sea water is more than that of pure water because it contains

- (a) dissolved air
- (b) dissolved salt
- (c) suspended matter
- (d) All of the above

38. Poise is the unit of

- (a) Surface tension
- (b) Capillarity
- (c) Viscosity
- (d) Buoyancy

39. Rain drops are spherical because of

- (a) Viscosity
- (b) Air resistance
- (c) Surface tension forces
- (d) None of the above

40. Piezometer is used to measure

- (a) Pressure in pipe, channels etc
- (b) Atmospheric pressure
- (c) Very low pressure
- (d) None of the above

41. The horizontal component of buoyant force is

- (a) negligible
- (b) same as buoyant force
- (c) zero
- (d) None of the above



42. A piece weighing 3 Kg in air was found to weight 2.5 Kg when submerged in water. Its specific gravity is

- (a) 1
- (b) 5
- (c) 7
- (d) 6

43. All the terms of energy in Bernoulli's equation have dimension of

- (a) energy
- (b) work
- (c) mass
- (d) length

44. Abrasive chips are formed during machining

- (a) mild steel
- (b) cast iron
- (c) high speed steel
- (d) high carbon steel

45. Drilling is an example of

- (a) orthogonal cutting
- (b) oblique cutting
- (c) simple cutting
- (d) uniform cutting

46. A single point cutting tool should ideally have

- (a) zero rake angle
- (b) positive rake angle
- (c) negative rake angle
- (d) point angle

47. The work on surface speed for cylindrical grinding varies from

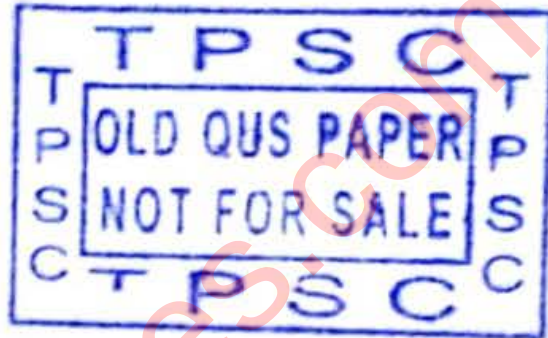
- (a) 5 to 10 m/min
- (b) 10 to 20 m/min
- (c) 20 to 30 m/min
- (d) 40 to 60 m/min

48. The cutting tool in a milling machine is mounted on

- (a) spindle
- (b) arbor
- (c) column
- (d) knee

49. In the relation $VT^n = \text{Cont.}$, the value of 'n' for carbide tools is

- (a) 0.1 to 0.2
- (b) 0.20 to 0.25
- (c) 0.25 to 0.40
- (d) 0.40 to 0.55



50. In machining metals, chips break due to of work material

- (a) toughness
- (b) ductility
- (c) elasticity
- (d) work hardening

51. The angle on which the strength of the tool depends is

- (a) rake angle
- (b) cutting angle
- (c) clearance angle
- (d) lip angle

52. A right hand tool on a lathe cuts most efficiently when it travels

- (a) from left to right end of lathe bed
- (b) from right to left end of lathe bed
- (c) with the help of a compound slide
- (d) across the bed

53. Low helix angle drills are preferred for drilling holes in

- (a) plastic
- (b) copper
- (c) cast steel
- (d) carbon steel

54. In plain milling machine, the table can be moved

- (a) longitudinally
- (b) crosswise
- (c) vertically
- (d) All the above

55. When the tool moves parallel to the lathe axis, the movement is termed as

- (a) cross feed
- (b) angular feed
- (c) longitudinal feed
- (d) None of these.

GROUP – C

5×6=30

Answer *all* questions.

Each question carries 6 (six) marks.

56. At what speed a 20 mm drill will run for cutting steel at 25 m/min surface speed ?
57. In a three-dimensional incompressible flow, the velocity component in Y and Z directions are $V = ax^3 - by^2 + cz^2$, $W = bx^3 - cy^2 + az^2x$. Determine the missing component of velocity distribution such that continuity equation is satisfied.
58. A spherical vessel of 2m diameter is subjected to an internal pressure of 2 MPa. Find the minimum thickness of the plates required, if the maximum stress is not exceed 100 MPa. Take efficiency of the joint as 80%.
59. In a taper, the bigger diameter is 90 mm, the smaller diameter is 80 mm and the length of taper is 100 mm. Find the angle of taper.
60. When a pressure of liquid is increased from 3.5 MN/m² to 6.5 MN/m² its volume is found to decrease by 0.08 percent. What is the bulk modulus of elasticity of the liquid ?

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