

Register No.:

2473

October 2025

Time – Two hours
(Maximum Marks: 60)

- N.B.**
1. Answer all questions under Part-A. Each question carries 1 mark.
 2. Answer any 5 questions under Part-B. Each question carries 2 marks.
 3. Answer any 3 questions under Part-C. Each question carries 10 marks.
 4. PSG Design Data Book or Approved Data Book is permitted.

PART – A

1. The preferred number series used in engineering design follows ____ progression
 - a) Arithmetic
 - b) Geometric
 - c) Harmonic
 - d) Random
2. The maximum shear stress theory is also known as
 - a) Von Mises theory
 - b) Rankine theory
 - c) Tresca theory
 - d) Mohr's theory
3. The factor of safety for brittle materials is usually ____ than ductile material
 - a) Higher
 - b) Lower
 - c) Equal
 - d) Unpredictable

4. The stress concentration factor is highest for
- a) A smooth cylindrical shaft
 - b) A stepped shaft with a fillet
 - c) A flat plate with a hole
 - d) A uniform beam
5. Which key type is most used in heavy-duty applications?
- a) Saddle key
 - b) Woodruff key
 - c) Gib-head key
 - d) Feather key
6. In a pin-type flexible coupling, flexibility is achieved by
- a) Flexible discs
 - b) Gear teeth
 - c) Universal joints
 - d) Rubber bushes
7. Which coupling type would be most suitable for connecting shafts with angular misalignment?
- a) Rigid flange coupling
 - b) Marine coupling
 - c) Universal coupling
 - d) Protected flange coupling
8. The marine-type flange coupling is designed to
- a) Withstand corrosive environments
 - b) Allow high misalignment
 - c) Reduce weight
 - d) Increase shaft speed

9. What does the designation 'B75' for a V-belt typically indicate?
- a) Belt type 'B' and 75 cm inside length.
 - b) Belt type 'B' and 75 inches pitch length.
 - c) Belt type 'B' and 75 mm width.
 - d) Belt type 'B' and a maximum tension of 75 N.
10. Selecting a larger driver pulley will
- a) Decrease driven pulley speed
 - b) Increase driven pulley speed
 - c) Have no effect
 - d) Decrease arc of contact
11. Angle of contact for smaller pulley in open belt drive is
- a) Always 180°
 - b) Always $>180^\circ$
 - c) Always $<180^\circ$
 - d) Independent of diameters
12. If service factor is 1.2 and transmitted power is 10 kW, design power is
- a) 8.33 kW
 - b) 10 kW
 - c) 11.2 kW
 - d) 12 kW
13. A bearing designed primarily for axial forces is called
- a) Thrust bearing
 - b) Radial bearing
 - c) Journal bearing
 - d) Roller bearing

14. In bearing code 6308, which indicates series & bore?

- a) 630 = series, 8 = bore
- b) 08 = series, 63 = bore
- c) 6 = series, 308 = bore
- d) 63 = series, 08 = bore

15. Bearing pressure for $D=50$ mm, $L=50$ mm, $W=6$ kN

- a) 2.55 MPa
- b) 2.30 MPa
- c) 2.0 MPa
- d) 2.40 MPa

16. The bearing clearance ratio (c/r) typical range

- a) 0.01-0.02
- b) 0.001-0.002
- c) 0.2-0.3
- d) 0.003-0.0004

17. In CAD, parametric modeling allows

- a) Fixed dimensions
- b) Static shapes
- c) Manual calculations
- d) Variable relationships

18. Value Engineering focuses on

- a) Increasing cost
- b) Maintaining function
- c) Reducing quality
- d) Extending timeline

19. Prototyping in product development helps in
- a) Final production
 - b) Cost reduction
 - c) Design validation
 - d) Market research
20. Modeling approach using primitives & Boolean operations
- a) B-Rep
 - b) CSG
 - c) Wireframe
 - d) Surface

PART – B

21. Define Factor of Safety.
22. A beam made of composite material is bending under load. Identify suitable composite material and justify its selection based on properties.
23. Design a sunk key for a 60 mm diameter shaft and select standard key dimensions using proportions.
24. State any two advantages of pin type flexible coupling over rigid couplings.
25. Sketch the cross section of a V – belt and label its important parts.
26. Differentiate between sliding contact and rolling contact bearings.
27. What is the primary cause of heat generation in a journal bearing?
28. What is lean manufacturing?

PART – C

29. A hydraulic press exerts a total load of 3.5 MN. The load is carried by two steel rods, supporting the upper head of the press. If the safe stress is 85 MPa and $E = 210 \text{ kN/mm}^2$. Find:
- Diameter of the rods.
 - extension in each rod in a length of 2.5 m.
30. A marine type coupling is used to transmit 65 kW at 100 rpm. The allowable shear stress in the shaft and bolt may be taken as 33 MPa and permissible crushing stress in the bolt is 35 MPa. Design the coupling, assuming number of bolts used as 6.
31. Design a V-belt drive for the following specifications:
- Power to be transmitted = 75 kW,
 - Speed of driving wheel = 1440 rpm,
 - Speed of driven wheel = 400 rpm,
 - Diameter of driving wheel = 300 mm,
 - Centre distance = 2500 mm,
 - Service factor = 1.3,
 - Correction factor for length = 1.07.
32. A 150 mm diameter shaft supporting a load of 10 kN has a speed of 1500 rpm. The shaft runs in a bearing whose length is 1.5 times the shaft diameter. If the diametral clearance of the bearing is 0.15 mm and the absolute viscosity of the oil at the operating temperature is 0.11 N-s/m^2 . Find the power wasted in friction.
33. What is Finite Elements Analysis (FEA)? Explain the basic steps.
