



C20-A-502

7602

BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER / NOVEMBER—2023

DAE - FIFTH SEMESTER EXAMINATION

DESIGN OF MACHINE ELEMENTS

Time : 3 Hours]

[Total Marks : 80

PART—A

3×10=30

- Instructions :** (1) Answer **all** questions.
(2) Each question carries **three** marks.
(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1. What size of hole must be drilled in M 34 bolt to make it uniform strength?
2. How a screw thread is designated? Give an example.
3. Classify shafts.
4. A solid shaft is required to transmit a torque of 20kN-m. Find the necessary diameter of the shaft, if the allowable shear stress is 70 N/mm².
5. Draw a neat sketch of Gib head key with approximate dimensions.
6. Define the terms (a) amplitude and (b) phase.
7. What is vibration? List out the types of vibrations.
8. Write the differences between governor and flywheel.
9. What is a turning moment diagram?
10. Draw a neat sketch of valve and label the parts.

- Instructions :** (1) Answer **all** questions.
(2) Each question carries **eight** marks.
(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer

- 11.** (a) A solid circular shaft is used to transmit a torque of 12 Nm. The angle of twist over a length of 1.8 m is 2°. Estimate the required diameter of the shaft and shear stress induced in the material tall $G = 0.8 \times 10^5 \text{ N/mm}^2$.

(OR)

- (b) Determine the diameter of a solid shaft which has to transmit 15 kW power at 260 rpm. Ultimate shear stress for shaft material is 350 N/mm^2 and the factor of safety for design is 8, if the hollow shaft is replaced by solid shaft. Find the inside and outside diameters of hollow shaft, if their ratio is 0.5.

- 12.** (a) Design a cast iron flange coupling for a shaft transmitting 15 kW at 200 rpm and having an allowable shear stress of 40 N/mm^2 . The working stress in the bolts should not exceeds 30 N/mm^2 . Assume that the same material is used for shaft and key and the crushing stress is 100 N/mm^2 . The maximum torque is 25% greater than the full-load torque. The shear stress for the cast iron is 14 N/mm^2 .

(OR)

- (b) Design a muff coupling to connect two shafts transmitting 100 kW at 200 rpm. The permissible shearing and crusting stresses for the shaft and key material are 50 N/mm^2 and 100 N/mm^2 respectively. The material of muff is CI with permissible shear stress of 15 N/mm^2 . Assume that the maximum transmitted torque is equal to the mean torque.

- 13.** (a) In a Porter governor two balls of weight 26 N each are joined by four equal links of length 300 mm each. A dead weight of 320 N is used on the sleeve at the centre. If the radius of rotation is 240 mm, find the equilibrium speed.

(OR)

- (b) A solid disc flywheel 0.5 m diameter and 12 cm thick is made from cast iron of density $7 \times 10^3 \text{ kg/m}^3$. Determine the (a) moment of inertia of the flywheel and (b) kinetic energy at 1200 rpm.

14. (a) The valve of an IC engine of 60 mm in diameter and is subjected to a maximum gas pressure of 4 N/mm^2 . The safe bending stress in the valve material is 45 N/mm^2 . Determine :
- (i) Thickness of valve head
 - (ii) Diameter of valve rod
 - (iii) Maximum lift of the valve
 - (iv) Width of seat
 - (v) Diameter of valve head

(OR)

- (b) A multi-disc clutch has three discs on the driving shaft and two discs on the driven shaft. The inner radius of contact is 40 mm and outer radius is 70 mm. Assuming uniform wear and coefficient of friction as 0.1, find the maximum axial intensity of pressure between the surfaces for transmitting 4 kW at 750 rpm.

15. (a) Find the diameter of a connecting rod, 250 mm long for a slow speed diesel engine. Cylinder diameter is 100 mm and stroke is 125 mm. Maximum combustion pressure is 4.9 N/mm^2 and factor of safety = 20. $F = 2.06 \times 10^5 \text{ N/mm}^2$.

(OR)

- (b) In a universal joint a driving shaft transmits a torque of 5000 Nm to a driven shaft. Determine the suitable diameter for the shaft and the pins. Assume the safe shear stress for shaft and pins are 50 N/mm^2 and 25 N/mm^2 respectively.

PART—C

10×1=10

- Instructions :**
- (1) Answer the following question.
 - (2) The question carries **ten** marks.
 - (3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

16. Design a piston for IC engine using the following data. The diameter of cylinder bore is 300 mm and maximum explosion pressure is 5 N/mm^2 . The piston may have 4 compression rings and an oil ring.

Permissible stress for piston	= 27 N/mm^2
Permissible stress for piston rings	= 80 N/mm^2
Radial wall pressure	= 0.04 N/mm^2
Permissible bearing pressure for pin	= 15 N/mm^2
Permissible bending stress for pin	= 85 N/mm^2
Permissible pressure on piston barrel	= 0.4 N/mm^2

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