03.11.2023 4020510 DME

Register No.:

151

October 2023

Time – Three hours
(Maximum Marks: 100)

[N.B. 1. Answer all questions under Part-A. Each question carries 3 marks.

2. Answer all the questions either (A) or (B) in Part-B. Each question carries 14 marks.]

PART – A

1. What are the factors to be considered for the selection of materials?
2. Define Fatigue and Endurance Limit.
3. What are the types of keys?
4. What is bushed-pin type flexible coupling? Where it is preferred?
5. Sketch and name the different types of belts used in engineering field.
6. Sketch the cross section of a V – belt and label its important parts.
7. Write about radial and thrust ball bearings.
8. Write short notes on speed reducer.
9. What are the roles of CAD in design?
10. What is solid modeling?

PART – B

11. (a) A journal of 25 mm diameter is supported in sliding bearing. It has a maximum end reaction of 2500 N. Assume the allowable bearing pressure of 5 N/mm^2. Calculate the length of sliding bearing.

(Or)

(b) A plate 100 mm wide and 10 mm thick is to be welded to another plate by means of double parallel fillets. The plates are subjected to a static load of 80 kN. Find the length of the weld if the permissible shear stress in the weld does not exceed 55 MPa.

12. (a) A shaft transmits 25 kW at 1500 rpm. It is also subjected to a bending moment of magnitude 100 Nm due to pulley. The material used is 30C8 steel with a yield stress of 300 MPa. Find the diameter of the shaft taking factor of safety as 3. The shock and fatigue factor are (K_b) 1.5 for bending and (K_t) 1.2 for torsion.

(Or)

(b) Design a protective type flange coupling to connect two shafts to transmit 7.5 kW at 720 rpm. The permissible shear stress for the shaft, bolt and key materials is 33 N/mm^2, permissible crushing strength for bolt and key material is 60 N/mm^2 and permissible shear stress for cast iron is 15 N/mm^2.

13. (a) A horizontal drive is required from an electric motor to a small ammonia compressor set. The power is transmitted to the compressor by a pulley overhang by 150 mm. It is desired to design the drive from the following data. Power of motor = 5 kW, Center distance = 1.5 m, Diameter of the motor pulley=150 mm, Total slip = 2.5%, Speed of motor pulley = 1440 rpm, Speed of compressor pulley = 540 rpm. Select a suitable flat belt drive.

(Or)

(b) Design a V belt drive to transmit 12 kW to a compressor. The motor speed is 900 rpm and the compressor pulley runs at 300 rpm.

14. (a) In a bearing the load on the journal is 40000 N, Diameter 150 mm, Speed 900 rpm, Ambient temperature 15.5°C, Temperature of oil film for SAE 10 oil is 50°C, L/D ratio = 1.6, Bearing pressure is 111.1 X 10^4 N/ mm^2, C/D=0.0013. Absolute viscosity of SAE 10 oil is 0.17 N/ms. Determine (i) Co-efficient of friction (ii) Heat generated.

(Or)

(b) Design a journal bearing for a centrifugal pump from the following data: Load on the journal is 25 kN, speed of the journal = 1000 rpm; Type of oil used is SAE 20 for which the absolute viscosity at 60°C = 22cP; Ambient temperature of air = 20°C; Maximum bearing pressure = 1.7N/mm^2; Heat dissipation co-efficient = 1232 J/s/m^2/°C. Calculate also mass of lubricating oil required for artificial cooling, if rise in temperature of oil is limited to 15°C.

15. (a) Explain Shigley's design process.

(Or)

(b) What is finite element analysis? Explain the basic steps of it.
