ME – 9261 – Machine Design

IV Semester - Common to Printing Technology and Manufacturing Engineering

Duration : 3 Hours **Max. Marks: 100**

29

Answer ALL questions

(Use of PSG Data book is permitted).

Part – A (2 x 10 = 20 marks)

1. What are preferred numbers? Explain with an example.
2. Explain the term factor of safety with an example.
3. How are keys designed? Explain.
4. Distinguish between rigid and flexible couplings.
5. With the help of a neat sketch explain how knuckle joints are used.
6. Give examples of 2 kinds of welded joints with neat sketches.
7. What are concentric springs? Where are they used ?
8. What are fly wheels used for? How are they designed?
9. Distinguish between sliding contact and rolling contact bearings.
10. Explain with neat sketches the design of a connecting rod.

Part – B (16 x 5 = 80 marks)

11. The crane hook carries a load of 20 kN as shown in Fig(1). The section at X-X is rectangular whose horizontal side is 100 mm. Find the stresses in the inner and outer fibres at the given section.

12(a). Find the diameter of a solid steel shaft to transmit 20 kW at 200 r.p.m. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 8. If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameter when the ratio of inside to outside diameters is 0.5.

(OR)

12(b). Design and draw a protective type of cast iron flange coupling for a steel shaft transmitting 15 kW at 200 r.p.m. and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for cast iron is 14 MPa.

13(a). Two shafts are connected by means of a flange coupling to transmit torque of 25 N-m. The flanges of the coupling are fastened by four bolts of the same material at a radius of 30 mm. Find the size of the bolts if the allowable shear for the bolt material is 30 MPa.

(OR)

13(b). Determine the length of the weld run for a plate of size 120mm wide and 15 mm thick to be welded to another plate by means of (i) A single transverse weld; and (ii) Double parallel fillet welds when the joint is subjected to variable loads.

14(a). Design a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm using the value of spring index as 5.

The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 kN/mm^2.

Take Wahl's factor; $K = \frac{4C-1}{4C-4} + \frac{0.615}{C}$, where C = Spring index

(OR)

14(b). An otto cycle engine develops 50 kW at 150 r.p.m. with 75 explosions per minute. The change of speed from the commencement to the end of power stroke must not exceed 0.5 % of mean on either side. Design a suitable rim section having width four times the depth so that the hoop stress does not exceed 4 MPa. Assume that the flywheel stores 16/15 times the energy stored by the rim and that the workdone during power stroke is 1.40 times the workdone during the cycle. Density of rim material is 7200 kg/m^3.(Fig.2)

15(a). Design a journal bearing for a centrifugal pump from the following data: Load on the journal = 20000 N; speed of the journal = 900 r.p.m.; Type of oil is SAE 10, for which the absolute viscosity at 55°C = 0.017 kg/m-s; Ambient temperature of oil 15.5°C; Maximum bearing pressure for the pump = 1.5 N/mm^2. Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C. Heat dissipation coefficient = 1232 W/m^2/°C.

(OR)

15(b). Design a self-aligning ball bearing for a radial load of 7000 N and a thrust load of 2100 N. The desired life of the bearing is 160 millions of revolutions at 300 r.p.m. Assume uniform and steady load.

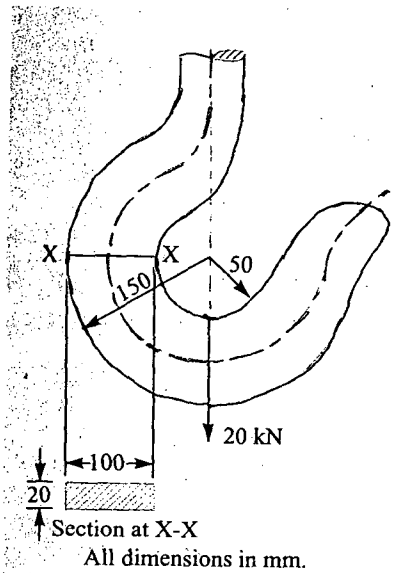
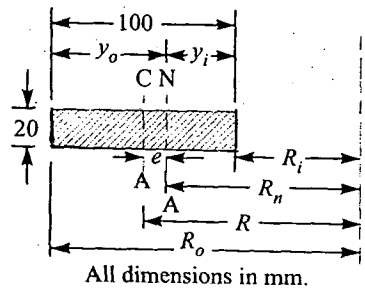

X
X
150
50
20 kN
100
20
Section at X-X
All dimensions in mm.

FIG 1


100
y_o
y_i
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20
e
A
A
R_i
R_n
R
R_o
All dimensions in mm.

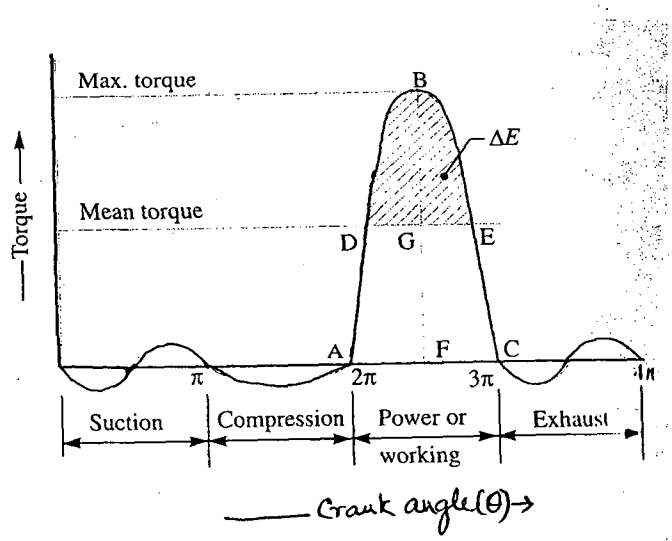
Max. torque
B
ΔE
Mean torque
D
G
E
Torque
A
F
C
π
2π
3π
4π
Suction
Compression
Power or working
Exhaust
Crank angle(θ)

FIG 2