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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 60856

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fifth Semester

Mechanical Engineering

ME 2303/ME 53/10122 ME 504 – DESIGN OF MACHINE ELEMENTS/
MACHINE DESIGN

(Common to Automobile Engineering and Mechanical and Automation Engineering, Fourth Semester – Manufacturing Engineering, Industrial Engineering and Management and Industrial Engineering)

(Regulations 2008/2010)

(Common to PTME 2303 — Design of Machine Elements for B.E. (Part-Time) Fourth Semester — Mechanical Engineering — Regulations 2009)

Time : Three hours Maximum : 100 marks

Use of approved data book is permitted.

Note: Approved Design Data Book is permitted to use in the examination.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are unilateral and bilateral tolerances?
2. What are the various theories of failure?
3. What is the difference between spindle and axle?
4. How the length and diameter of a shaft affects its critical speed?
5. What is preloading of bolts?
6. State the advantages of the welded joints.
7. Write the formula for natural frequency of spring.
8. How does the function of flywheel differ from that of governor?
9. What is meant by life of anti- friction bearings?
10. What are the essential requirements in an end face seal?

PART B — (5 × 16 = 80 marks)

11. (a) A machine part is statically loaded and has an yield point strength of 350 N/mm^2. If the principal stresses are 70 N/mm^2 and 35 N/mm^2, both tensile, find the factor of safety for the following cases.

(i) Maximum normal stress theory

(ii) Maximum shear stress theory and

(iii) Distortion energy theory.

Or

(b) An unknown weight falls through 10 mm on to a collar which is rigidly attached to the lower end of a vertical bar 3 m long and 600 mm^2 cross section. The maximum instantaneous extension is 2 mm. What is the corresponding stress and the value of the weight. Take E = 200 kN/mm^2.

12. (a) A steel solid shaft transmitting 15 kW at 200 rpm is supported on two bearings 750 mm apart and has two gears keyed to it. The pinion having 30 teeth of 5 mm module is located 100 mm to the left of the right hand bearing and delivers power horizontally to the right. The gear having 100 teeth of 5 mm module is located 150 mm to the right of the left hand. bearing and receives power in a vertical direction from below. Using an allowable stress of 54 MPa in shear. Determine the diameter of the shaft. (16)

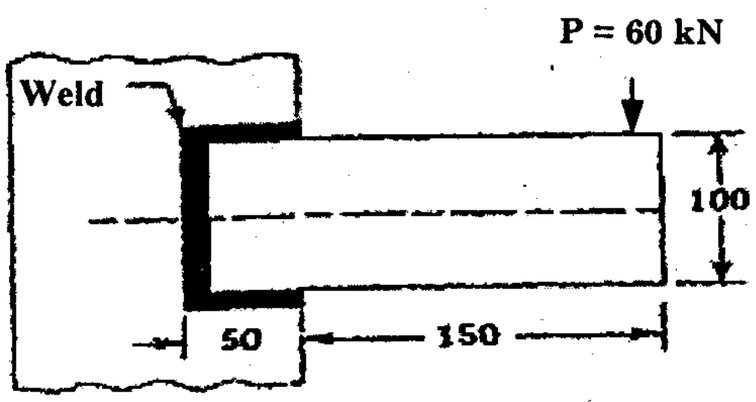
Or

(b) A rigid type of coupling is used to connect two shafts transmitting 15 kW at 200 rpm. The shaft, keys and bolts are made of C45 steel and the coupling is of cast iron. Design the coupling. (16)

13. (a) Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. (16)

Or

(b) A rectangular steel plate is welded as a cantilever to a vertical column and supports a single concentrated load P, as shown in figure. Determine the weld size if shear stress in the same is not to exceed 140 MPa. (16)



All dimensions in mm

14. (a) A helical compression spring made of oil tempered carbon steel is subjected to a load which varies from 400 N to 1000 N. The spring index is 6 and the design factor of safely is 1.25. If the yield stress in shear is 770 MPa and endurance stress in shear is 350 MPa, find :

(i) Size of the spring wire,

(ii) Diameter of the spring.

(iii) Number of turns of the spring, and

(iv) Free length of the spring. The compression of the spring at the maximum load is 30 mm. The modulus of rigidity for the spring material may be taken as 80 kN/mm^2. (16)

Or

(b) A single cylinder double acting steam engine delivers 185 kW at 100 r.p.m. The maximum fluctuation of energy per revolution is 15 percent of the energy developed per revolution The speed variation is limited to 1 percent either way from the mean. The mean diameters of the rim are 2.4 m. Design and draw two views of the flywheel. (16)

15. (a) Design a journal bearing for a centrifugal pump for 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 = 0.17 N/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. (16)

Or

(b) Determine the dimensions of an I–section connecting rod for a petrol engine from the following data :

Diameter of the piston	=	110 mm
Mass of the reciprocating parts	=	2kg
Length of the connecting rod from centre to centre	=	325 mm
Stroke length	=	150 mm
R.P.M.	=	1500 with possible over speed of 2500
Compression ratio	=	4:1
Maximum explosion pressure	=	2.5 N/mm^2. (16)