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Roll No. of candidate | | | | | | | | | | |

BINA CHOWDHURY
(GIMT & GIPS)
Azara, Halkhowapara,
Guwahati -781017

2022

B.Tech. 6th Semester End-Term Examination

MACHINE DESIGN — II

(New Regulation & New Syllabus)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

Use of Design Data Handbook permitted.

1. Pick the correct option from the following: (10 × 1 = 10)

(i) A compression spring is made of music wire of 2 mm diameter having a shear strength and shear modulus of 800 MPa and 80 GPa respectively. The mean coil diameter is 20 mm, free length is 40 mm and the number of active coils is 10. If the mean coil diameter is reduced to 10 mm, the stiffness of the spring is approximately

(a) decreased by 8 times

(b) decreased by 2 times

(c) increased by 2 times

(d) increased by 8 times

(ii) For a ductile material, toughness is a measure of

(a) Resistance to scratching

(b) Ability to absorb energy up to fracture

(c) Ability to absorb energy till elastic limit

(d) Resistance to indentation

(iii) While designing a Journal Bearing, if K is the bearing modulus, for hydrodynamic condition, the bearing is designed at a value beyond:

(a) 1.5 K

(b) 2.0 K

(c) 2.5 K

(d) 3.0 K

[Turn over

(iv) A ball bearing operating at a load F has 8000 hours of life. The life of the bearing, in hours, when the load is doubled to 2F is:

(a) 8000

(b) 6000

(c) 4000

(d) 1000

(v) A Ball bearing has to operate for 8 hours per day with 90% days of operation in a year for an expected life of 4 years at 600 rpm. What is the life of the bearing in Millions of revolutions?

(a) 678.43

(b) 824.23

(c) 428.34

(d) 554.23

(vi) If in a circular helical spring mean Coil diameter is 12 cm and wire diameter is 12 mm, what is the value of the spring index?

(a) 1

(b) 10

(c) 100

(d) 1000

(vii) The capacity of a brake depends on

(a) the unit pressure between the braking surfaces

(b) the coefficient of friction

(c) heat radiating capacity of the brakes

(d) all the above

(viii) Rolling contact bearings are also called

(a) Non Friction Bearings

(b) Less friction Bearings

(c) Anti Friction Bearings

(d) Thrust Bearings

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(ix) The steering mechanism of an automobile normally uses

(a) Bevel gear

(b) Worm gear

(c) Rack and Pinion

(d) Planetary gear

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(x) Fill in all the blank spaces:

The basic static load rating is defined as the static radial load (in case of ———— bearings) or axial load (in case of ———— bearings) which corresponds to a total permanent deformation of the ball (or roller) and race, at the most heavily stressed contact, equal to ———— times the ball (or roller) diameter.

2. (a) A critical section in a solid shaft of 80mm diameter subjected to a twisting moment of 50 kNm, a bending moment of 20 kNm and an axial (compressive) thrust of 60 kN. Determine the maximum value of normal stresses and shear stresses in that section .

(b) A steel rod (SAE 1095 Annealed) of circular cross section is subjected to axial load varying from 20kN to 50 kN, as the bending moment varies from 500 Nm to 1000 Nm. The maximum BM and maximum axial load occurs at the same inastant. Determine the diameter of the rod. Material properties may be selected from IS Codes. (7+8=15)

3. (a) What is the significance of Walh's Stress Concentration factor in the design of springs?

(b) Design a closed coil helical spring for a service ranging from 4000 N to 4300 N. The axial deflection for the load range is 10 mm. The allowable shear stress of the spring material is 400 MPa and G = 84 kN/sq. mm. (2 +13= 15)

4. (a) Differentiate between Positive Clutch and Friction Clutch.

(b) Design a single dry plate clutch to transmit 15 kW at 1200 rpm. Six numbers of identical springs are used with Spring Index of 6. (2 +13= 15)

5. A pair of involute teeth spur gears has to transmit 30 kW when the pinion rotates at 400 rpm. The velocity ratio is 1:3. The pinion has 24 numbers of teeth. Assuming suitable material, design the gear drive and check for all possible failures. (15)

6. (a) What is the importance of bearing modulus is journal bearing design?

(b) Select a deep groove ball bearing which is subjected to a radial load of 3000N and axial load of 500N operating at 1200 rpm for an average life of 3.5 years at 10 hours per day. (2 +13= 15)

7. (a) What is the basic difference between a double helical and a herringbone gear?

(b) Design a Journal Bearing to support a shaft of 50 mm diameter for use in a Centrifugal Pump for a maximum load of 25 kN and maximum journal speed of 1000 rpm. Consider an ambient temperature of 30 degree centigrade. (2 +13= 15)

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