Total No. of printed pages = 4

ME 181601

12/6/23

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

2023

B.Tech. 6th Semester End-Term Examination

MACHINE DESIGN — II

(New Regulation (w.e.f. 2017 – 18) & New Syllabus (w.e.f. 2018-19))

Full Marks – 70 Time – Three hours

(Use of Design Data Handbook allowed)

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

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

(Required data may be assumed from Design Data Handbook)

1. Select the most appropriate option from the following : (10 × 1 = 10)

(i) Life of a bearing is expressed in terms of

(a) Hours of operation (b) Millions of revolution

(c) Both (a) and (b) (d) Maximum load on the bearing

(ii) At what temperature the standard specific gravity of oils are specified?

(a) 10° C (b) 15° C

(c) 20° C (d) 25°C

(iii) Which factor in helical spring design takes into account the effect of stress concentration?

(a) Spring Index (b) Spring Rate Factor

(c) Walh's factor (d) Resilience factor

(iv) Clutch is basically a/an

(a) Frictionless drive (b) Friction drive

(c) Engagement drive (d) Multi disc drive

[Turn over

(v) Face width to module ratio in a spur gear normally varies from

(a) 5.5 to 10.5 (b) 9.5 to 12.5

(c) 10 to 15 (d) 14.5 to 18.5

(vi) If the calculated value of the module in a spur gear is 2.49 mm, if preferred series is considered, what is the standard value of the module?

(a) 2.0 mm (b) 2.4 mm

(c) 2.5 mm (d) 3.0 mm

(vii) If the module of a spur gear is 6 mm, what is the standard value of working depth?

(a) 6.0 mm (b) 9.00 mm

(c) 12 mm (d) 15.0 mm

(viii) In a 62 Series Deep Groove Ball Bearing, if the SKF Number is 6202, what are the values of internal and external diameters of the bearing respectively?

(a) 10 mm and 30 mm (b) 12 mm and 32 mm

(c) 15 mm and 35 mm (d) 17 mm and 40 mm

(ix) If K is the bearing modulus of a Journal bearing, to attain hydro dynamic lubrication condition, the bearing must be designed beyond

(a) 2K value (b) 2.5K value

(c) 3K value (d) 3.5K value

(x) The steering mechanism of an automobile normally uses

(a) Double helical- herringbone mechanism

(b) Worm and wheel mechanism

(c) Bevel gear mechanism

(d) Rack and pinion mechanism

2. A loaded narrow gauge Car weighing 20,000 N and moving at 72 m/min is brought to rest by a bumper consisting of two helical springs of round section. In bringing the car to rest the springs are to be compressed by 200 mm. Design the spring.

Maximum allowable stress = 550 N/mm^2

Modulus of rigidity = 84×10^3 N/mm^2

Spring index = 10. (15)

3. Select a single row deep groove ball bearing for a radial load of 4000N and a thrust load of 5000N operating at 2000 rpm for an average life of 5 years at 12 hours per day of operation. (15)

4. Design a Journal Bearing to support a shaft of 50 mm diameter for use in a Centrifugal Pump for a maximum load of 2.5 kN and maximum journal speed of 1000 rpm. Consider an ambient temperature of 30 degree centigrade. (15)

5. (a) If for a spur gear drive, allowable static stresses for a gear is 225 MN/m^2, module is 6 mm, number of teeth is 18, face width to module ratio is 10, enumerate the dynamic strength of the gear.

   (b) If in a vertical spur gear drive, the number of the driver gear is 32 and the velocity ratio is 4. If the allowable static stresses for the driver and driven gear are 250 MN/m^2 and 235 MN/m^2, analyze the beam strengths of both the two gears and conclude on the basis of which gear the design should be initiated.

   (c) It has been estimated that the module of a spur gear for all given inputs of power, rpm, pressure angle, hardness etc. is 6 mm, compute the corresponding standard values of addendum, dedendum, tooth thickness, working depth and whole depth using Design Data handbook. (5+5+5=15)

6. A single dry plate clutch has to transmit 20 kW at 900 rpm. To design the clutch,

   estimate the following :

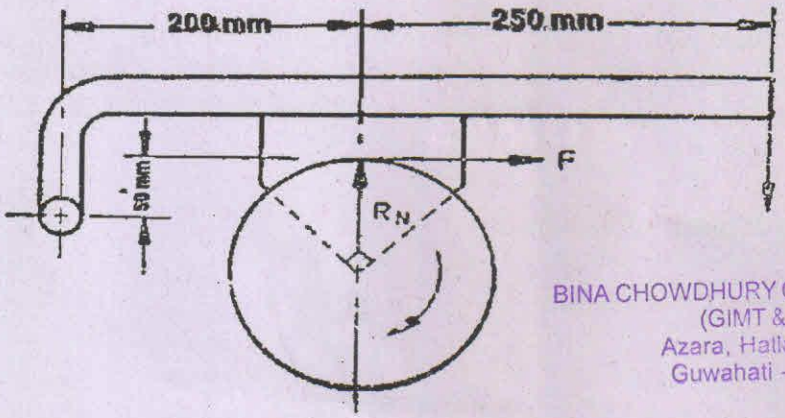
   (a) Diameter of the shaft

   (b) Mean radius and face width of the friction lining [assume the ratio of the mean radius to face width as 4]

   (c) Outer and inner radius of the clutch plate

   Given ; allowable shear stress for the material of the spring = 42 MN/m^2.(15)

7.



In a single block brake (as shown in the figure), the brake drum diameter is 250 mm and angle of contact is 90°. An operating force of 700 N is applied at the end of the lever and the coefficient of friction between the drum and the lining is 0.35, for the purpose of design of the block brake, estimate the torque transmitted by the block brake. (15)
