Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH (MECHANICAL ENGG.) END SEMESTER EXAMINATIONS, APRIL 2019

SUBJECT: MECHANICAL DESIGN – II [MME 3202]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

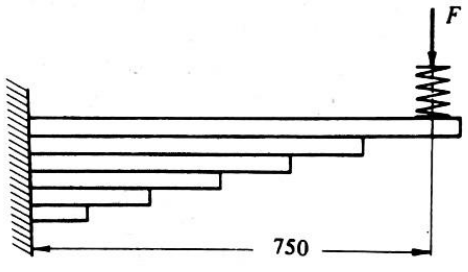
Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Use of Design data hand book is permitted

1A. Derive an expression for shearing stress induced in a helical spring subjected to a compressive load. **(03)**

1B. In a concentric spring if the diametral clearance is equal to the difference between the wire diameters, prove that $\frac{d_1}{d_2} = \frac{C}{C-2}$ Where C= spring index, d_1 and d_2 = wire diameter of outer spring and inner spring respectively **(02)**

1C. A 100 mm outer diameter steel coil spring having 10 active coils of 12.5 mm diameter wire is in contact with a 750 mm long steel laminated cantilever spring having six graduated leaves 100 mm wide and 6.5 mm thick as shown in figure. Take G = 83 GN/m^2 and E = 200 GN/m^2 **(05)**



(a) What force F, if gradually applied to the top of the coil spring will cause the laminated cantilever spring to deflect 25 mm?

(b) What will be the maximum shear stress in the coil spring?

(c) Energy absorbed by the coil spring.

2A. Design a pair of continuously lubricated equal diameter 20^0 involute teeth helical gears to transmit 37.5 kW with moderate shocks (8-10 hrs. per day service) at 1200 rpm. The two shafts are parallel and 0.45 m apart. Each gear is made up of C45 steel untreated. Helix angle = 30^0 . Take the face width as 15 times the normal module. Design the gears based on strength and check for wear load. **(06)**

2B. With the suitable assumptions derive an expression for beam strength of a spur gear. **(04)**

3A. Design a worm drive based on strength for a speed reducer to transmit 20 kW at a worm speed of 600 rpm. The required velocity ratio is 25:1. The worm is made of C30 heat treated steel and the worm wheel is made of phosphor bronze. The center distance is approximately 350mm. The service conditions are intermittent operations with medium shock loads. .Assume face width 8 times the module. Use $C_v = \frac{3.05}{3.05+v}$ **(05)**

3B. A pair of 20° full depth involute teeth bevel gears connect two shafts at right angles having a velocity ratio of 3:1. The gear is made of cast steel, 0.2% untreated and the pinion material is of steel, C30 heat treated. The pinion has 20 number of teeth and transmits 40 kW at 750 rpm. Assume C_s=1.25. The teeth are made by form cutters. Determine: (i) Module (ii) Face width (iii) Pitch diameters **(05)**

4A. A 100 mm long full journal bearing of diameter 80 mm supports a radial load of 0.65 kN. The radial clearance is 0.05 mm. It is lubricated with SAE 10 at 80^0 C. The shaft rotates at 1400 rpm. Using McKee's equation, find **(05)**

a) Friction coefficient
b) Power loss

4B. Define the following **(02)**

a) Dynamic load carrying capacity
b) Rating life

4C A single row deep groove ball bearing is used to support a shaft of 25 mm diameter subjected to an axial thrust of 1 kN and a radial load of 2.2 kN. The shaft runs at 1500 rpm. It is proposed to use 6205 SKF bearing for an **(03)**

expected life requirement of 650 hours. Check the suitability of the bearing. Assume that inner race rotates

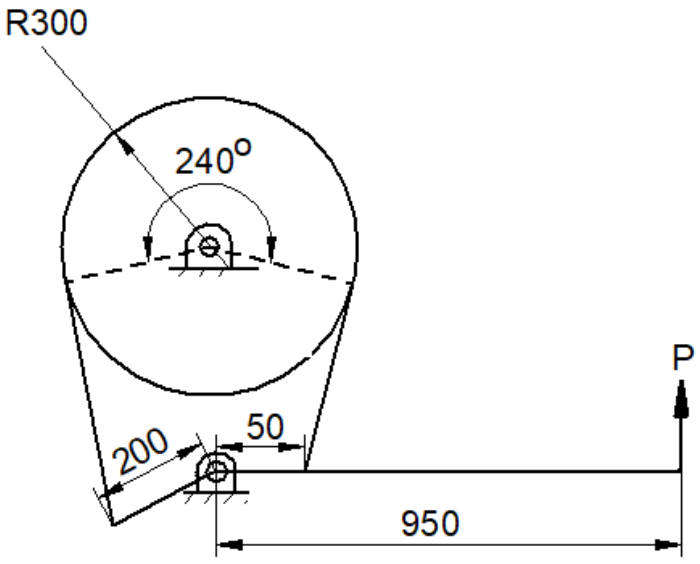
5A. A differential band brake is as shown in figure below. The width and thickness of the steel band are 100 mm and 3 mm respectively and the maximum tensile stress in the band is 50 N/mm^2. The coefficient of friction between the friction lining and the brake drum is 0.25. Calculate: **(05)**

i. The tensions in the band.

ii. Determine the actuating force for both clockwise and counter-clock wise rotation.

iii. The torque capacity of the brake.

iv check for self-locking.



All dimensions are in mm

5B. Explain polygonal effect in a chain drive with a neat sketch. **(03)**

5C. Write a note on construction of V belt. **(02)**