Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B. TECH (MECHANICAL ENGG.) END SEMESTER EXAMINATIONS, APRIL 2018

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. Define the following **(03)**

(a) Compressed length (b) Surging (c) Nip

1B Prove that **(02)**

$$\frac{d_1}{d_2} = \frac{C}{C-2}$$

if the diametral clearance is equal to the difference between the wire diameters where C is the spring index .

1C. The free end of a horizontal constant strength cantilever beam is in contact with two helical compression springs, nested one inside the other. The two springs are situated directly below the free end of the beam. The load is applied at the free end of the beam causing a deflection of 30 mm. The width of the beam at the fixed end is 350 mm. Its length is 750 mm and thickness is 12 mm. Take E=210 GPa, G=82.7 GPa. The dimensions of helical compression springs are as follows: **(05)**

Particulars	Outer spring	Inner spring
Spring index	8	7
Wire diameter (mm)	5	4
Number of active coils	10	8
Free length (mm)	90	78

Determine

i) Load shared by beam ii) Bending stress at the middle of the beam

iii) Load shared by inner spring iv) Energy absorbed by outer spring

2A. State any two assumptions and derive an expression for beam strength of a spur gear tooth. **(04)**

2B. A pair of helical gears is to transmit 15 kW at 5000 rpm of the pinion. Both the gears are made of cast steel (untreated). The centre distance is approximately 200 mm. The velocity ratio is 4:1. The gears are subjected to scant lubrication. The teeth are of 20^o full depth involute profile. The helix angle is 45^o. The starting torque is to be taken as 50 % more than the running torque. Take face width as 15 times the normal module. Design the gears based on strength and suggest suitable hardness for the gears. **(06)**

3A. Define the following **(03)**

a) Zerol gear b) Pitch cone c) Shaft angle

3B. A worm gear drive transmits 24 kW power at 1750 rpm. The speed ratio is 10. The approximate centre distance is 250 mm. The gears are subjected to medium shock with 10 hrs/day of service. Design the gear drive based on strength and check for wear load. **(07)**

4A. Define the following with respect to ball bearing **(03)**

a) Equivalent load b) Static load carrying capacity c) Life

4B. State any two advantages and two disadvantages of ball bearings. **(02)**

4C. A full journal bearing 80 mm diameter and 140 mm long has a bearing pressure of 2 MPa. The speed of the shaft is 450 rpm. The bearing is operating with SAE 40 oil at 68 ^oC in still air. The ambient temperature is 30^oC. The diametral clearance is 0.08 mm. **(05)**

a) Determine the coefficient of friction, minimum film thickness and oil flow rate using graphs.

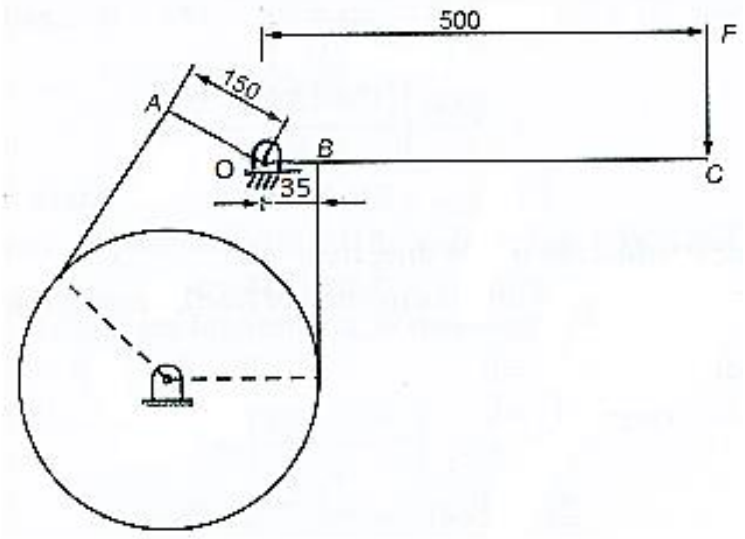
b) Check whether artificial cooling is required.

5A. A differential band brake shown in the **Fig.Q.5A** has an angle of contact of 225^o .The brake is to sustain a torque of 350 Nm and the coefficient of friction is 0.3. The diameter of the drum is 350 mm. Determine **(05)**

(a) Force F required for clockwise and anticlockwise rotations of drum.

b) Value of OA for the brake to be self-locking, when the drum rotates clockwise.

5B A temporary construction elevator is designed to carry workers and materials to a height of 100 m. It is estimated that atleast 10 workers along with a material load of 30 kN should be hoisted at a speed of 0.5 m/s which should be attained in the first 0.4 seconds. The recommended steel rope is of 8 X 19 construction with wire diameter of 1.25 mm. Take the pulley diameter as 45 times the rope diameter. Assume the average weight of the person as 75 kg. The factor of safety is 5. The tensile strength of the wire is 1300 MPa. Determine the number of ropes required. **(05)**



All dimensions in mm

Fig.Q.5A