Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH (MECHANICAL ENGG.)

END SEMESTER MAKE UP EXAMINATIONS, JUNE 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 suitable assumed.
- Use of Design data hand book is permitted
- 1A. Derive an expression for shearing stress induced in a helical spring subjected (05) to a compressive load.
- 1B. A multi-leaf spring is fitted to the chassis of an automobile over a span of 1.2 (05) m to absorb shock due to maximum load of 20 kN. All the leaves are to be stressed to 0.4 GPa when fully loaded. The spring has 2 full length leaves out of 8 leaves. The leaves are assembled with bolts over a span of 150 mm width at the middle. Determine the width and thickness of the leaves. The maximum deflection of the spring is 50 mm. What radius the leaves must be bent so that spring becomes flat under the given load? Take E=210 GPa.
- **2A.** A pair of continuously lubricated helical gears is used to transmit 24 kW at **(07)** 2800 rpm of the pinion. The gear rotates at 1200 rpm. The teeth are having 20° full depth involute profile with helix angle of 45° . Both the gears are made of heat treated forged steel. The gears are subjected to steady load with 10 hrs /day of service. The centre distance is about 175 mm with a permissible variation of ± 2 %.Take the face width as 15 times the normal module. Design the gears based on strength and check for wear load.
- **2B.** State any three assumptions for deriving Lewis equation. (03)

- **3A.** A pair of right angle bevel gears transmits 20 kW of power at 780 rpm of **(05)** pinion. The velocity ratio is 3.5:1.The module and face width are 6 mm and 60 mm respectively. The teeth are of $14\frac{1}{2}^{\circ}$ involute profile. The number of teeth on the pinion is 32.The gears are subjected to light shock with 8 hrs/day of service. The material for pinion is C40 steel and material for gear is untreated forged steel. Calculate the dynamic load and determine the minimum necessary hardness to withstand wear load.
- **3B.** Explain how the efficiency and self-locking in a worm gear drive is related to **(03)** the number of starts.
- **3C.** Define the following (02)
 - a) Lead angle b) Diametric quotient
- 4A. A bearing 0.05 m in diameter and 0.075 m in length supports a shaft running (05) at 900 rpm. The room temperature is 32 °C and the bearing temperature is 82 °C. The viscosity of the oil used is 0.0128 Ns/m². The diametric clearance is 0.05 mm and the bearing is to operate in still air without any artificial cooling. Determine
 - a) The permissible load on the bearing.
 - b) Power loss.
- **4B.** Define the following with respect to rolling contact bearing. **(05)**
 - a) Life of a bearing
 - b) Median life
 - c) Static load carrying capacity
 - d) Dynamic load carrying capacity
 - e) Rating life
- 5A. Select a V belt drive to transmit 5 kW from a normal torque AC motor running (05) at 1500 rpm to a light duty compressor running at approximately 970 rpm. The groove angle is 34^o. The power rating of belt is 2.65 kW. The center distance is approximately 600 mm. The allowable fluctuation of speed of driven pulley is 20 rpm.
- **5B.** With a neat sketch explain polygonal effect in chain drive. **(03)**
- **5C.** Mention two important design rules in a chain drive. (02)