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Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



## V SEMESTER B.TECH (AUTOMOBILE ENGINEERING) END SEMESTER EXAMINATIONS, NOV/DEC 2015

## SUBJECT: MECHANICAL DESIGN-II [AAE 351]

## **REVISED CREDIT SYSTEM**

Time: 3 Hours

MAX. MARKS: 50

## Instructions to Candidates:

- ✤ Answer ANY FIVE FULL the questions.
- ✤ Missing data may be suitable assumed.
- 1A. Design a valve spring of a petrol engine for the following operating conditions: (05) Spring load when the valve is open = 400 N, Spring load when the valve is closed = 250 N, Maximum inside diameter of spring = 25 mm, Length of the spring when the valve is open= 40 mm, Length of the spring when the valve is closed= 50 mm, Maximum permissible shear stress = 400 MPa.
- **1B.** With a neat sketch, deduce a relation for ratio of tensions in a V-Belt drive **(05)** system.
- 2A. A pair of bevel gears connect two shafts at right angles and transmits 9 kW. (05) Determine the required module and calculate gear parameters for the following specifications :

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<u>Particulars</u>	<u>Pinion</u>	<u>Gear</u>
No.of teeth	21	60
Material	Steel	Cast Iron
B.H.N	200	160
Speed	1200 r.p.m	420 r.p.m
Allowable static stress	85 MPa	55 MPa

- **2B.** For the above gear pair, check the design for static, dynamic and wear loads. **(05)**
- 3A. An industrial machine is intended for continuous 8hrs/day operation at 1800 (05) r.p.m. The radial and thrust loads are 1.2 kN and 1.5 kN respectively. Select and design a suitable deep groove (medium duty) and angular contact (heavy duty) ball bearing.
- 3B. A composite spring has two closed coil helical springs. The outer spring is 15 (05) mm larger than the inner spring. The outer spring has 10 coils of mean diameter 40 mm and wire diameter 5mm. The inner spring has 8 coils of mean diameter 30 mm and wire diameter 4 mm. When the spring is subjected to an axial load of 400 N, Find: Compression of each spring, Load shared by each spring and Shear stress induced in each spring. (Take G= 84 kN/mm<sup>2</sup>)

- 4A. A compressor at 320 r.p.m is driven by a 50 kW motor running at 1440 r.p.m (05) through a pair of helical gears. The gears are 20° full depth in normal plane with a helix angle of 30°. The center distance between the gears are 360 mm. The pinion is to be high carbon steel and the gear is to be 0.4% carbon steel (heat treated). The gear materials are to be hardened to 400 B.H.N. The operation is with medium shock for 8-10 hrs/day. Design the gear pair and find all the gear parameters.
- 4B. For the above gear pair, check the design for static, dynamic and wear loads. (05)
- 5A. A full journal bearing 90 mm in diameter and 150 mm long has a radial load of 2 MN/m2 of projected area. The shaft speed is 500 r.p.m. The air temperature is 20°C and the oil used has a viscosity of 0.099 kg/ms at its operating temperature. Determine the probable bearing surface temperature and the operating temperature of oil.
- **5B.** Define: Wettability of oil, Viscosity Index. Mention the merits and demerits of **(05)** V-belt over flat belt drive systems.
- 6A. A semi-elliptical laminated vehicle spring to carry a load of 6000 N is to consist of seven leaves 65 mm wide, two of the leaves extending the full length of the spring. The spring is to be 1.1 m in length and attached to the axle by two U-bolts 80 mm apart. The bolts hold the central portion of the spring so rigidly that they may be considered equivalent to a band having a width equal to the distance between the bolts. Assume a design stress for spring material as 350 MPa. Determine: Thickness of leaves, Deflection of spring, Diameter of eye, Length of leaves, and radius to which leaves should be initially bent.
- 6B. Briefly explain the types of brakes used in automobiles. (05)Define: Soderberg number, Pitch cone radius and module.