



IV SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, JUNE 2017

SUBJECT: DESIGN OF MACHINE ELEMENTS (AAE 2252)

**REVISED CREDIT SYSTEM
(16/06/2017)**

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ❖ Answer **ALL** the questions.
- ❖ Missing data **IF ANY**, may be suitably assumed and mentioned clearly

- 1A.** Write a short note on nipping of leaf springs. **(02)**
- 1B.** With a neat sketch, briefly explain the terminology of Spur gears. **(04)**
- 1C.** Deduce a relation to calculate the ratio of tensions in a belt drive. **(04)**
- 2A.** A helical tension spring is used in the spring balance to measure the weights. One end of the spring is attached to rigid support while the other end carries the weights to be measured. The maximum weight attached to spring balance is 1500 N and the length of the scale is 100 mm. The spring is made of steel wire with ultimate strength of 1360 N/mm² and modulus of rigidity of 81370 N/mm². The permissible shear stress can be taken as 50% of ultimate strength. Design the spring. **(05)**
- 2B.** A wood working machine has a shaft diameter of 40 mm. It is subjected to a radial load of 2 kN and a thrust load of 1 kN. The machine has to work for 8 hours/day, 5 days/week for 2 years. Select a suitable ball bearing if the shaft speed is 1000 rpm. **(05)**
- 3A.** A pair of straight tooth bevel gears at acute angles are used to transmit 5 kW at 900 rpm of the pinion. The shaft angle is 60° and the speed reduction is 3:1. The teeth are 20° full depth form and the number of teeth on pinion is 20. The pinion is to be made of steel and the gear is to be made of phosphor bronze. The load is steady and service is continuous. Design the gear pair and find the gear parameters. **(05)**

- 3B.** For the above gear pair, check the design safety based on strength and wear, considering suitable BHN. **(05)**
- 4A.** What are the advantages of V- belts over flat belts? Distinguish between open and cross belt drives. **(04)**
- 4B.** A full journal bearing 50 mm in diameter and 50 mm long operates at 1000 rpm carries a load of 5 kN. The radial clearance is 0.025 mm. The bearing is lubricated with oil of viscosity 16.5 cP and oil temperature of 353 K. Assume the attitude angle as 60° . Determine: Bearing pressure, Sommerfeld number, MFT, Heat generated and heat dissipated at an ambient temperature of 293 K, amount of artificial cooling if necessary. Use McKee's equation. **(06)**
- 5A.** Design a concentric spring for an aircraft engine valve to exert a maximum force of 4 kN under a deflection of 30 mm. Both the springs have the same free length, solid height and are subjected to equal shear stress of 600 MPa. The spring index for both the spring is 6. Take $G=82.7$ GPa. **(05)**
- 5B.** A compressor running at 320 rpm is driven by a 50 kW motor running at 1440 rpm through a pair of helical gears. The gears are 20° full depth involute in normal plane and the helix angle is 30° . The center distance between the gears is 360 mm. The pinion is made of steel, heat treated and the gear is made of cast iron. The pinion is hardened to 250 BHN. The operation is with medium shock for 8 to 10 hrs./day. Design the gear pair and find the gear parameters. **(05)**