



Code No. : 5191/M

**FACULTY OF ENGINEERING**  
**B.E. 3/4 (M/P) II Semester (Main) Examination, May/June 2012**  
**MACHINE DESIGN**

Time : 3 Hours]

[Max. Marks : 75

**Note :** Answer *all* questions of Part A.  
Answer *five* questions from Part B.

**PART – A**

**(10×2.5=25 Marks)**

1. Briefly discuss the importance of A.M. Wahl's factor in the design of helical springs.
2. Define the term spring index and stress factor in springs.
3. Mention four important types of gears and discuss their applications.
4. What is herringbone gear ? Where they are used ?
5. What are rolling contact bearings ? Discuss their advantages over sliding contact bearings.
6. Give the applications and limitations of rolling contact bearings.
7. Mention the various considerations in the design of flywheel.
8. Mention the various types of stresses used in crank shafts.
9. What factors are to be considered while designing crane hooks ?
10. Mention the criteria for design of C-clamp.

**PART – B**

**(50 Marks)**

11. A rail wagon of mass 20 tonnes is moving with a velocity of 2 m/s. It is brought to rest by two buffers with springs of 300 mm diameter. The maximum deflection of springs is 250 mm. The allowable shear stress in the spring material is 600 MPa. Design the spring for the buffers.
12. Design a leaf spring for the following specification :

Total load = 140 kN ; number of springs supporting the load = 4 ; Maximum number of leaves = 10 ; span of the spring = 1000 mm ; permissible deflections = 80 mm. Take Young's modulus,  $E = 200 \text{ kN/mm}^2$  and allowable stress in spring material as 600 MPa.



13. A bronze spur pinion rotating at 600 rpm drives a cast iron spur gear at a transmission ratio 4 : 1. The allowable static stresses for the bronze pinion and C.I gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength.
14. A worm drive transmits 15 kW at 2000 r.p.m. to a machine carriage at 75 r.p.m. The worm is triple threaded and has 65 mm pitch diameter. The worm gear has 90 teeth of 6 mm module. The tooth form is to be 20° full depth involute. The coefficient of friction between the mating teeth may be taken as 0.1. Calculate
- Tangential force acting on the worm.
  - Axial thrust and separating force on worm and
  - Efficiency of the worm drive.
15. Design a journal bearing for a centrifugal pump from the following data : load on the journal = 20,000 N ; speed of the journal = 900 rpm ; type of oil is SAE 10, for which the absolute viscosity at 55°C = 0.017 kg/ms, ambient temperature of oil = 15.5°C ; maximum bearing pressure for the pump = 1.5 N/mm<sup>2</sup>. Calculate also mass of the lubricating oil required for artificial cooling, if rise of temp. of oil to be limited to 10°C. Heat dissipation coefficient = 1232 W/m<sup>2</sup>/°C.
16. Design a side or overhung crankshaft for a 250 mm × 300 mm gas engine. The weight of flywheel is 30 kN and the explosion pressure is 2.1 N/mm<sup>2</sup>. The gas pressure at the maximum torque is 0.9 N/mm<sup>2</sup>, when the crank angle is 35° from I.D.C. The connecting rod is 4.5 times the crank radius.
17. Design a crane hook with the useful load lifting capacity of the crane as 200 kW. The weight of the hook is 40 kN.