B. E. 6th Semester (Mech. Engg.) Examination,

May–2010

MACHINE DESIGN–II

Paper–ME–304–E

Time allowed : 3 hours]   *[Maximum marks : 100*

Note :   *Attempt any five questions. All questions carry*
       equal marks.

1.   (i)   Discuss the role of value engineering in design ?

    (ii)   List the fundamental requirements for machine
         members for their efficient working.

    (iii) How is factor of safety evaluated for different
         types of loading ?   20

2.   A helical spring whose mean diameter of coils is 8
    times that of the wire is to absorb 500Nm of energy.
    The initial compression of the spring is 50mm and the
    additional compression is 100mm while absorbing the
    shock. The maximum permissible stress is 450N/mm²
    and modulus of rigidity is 0.83 ×10⁵N/mm². Design
    the spring completely.   20

3.   A horizontal power transmission shaft is supported by
    two bearings 1.0m apart. The shaft overhangs the right

hand bearing and supports a 0.75m pitch diameter straight tooth spur gear 0.30m from the bearing. It supports a 1.25m flat belt pulley 0.25m to the left of the left hand bearing. The gear weights 3kN and the pulley weighs 10kN. The gear is driven by pinion such that the tangential turning force acts upwards. The pulley that delivers the power vertically downwards has a belt tension ratio of 2.5:1. The shaft must transmit 20kW at 150rpm. Assume transmission efficiency as 100%. Determine the shaft diameter based on maximum normal stress theory. Assume suitable other data.

4. A steel shaft 1.5m long between bearings carries 1000N pulley at its mid point. The pulley is keyed to the shaft and receives 20kW at 200rpm. The belt drive is horizontal and the ratio of the belt tensions is 3:1. The diameter of the pulley is 600mm. The load is applied with moderate shocks. Calculate the necessary diameter of the shaft.   20

5. Determine the dimensions of a bearing and journal to support a load of 5500N as 800rpm using hardened steel journal and bronze-backed bearing. An abundance of oil is provided which has a specific gravity of 0.9 at 15.5°C and a viscosity of 10.2 centistockes at 82°C that may be taken to the limiting temperature for oil. Assume a clearance of 0.0025 cm per cm of diameter. Calculate also the rate of heat generated in the bearing.   20

6. Select a roller bearing for a shaft to carry 1800N stationary radial load and 2700N axial load at a shaft speed of 500rpm. The rating life required is 6000hrs. There is no shock loading.   20

7. Design the teeth for a pair of cast iron spur gears with cast teeth to transmit 26kW. The pinion runs at 50rpm and the velocity ratio is to be 2.5. Decide upon a suitable grade of cast iron and find the module, face and diameters and centre distance for the gears.   20

8. A pair of helical gears is to transmit 37.5kW at 1750rpm of the pinion. The velocity ratio is to be 4.25 and the helix angle is to be 15°. The gears are subjected to a heavy shock load 24hr per day. The minimum pitch diameter of the pinion is 0.116m. Determine the module, face, material if the teeth are 20° full depth in the normal plane. 20