NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL ENGINEERING

PART III – ENGINEERING DESIGN APPLICATIONS – TIE 2208

SECOND SEMESTER EXAMINATION – APRIL/MAY 2000

Time Allowed: 3 Hours
Answer **ALL** Questions

Qu. 1 Design a belt drive to transmit 150kW for a system consisting of two pulleys of diameters 90cm and 120 cm, center distance of 360 cm, a belt speed 20 m/sec, coefficient of friction 0.3, a slip of 1.2% at each pulley and 5% friction loss at each shaft, 20% over load. Assume leather belt with density of 1gm/cm^2. [25]

Qu. 2 A steel solid shaft transmitting 20kW at 200 rpm is supported on two bearings 750 mm apart and has two gears keyed to it. The pinion having 30 teeth of 5mm module is located 100 mm to the left of the right hand bearing and delivers power horizontally to the right. The gear having 100 teeth of 5mm module is located 150 mm to the right of the left-hand bearing and receives power in a vertical direction from below. Using an allowable stress of 540MPa in shear, determine the diameter of the shaft. [25]

Qu. 3 A mild steel shaft transmits 23 kW at 200 rpm. It carries a central load of 900N and is simply supported between the bearings 2.5 metres apart. Determine the size of the shaft, if the allowable shear stress is 42 N/mm^2 and the maximum tensile or compressive stress is not to exceed 56 N/mm^2. What size of the shaft will be required if it is subjected to gradually applied loads? [25]

Qu. 4 A pair of straight teeth spur gears is to transmit 20kW when the pinion rotates at 300 rpm. The velocity ratio is 1:3. The allowable static stresses for the pinion and gear materials are 120 and 100 N/mm^2 respectively. The pinion has 15 teeth and its face width is 14 times the module. Determine: Module, face width and pitch circle diameters of both the pinion and the gear from the stand point of strength only, taking into consideration the effect of the dynamic loading. The tooth form factor can be taken as:

$$Y = 0.154 - \frac{0.912}{No.\ of\ \ teeth}$$

and the velocity factor C_v as

$$C_v = \frac{3}{3+V}$$

where v is expressed in m/s. [25]