NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL & MANUFACTURING ENGINEERING

Bachelor of Engineering Honours Degree Industrial & Manufacturing Engineering

Engineering Design Applications II – TIE 2208

2nd SEMESTER EXAMINATIONS - AUGUST 2009

Instructions:
Time Allowed 3 hours
Answer Five Questions

QUESTION 1
A pair of mating spur gears have 14½° full depth teeth of 10 module. The pitch diameter
of the smaller gear is 160mm. If the transmission ratio is 3 to 2.

Calculate:
  a) number of teeth of each gear
  b) addendum
  c) whole depth
  d) clearance
  e) outside diameters
  f) root diameters
  g) dedendum
  h) base circle diameters
 i) check for inteference   [20]

QUESTION 2
A multiple disk clutch, steel on bronze, is to transmit 4 kW at 750 rev/min. The inner
radius of contact is 70mm.The clutch operates in oil with expected coefficient of friction
0.10. The average allowable pressure is 350 kN/m^2 maximum

a). How many total disks of steel and bronze are required?   [5]
b). What is the average pressure?   [5]
c). What axial force is required?   [5]
d). What is the actual maximum pressure?   [5]

QUESTION 3

A fan is driven by a belt from a motor which runs at 880rev/min. A medium double ply leather belt 8mm thick and 250mm wide is used. The diameters of the motor pulley and driven pulley are respectively 350mm and 1370mm. The centre distance is 1370mm, and both pulleys are made of cast iron. Coefficient of friction of leather on cast iron is 0.35. The allowable stress for the belt is 2.4MPa, which allows for the factor of safety and also for the fact that a double ply belt does not have double the capacity of a single ply belt. (A double ply belt has approximately 85% the capacity of a single ply belt of the same thickness.) The belt mass is 970kg/m^3. What is the power capacity of the belt?
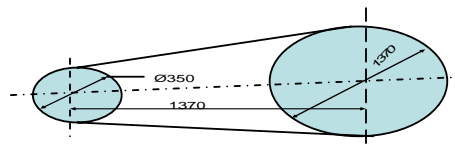
Driver   Driven

[20]

Fig Q3 belt drive

QUESTION 4

Two steel level gears, both having a brinell hardness of 250, connect shafts at 90 degrees. The teeth are 14 ½ dgrees full depth and the module is 4. The number of teeth on the pinion and gear are 30 and 48. The face width is 40mm. Determine the wear load Fw.[20]

QUESTION 5

A differential band has a force of 220N applied at the end of the lever as shown in Fig 5 the coefficient of friction between the band and drum is 0.4
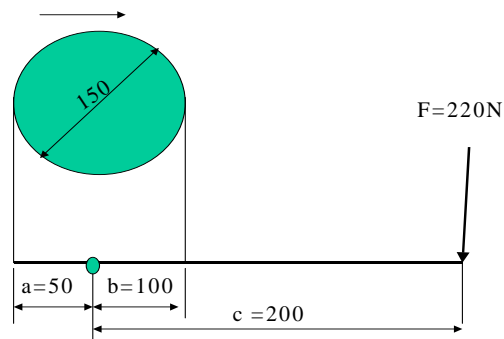
Ffig 5 differential brake

a) If a clockwise torque of 450N is applied to the drum determine the maximum and minimum force in the band   [10]
b) What is the maximum torque that the brake may sustain for counter clockwise rotation of the drum?   [10]

QUESTION 6

Referring to Fig 6., spur gear A receives 3kW at 600rev/min through its shaft and rotates clockwise. Gear B is an idler and gear C is the driven gear. The teeth are 20 degrees full depth. (The pitch circles are shown in the sketch.)
Determine:

a) The torque each shaft must transmit   [5]
b) The tooth load for which each gear must be designed,   [10]
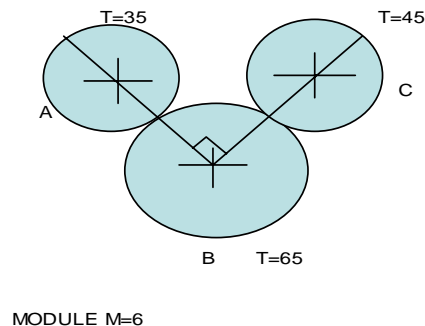c) The force applied to the idler shaft as a result of the gear tooth loads.   [5]

MODULE M=6

Fig. 6 spur gear drive

END OF EXAM