

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL & MANUFACTURING ENGINEERING

ENGINEERING DESIGN APPLICATIONS 1 – TIE 2107

1st SEMESTER EXAMINATIONS APRIL 2009

Instructions to Candidates

Time Allowed 3 hours

*Answer any **FIVE** questions*

Question 1

Explain the design phases.

[20]

Question 2

- a) A gear set consists of a 16 tooth pinion driving a 40 tooth gear. The module is 12mm and the addendum and dedendum are 12 and 15 mm respectively. The gears are cut using a pressure angle of 20°

Compute:

- i. The circular pitch [6]
 - ii. The center distance [6]
 - iii. The radii of circles [3]
- b) Explain the various methods of making gears [5]

Question 3

- a) Derive an expression for the force required to raise the load in power screws [10]

- b) A power screw has a major diameter 32mm, a pitch of 4mm with double threads. The given data include $\mu = \mu_c = 0.08$, $d_c = 40\text{mm}$ and $F = 6.4\text{KN}$ per screw.

- i. Find the thread depth, thread width, mean diameter, minor diameter and the lead. [6]
- ii. Find the torque required to rotate the screw against the load [2]
- iii. The overall efficiency [2]

Question 4

A cone clutch has a cone angle of 11.5° a mean friction diameter of 320mm, and a face width of 60mm. The clutch is to transmit a torque of 200Nm. The coefficient of friction is 0.26. Find the actuating force and pressure. Use the assumption of uniform pressure.

[20]

Question 5

Pinion two in the Figure Q5 below runs at 1800 revs/min and transmits 3KW to the idler gear 3. the teeth are cut on the 20^0 full depth system and have a module of 3mm.

- i) Draw a free body diagram of gear 3 and show all the forces which act upon it.
- ii) Calculate also the resultant shaft reactions. [10]

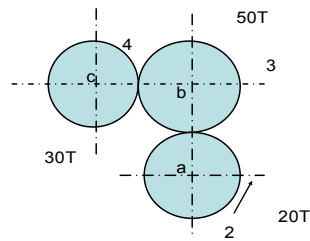


Fig. Q5

Question 6

- a) Derive the formula
$$\frac{T_1 - mv^2}{T_2 - mv^2} = e^{\alpha f}$$
 [10]
- b) A smaller pulley of a crossed belt drive transmits 7.5kW at 1000rpm. The smaller pulley has a diameter of 250mm, velocity ratio 2 and center distant is 1.25m. It is desired to use a flat belt 6mm thick with expected coefficient of friction 0.3. If the maximum allowable stress in the belt is 1.7MPa determine the leather belt width b . Leather has a density of 970kg/m^3 [10]

Question 7

Referring to fig Q6. above find the operating force required to stop rotation if the drum is 500mm in diameter, rotates at 100rpm counterclockwise and transmits 5Hp. Assume that $a=150\text{mm}$, $b=25\text{mm}$ and $c=300\text{mm}$, and that the coefficient of friction is 0.3. The wrap angle is 240° [20]

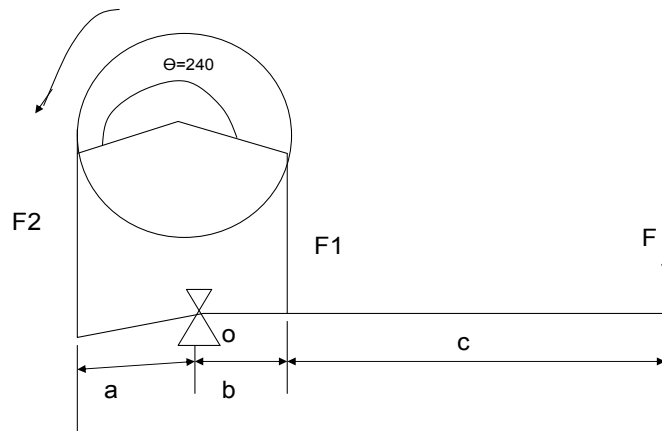


Fig Q6

End of Exam