



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER 2
SESSION 2016/2017**

COURSE NAME : MECHANICS OF MACHINES
COURSE CODE : BDA20303
PROGRAMME : BDD
EXAMINATION DATE : JUNE 2017
DURATION : 3 HOURS
INSTRUCTION : ANSWER ANY **FIVE (5)** OUT OF **SIX (6)** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

- Q1** (a) Define what is backlash in a gear system. State **two (2)** importance of backlash in a gear train applications. You may use some diagram to support your explanation. (6 marks)
- (b) A car with mass 1000 kg moves in an inclined plane using second gear. Gear ratio for the second gear is 3:4, with gear efficiency of 95%. Moment of inertia for the engine parts that rotates is 0.25 kgm^2 and for the tyre is 0.7 kgm^2 . Radius of the tyre is 0.75 m. If the wind resistance is 800 N and total engine thrust is 1500 Nm, calculate the angle of inclination of the inclined plane so that the car can accelerate at 0.8 m/s^2 (14 marks)
- Q2** A flat belt connects a 1.20m diameter pulley on a shaft running at 25 rad/s with another pulley running at 50 rad/s, the angle of lap on the latter pulley being 150° . The maximum permissible load on the belt is 1200 N and the coefficient of friction between the belt and the pulley is 0.25.
- (a) Determine velocity of belt. (4 marks)
- (b) If the initial tension in belt may have any value between 800 N and 960 N, what is the maximum power that the belt can transmit? (16 marks)
- Q3** (a) Define static and dynamic balancing. What are the importance of balancing in engineering? (6 marks)
- (b) Four masses m_1 , m_2 , m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45° , 75° and 135° . Using graphical method, determine the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.
- (i) Draw the illustration of the plane and tabulate all the given data in a table. (4 marks)
- (ii) Draw the vector diagram with the above values, to some suitable scale, (4 marks)
- (iii) By considering all the above data, determine the magnitude and angular position of the mass required (6 marks)
- Q4** (a) A screw jack having square threads of 5 cm mean diameter and 1.25 cm pitch is operated by a 50 cm long hand lever. Coefficient of friction at the threads is 0.1. Determine the effort needed to be applied at the end of the lever to lift a load of 20 kN. (5 marks)

- (b) A multiple clutch is transmitting 12000 W at 1500rpm. The inner and outer radius for the plates are 50mm and 100mm respectively. The maximum axial spring force is restricted to 1000N.
- (i) By assuming uniform wear, calculate number of pairs of surface if $\mu = 0.35$.
 - (ii) Based on previous answer Q4 b (i), what will be the required axial force?
 - (iii) Give three (3) alternative ways to increase the amount of power transmitted by the system. (15 marks)

- Q5** (a) What do you understand about mechanism and what is the function of mechanism? (3 marks)
- (b) List types of mechanism and explain your classification. (4 marks)
- (c) **Figure Q5(c)** shows a toggle clamp used for securing a work piece during a machining operation. Pin holes distance for handle arm is 20 mm, clamp arm is 12 mm, support base is 25 mm and connecting linkage is 15 mm. Determine the angle that handle must be displaced in order to lift the clamp arm 30° clockwise direction. (13 marks)

- Q6** (a) A horizontal shaft running at 400 rpm is to drive a parallel shaft at 500 rpm. The diameter of the pulley on the driving shaft is 80 cm. If the belt is 8 mm thick, calculate the diameter of the driven pulley :
- (i) Neglecting belt thickness
 - (ii) Taking belt thickness into account
 - (iii) Assuming belt thickness and a slip of 5%

Given:
$$\frac{N_B}{N_A} = \frac{D_A}{D_B}, \quad \frac{N_B}{N_A} = \frac{D_A + t}{D_B + t}, \quad \frac{N_B}{N_A} = \frac{D_A + t}{D_B + t} \times \left(1 - \frac{s}{100}\right)$$

(10 marks)

- (b) A vertical screw threads of mean diameter 50 cm and 12 cm pitch. Given that the coefficient of friction between nut and screw is 0.15.
- (i) Calculate the torque required on the screw to raise a load of 25kN
 - (ii) Calculate the percentage of efficiency.
 - (iii) If a Vee thread of $\beta = 10^\circ$ is used to replace the present screw, what is the torque required on the screw and its efficiency?

Given:

$$\tan \alpha = \frac{p'}{\pi d} \quad \eta\% = \frac{Wp'}{F\pi d} \quad T = Fr \quad \tan \phi = \mu$$

$$F = W \frac{\tan \alpha + \tan \phi}{1 - \tan \alpha \tan \phi} \quad F_v = W \frac{(\cos \beta \tan \alpha + \tan \phi)}{(\cos \beta - \tan \alpha \tan \phi)}$$

(10 marks)

- END OF QUESTION -

FINAL EXAMINATION

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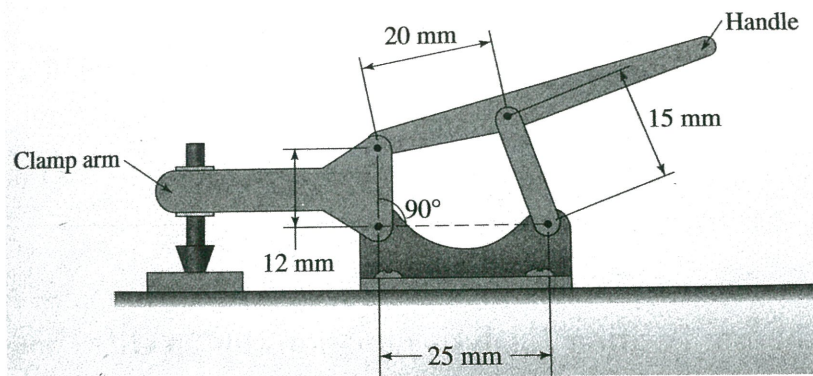


Figure Q5(c)

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