TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATIONS 2013/2014
FOR THE DEGREE OF BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMG 2311: DESIGN OF POWER TRANSMISSION SYSTEMS

Year III Semester II SUPPLEMENTARY/SPECIAL EXAMINATIONS
SERIES: FEBRUARY 2013
TIME: 2 HOURS

INSTRUCTIONS:

– This paper consists of **FIVE** questions
– Answer any T**HREE**
– All questions carry equal marks
This paper consists of Three printed pages.

QUESTION 1

Fig. Q1 shows a compound gear train gears S1 and S2 being rigidly attached to the shaft Q. If shaft P rotates at 1000 revs/min, whilst the annulus A_2 is driven in the opposite direction at 500 revs/min, determine the speed and direction of rotation of shaft Q.

The numbers of teeth in the wheels are $S_1 = 24$, $S_2 = 40$ $A_1 = 100$, $A_2 = 120$ **(20 marks)**

QUESTION 2

a) Illustrate with neat sketches how the following keys are used, and state where each is used:
   i)   Parallel sunk key
   ii) Cib head key
   iii) Saddle key
   iv) Tangent key   **(8 marks)**

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b) Design a split muff coupling to be used to transmit 20KW at 250kW   revs/min. permissible shear and curbing stresses for shaft and key materials are 60 and 120 N/mm² respectively. The split muff is to be made of cast iron with permissible shear stress of 18N/M². Assume the maximum torque to be transmitted is to be 30 per cent greater than the mean turque.   **(12 marks)**

QUESTION 3

a) List **FOUR** advantages of helical springs.   **(4 marks)**

b) Use neat sketches to illustrate the following types of springs and state where each is used:
   i) Tension helical
   ii) Torsion
   iii) Lammated
   iv) Bellevile   **(8 marks)**

c) Design a helical compression spring for minimum load of 1200N and a deflection of 30mm using the value of spring index of 5. The maximum permissible shear stress for spring wire is 420 Mpa and Modulus of rigidly is 84Kn/mm².

   Take Wahl factor, $K = \dfrac{4C-1}{4C-4} + \dfrac{0.615}{C}$

   Where C = Spring index   **(8 marks)**

QUESTION 4

a) Two machine parts were fastened together rightly by means of a 27mm tap bolt. If the load tending to separate this part is neglected, find the stress that is set up in the bolt by the initial tightening.   **(10 marks)**

b) A glass cylinder has a pitch circle diameter of 420mm and the maximum gas press acting on the cylinder is 2.5N/mm². If such of nominal diameter 24mm are to be used, calculate the number of slids required to fix the cylinder cover.   **(10 marks)**

QUESTION 5

a) Illustrate with sketch the profile of a square thread and show the following elements: **(8 marks)**
   i) Pitch
   ii) Depth
   iii) Width
   iv) Minimum diameter
   v) Pitch circle diameter

b) A square thread screw having a mean diameter of 40mm and 160 threads meter is used to raise a load of 7.5KN. The nut which rotates has a bearing surface of mean diameter 56mm. Find the effort required at the end of the lever 300mm effective length to raise a load when the coefficient of friction, (ai) is 0.08 **(12 marks)**