TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMG 2413: MACHINE DESIGN

SUPPLEMENTARY EXAMINATION

SERIES: SEPTEMBER 2018

TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Answer any THREE questions. All questions carry equal marks.

Do not write on the question paper.

Question ONE

a) With the aid of a sketch describe forces acting on a sunk key when transmitting torque from a shaft to a rotor or hub. **(10 marks)**

b) Design a rectangular key for a shaft of 50mm diameter. The shearing and crushing stresses for the key material are 42MPa and 70Mpa respectively. **(10 marks)**

Question TWO

a) Distinguish clearly between rigid couplings and flexible couplings. **(2 marks)**

b) Give five requirements of a good shaft coupling. **(5 marks)**

c) Design a clamp coupling to transmit 30kW at 100 rpm. The allowable shear stress for the shaft and key is 40MPa and the number of bolts connecting the two halves are six. The permissible tensile stress for the bolts is 70MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3. **(13 marks)**

Question THREE

a) Describe seven main considerations in designing a friction clutch **(7 marks)**

b) A single plate clutch, effective on both sides is required to transmit 25kW at 3000 r.p.m . Determine the outer and inner diameters of frictional surface if the coefficient of friction is 0.255, ratio of diameters is 1.25 and the maximum pressure is not to exceed $0.1N/mm^{2}$.. Also, determine the axial thrust to be provided by springs. Assume the theory of uniform wear. **(13 marks)**

Question FOUR

a) Describe eight advantages and four disadvantages of using rolling contact bearings over sliding contact bearings. **(12marks)**

b) Describe the working principle of hydrodynamic lubricated bearing. **(8 marks)**

Question FIVE

a) With the aid of sketches, describe the following types of weld joints indicating considerations involved in their selection:

i. Lap joint or fillet joint

ii. Butt joint **(8 marks)**

b)

i. A 50mm diameter solid shaft is welded to a flat plate by 10mm fillet weld in figure Q5b(i) Find the maximum torque that the welded joint can sustain if the maximum shear stress intensity in the weld material is not to exceed 80MPa**.** **(6 marks)**

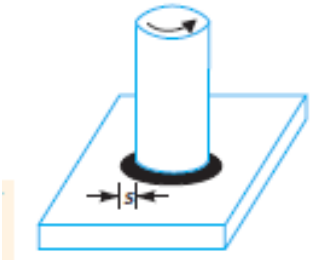

Figure Q5 b(i)

ii. A plate 1m long, 60mm thick is welded to another plate at right angles to each other by 15mm fillet weld, as shown in figure Q5b(ii). Find the maximum torque that the welded joint can sustain if the permissible shear stress intensity in the weld material is not to exceed 80 Mpa.

(6 marks)

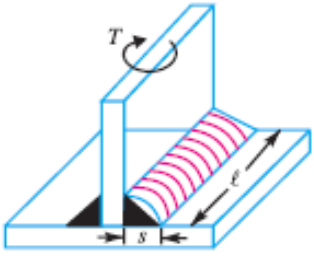

Figure Q5b(ii)