



# **THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE**

*(A constituent College of JKUAT)*  
**FACULTY OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING**  
DIPLOMA IN MECHANICAL ENGINEERING

- PLANT (DPL4)
- AUTOMOTIVE (DDE4)

## **EME 2207: MECHANICS OF MACHINES II**

YEAR II SEMESTER II

SPECIAL/SUPPLEMENTARY EXAMINATION  
MAY 2012 SERIES  
TIME: 2 HOURS

### **INSTRUCTIONS TO CANDIDATES:**

You should have the following for this examination:

- Answer booklet
- Scientific Calculator

This paper consists of **FIVE** questions

Attempt any **THREE** questions. Maximum marks for each part of a question are as shown.

**This paper consists of 3 printed Pages**

**Question ONE**

- a) In a gear drive system, the smaller driven gear of 20 teeth is rotating at 33 revolutions per second. It is in mesh with a driven gear of 40 teeth. If the two gears are of  $20^\circ$  involute form with an addendum length and module of 5mm and 0.005m respectively. Calculate: Their velocity of sliding at engagement, at the pitch point and at dis-engagement. (14marks)
- b) By using sketches, illustrate the teeth profile of helical gears and spiral gears, stating TWO disadvantages of each. (6marks)

**Question TWO**

- a) The driven pulley of an open belt drive system of 450mm diameter is rotating at 200rpm at a center distance of 1.95m away from the driven pulley of 450mm diameter. If the maximum belt tension is limited to 1kN, and the co-efficient of friction of 0.25. Calculate.
- i. The velocity of the belt
  - ii. The power transmitted
  - iii. The angle contact in degrees
  - iv. The length of the belt (15marks)
- b) State FIVE disadvantages of flat belts (5marks)

**Question THREE**

- a) State and explain the TWO main forms of teeth profiles used in the design and manufacture of Industrial gears. (4marks)
- b) A plate clutch arrangement is to be engaged to a drum wheel of 55Kg and 0.4m radius through a flywheel of 25Kg and 0.3m radius at a speed of 500rpm. At this speed, the clutch experiences an axial force of 1300N and develops a torque of 40Nm. If the inner and outer diameters of the clutch are 0.24m and 0.32m respectively and the co-efficient of friction is 0.3, Calculate:
- i. The clutch speed after slip
  - ii. The time taken for the drum wheel to attain a speed of 500rpm (16marks)

**Question FOUR**

- a) A compound belt drive system consists of four pulleys of 0.75m, 0.45m, 0.9m and 0.15m respectively and progressively. The first pulley rotates at 150rpm and drives the second and third pulley which are keyed to the same shaft. If there is a slip of 2% each in the two belts connecting the pulleys, Calculate the speed of the fourth pulley. (10marks)

- b) Two parallel shafts at 6meters apart are to rotate at 120rpm and 360rpm respectively by aid of a spur gear drive. If the circular pitch of the two gears is 25mm, calculate:
- I. The No of teeth of each gear
  - II. The pitch circle diameters
  - III. The exact center distance between the shafts. *(10marks)*

### **Question FIVE**

- a) A cone clutch of 750mm diameter, and  $15^\circ$  cone semi-angle is engaged to a flywheel of 13.5Kg and 0.15m radius at a speed of 1000rpm. If the clutch experiences an axial thrust of 180N and has a co-efficient of friction of 0.3, Calculate:
- i) The time it takes for the flywheel to reach 1000rpm
  - ii) The energy gained by the clutch
  - iii) The energy lost due to slipping *(14marks)*
- b) Using sketches, explain the design features and the working principles of:
- i. Cone clutch
  - ii. Plate clutch *(6marks)*