



# MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya.

Tel: +254(0) 799 529 958, +254(0) 799 529 959, +254 (0)712 524 293

Website: [www.must.ac.ke](http://www.must.ac.ke) Email: [info@mucst.ac.ke](mailto:info@mucst.ac.ke)

---

## UNIVERSITY EXAMINATIONS 2022/2023

SECONDYEAR, FIRST SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION  
FOR DEGREE OF BACHELOR OF EDUCATION SCIENCE AND BACHELOR OF  
SCIENCE (PHYSICS)

### SPH 3200: MECHANICS II

DATE: AUGUST 2023

TIME: 2 HOURS

---

INSTRUCTIONS: Answer Question ONE and any other TWO questions.

---

#### QUESTION ONE (30 MARKS)

- a) Match the following quantities of linear motion with the respective quantities of angular motion (2 Marks)
- Force
  - Mass
- b) A force of  $F$  is applied an angle of  $30^\circ$  to tangent of a ply wheel of radius 30 cm. If the torque on the ply-wheel 36 N. Find  $F$  (4 Marks)
- c) Three masses of mass 80g, 60g and 90 g are placed at the vertices of an equilateral triangle of sides 5 m. the system rotates about an axis perpendicular to the plane of the triangle and through the centre of mass. Find the moment of inertia (8 Marks)
- d) A fixed solid disc pulley is acted upon by a torque of 12 Nm. If the mass of the disc is 0.6 Kg, calculate the acceleration of the pulley if the radius of the pulley is 0.2 m (5 Marks)
- e) A rod of diameter 4 cm, length 48 cm and mass 1.2 kg rotates through its centre with axis parallel to its length. Find the Moment of inertia (5 Marks)
- f) Define a couple of force (2 Marks)
- g) For a solid cylinder of radius 24 cm and mass 3.2 kg find the radius of gyration (5 Marks)
-

### QUESTION TWO (20 MARKS)

- a) An engine fly wheel of mass 20 kg and radius 0.12 m is rotating at 1200 revolutions per minute. The engine is stopped by applying some frictional force on wheel. Calculate the work done in stopping the wheel (9 Marks)
- b) A very thin circular ring has internal radius of 12 cm and external radius of 16 cm. If the mass of the ring is 800 g,
- Find its moment of inertia about an axis through its centre and perpendicular to its plane (4 Marks)
  - Calculate its radius of gyration (3 Marks)
  - For a uniform solid sphere of R and Mass m, derive the equation for the radius of gyration (4 Marks)

### QUESTION THREE (20 MARKS)

- a) Derive the work energy theorem (8 Marks)
- b) A cylinder of mass 8 kg and radius 0.05m rolls without slipping so that the periodic time of its angular motion is 0.2 Seconds. Calculate:
- Angular velocity (2 Marks)
  - Linear speed (2 Marks)
  - Translational kinetic energy (3 Marks)
  - Rotational Kinetic energy (5 Marks)

### QUESTION FOUR (20 MARKS)

- a) Find an equation for the plane defined by the three points  $(-1, -1, -1)$ ,  $(1, 1, 1)$  and  $(1, -1, 0)$  (7 Marks)
- b) For the vector fields  $F_1 = xyi + yzj + zyk$  and  $F_2 = yzi + xzj + xyk$ , find;
- The divergence (5 Marks)
  - Curl  $\nabla \times z$  (8 Marks)