



MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

FIRST YEAR SECOND EXAMINATION FOR

DIPLOMA IN MECHANICAL ENGINEERING

2601/102/MS: MECHANICAL SCIENCE

DATE: 10/9/2021

TIME: 8.30-11.30 AM

INSTRUCTIONS:

Answer ALL the questions

1. (a) State three types of coupling devices used in power transmission. (3 marks)
(b) (i) Explain how a centrifugal governor operates to control the speed of a steam engine.
(ii) List two merits of governors in b(i). (6 marks)
(c) Explain the following terms as used in dynamics:
(i) moment;
(ii) couple. (6 marks)
(d) The velocity of a body increases uniformly from a velocity of u m/s to v m/s in time t seconds. The body accelerates uniformly at a m/s². Derive an expression for displacements of the body in terms of acceleration. (5 marks)
2. (a) (i) State Archimedes principle.
(ii) With the aid of a U-tube manometer diagram, show that pressure due to a column of a liquid depends upon the density of the liquid and the height of the column. (8 marks)
(b) (i) Distinguish between 'momentum' and 'impulse'.
(ii) A railway truck A of mass 2×10^4 kg travelling at 0.5 m/s collides with another truck B of half its mass and moving in the opposite direction at a velocity of 0.4 m/s. The trucks couple automatically on collision. Determine the common relative velocity which they move.

(6 marks)

(c) With aid of a T-S diagram explain the processes in the carnot cycle. (6 marks)

3. A pile driver of mass 300 kg is used to drive a pile of mass 500 kg vertically into the ground. The pile

driver falls freely through a distance of 54.0 m, rebounding with a velocity relative to the pile and equal to the relative velocity immediately before impact. Determine:

(a) the velocity of the driver immediately before impact; (4 marks)

(b) the velocity of the pile immediately after the impact: (7 marks)

(c) the depth of penetration of the pile after impact given that the ground resisting force is constant and equal to 115 kN; (4 marks)

(d) the time taken for the penetration. (5 marks)

4. (a) Differentiate between a flywheel and a speed governor. (4 marks)

(b) Describe the following characteristics of governors:

(i) sensitivity;

(ii) stability;

(iii) isochronous.

(c) The following figures were obtained during a tensile test of mild steel: (6 marks)

Original diameter	12.5mm
Gauge length	200mm
Final length	257mm
Diameter at structure	-7.85mm
Load at yield point	34575N
Maximum load	49023N

Determine;

(i) tensile strength;

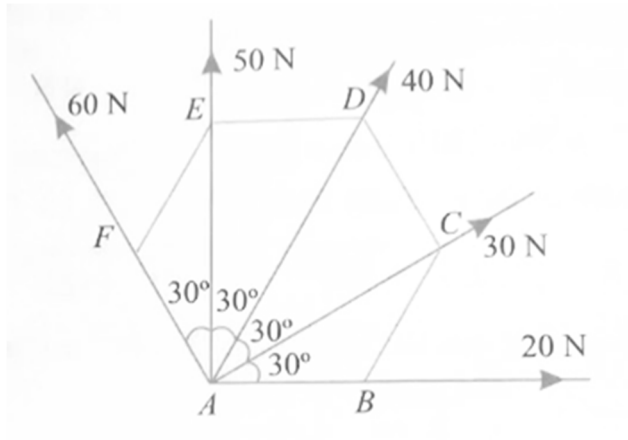
(ii) stress at yield point:

(iii) percentage reduction in area;

(iv) percentage elongation. (10 marks)

5. (a) The forces 20N, 30N, 40N, 50N and 60N are acting at one of the angular points of a regular

hexagon as shown in the diagram below, towards the other five angular points, taken in order. Find the magnitude and direction of the resultant force analytically. (10 marks)



- (b) The figure below shows a system of forces. Determine the magnitude and direction of the resultant force using the graphical method. (10 marks)

