THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE
DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

DIPLOMA IN TECHNOLOGY

Electrical Power Engineering
Telecommunication Engineering
Automation & Control Engineering

MECHANICAL ENGINEERING SCIENCE

SPECIAL/SUPPLEMENTARY EXAMINATION
October, 2011 Series

2 Hours

Instructions to Candidates
You should have the following for this examination:

- Answer Booklet
- Non-Programmable Calculator

Answers any **THREE.** All questions carry equal marks.

QUESTION ONE

(a) State:
(i) The polygon of forces rule.
(ii) Two applications of balancing.

(4 Marks)

(b) Four bodies w; x; y and z are rigidly attached to a shaft that rotates at 10rev/sec. If masses, radii of rotation and angular displacement of the bodies are as follows:

Body	**Mass (kg)**	**Radius (m)**	**Angular Displacement (θ°)**
W	4	0.15	165°
X	3	0.3	120°
Y	2	0.6	30°
Z	1	1.2	0°

Find the:

(i) Mr Products for each body.
(ii) Out-of balance force on the shaft.
(iii) Magnitude and position of the balance mass required at 0.5m radius.

(11 Marks)

(c) A lamp 5N in weight is suspended from a ceiling by a chain. It's filled aside by a horizontal zero till the chain makes an angle of 60° with the ceiling. Determine the tensions in the chord. **(5 Marks)**

QUESTION TWO

(a) A café 200kg is moving at a speed of 10m/s on a rope way. If the cape is 50m above the ground level determine the ratio of its kinetic to potential energy. **(3 Marks)**

(b) A wooden block 950N in weight is placed on an sunclined plane that makes 30° with the horizontal. If the block is moved 3m upwards the plane; determine the work done if the plane is:-

(i) Smooth
(ii) Rough with a coefficient of friction of 0.3

(8 Marks)

(c) A lorry 4t in mass accelerates uniformly from 40 to 70km/h in 10 seconds. If the tractive effort is constant during this time at 3kN; find the:-
(i) Average resistance in motion
(ii) Maximum tower developed
(iii) Average tower developed

(9 Marks)

QUESTION THREE

(a) State:

(i) Principle of moments
(ii) Any TWO applications of moments.

(4 Marks)

(b) A uniform rod AB 3m long and 100N in weight is hinged at A to rotate in the vertical plane. If it's held horizontally by a string attached at B inclined at 60° to the horizontal; as shown in figure 3.0. Find the tension in the string. (6 Marks)

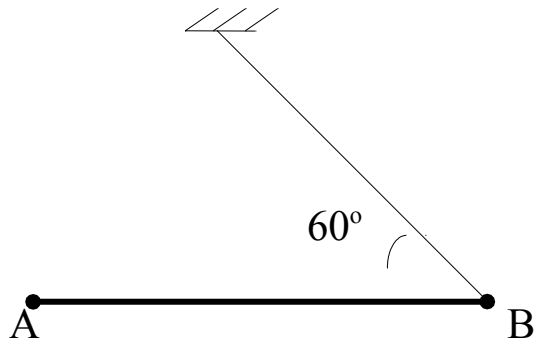

Fig. 3.0

(c) (i) A body undergoing linear motion with an initial velocity a m/s attains a final velocity vm/s in t seconds with a uniform acceleration of a m/s. show that $V^2 = u^2 + 2as$ (4 Marks)

(ii) A motorist driving a car at 80km/h observes traffic lights 100m a head turning red. The lights are timed to remain red for 30 seconds before turning green. However, the motorist wishes to pass the lights without stopping to wait for it to turn green. Find the:

(a) Required uniform acceleration of the car
(b) Speed of the car as it passes the traffic lights.

(6 Marks)

QUESTION FOUR

(a) Fig. 1 shows a system of co-planar concurrent forces. Determine the magnitude and direction of the resultant force.

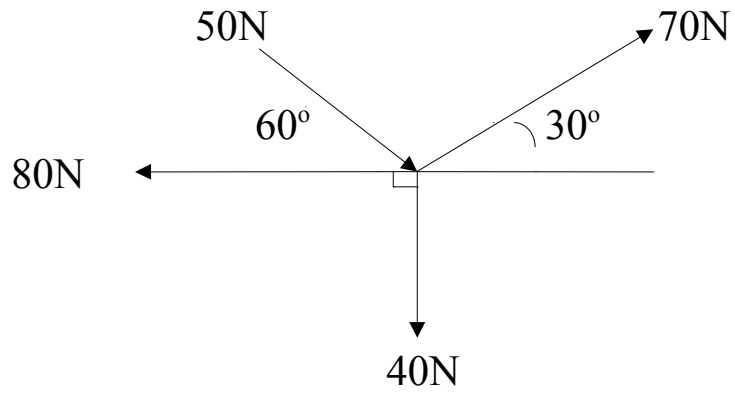

Fig. 4.0

Determine the magnitude and direction of the resultant force by way of:

(i) The method of components
(ii) Construction

(10 Marks)

(b) Two blocks A and B 1kg mass each rests on a rough surface inclined at 15° with the horizontal. If the blocks are 0.5m apart and the static friction between the surface and A and B is 0.12 and 0.3 respectively. Take the coefficient of restitution as 0.75 and calculate the:-

(i) Time at which the impact occurs.
(ii) Velocity of the blocks immediately after impact.

(10 marks)

QUESTION FIVE

(a) State any **FOUR:**

(i) Advantages and disadvantages of friction.
(ii) Laws of any friction.

(8 Marks)

(b) A body just begins to slide down a rough plane inclined 25^{o} to the horizontal. If the weight of the body is 50N; determine the parallel force to the plane required to haul it up the plane. (12 Marks)