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

EME 2313: MECHANICS OF MACHINES IV

YEAR III 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 motor vehicle is rear wheel driven and the car is stationary, 0.55 of the mass is supported by the rear wheels. The height of the centre of gravity above the ground is 1/5 of the wheel base. On a level road the greatest acceleration possible without skidding the wheels is $3m/s^2$.

a) Calculate the coefficient of friction between the types and the road.
b) Using the coefficient of friction, find the steepest gradient which the car could climb.

(20marks)

Question TWO

Three rotating masses A = 14Kg B = 11Kg and C = 21kg are carried on a shaft with a centre of gravity 275mm. 400mm and 150mm respectively from the shaft axis. The angular position of B and C are 60 and 135 respectively from A. Measured in the same direction. The distances between the planes of rotation of A and B is 1.35m and between those of A and C is 3.6m B and C being on the same side of A. two balance masses are to be fitted each with its centre of gravity 225mm from the shaft axis in planes midway between those of A and B and of B and C. Determine the magnitude and angular position with respect of A of each balance mass.

(20marks)

Question THREE

A vehicle of mass 1tonne has the moment of inertia of the road wheels and rear axle together of 8.5 Kgm2. The effective diameter of the road wheels is 600mm. The overall speed reduction is 15 with road and air resistance of 200N at this speed. If the overall transmission efficiency is 88%, determine the acceleration on a level road at the instant when the engine develops a torque of 100Nm. **(20marks)**

Question FOUR

A shaft 1.4m long carries four eccentric loads A,B,C and D spaced at 0.45, 0.75, and 1.4m from one end. The loads are respectively 7.5, 11 15 and 6 kg and ecentirity 36, 48, 54 and 96mm. The direction of the eccentricies of B.C and D relative to A are 60˚, 200˚ and 270˚ The

shaft is carried in bearings E and F which are 0.175m and 1.0m from A, E being between A and B.

Determine

a) The minimum and maximum vertical force on bearing F when the shaft rotates at 90 vers/min
b) The maximum speed at which the shaft may run to ensure that the vertical component of load on F is always. Downwards. **(20marks)**

Question FIVE

For a typical motor car the rolling resistance is given by the expression 18 + 0.6V and air resistance $0.1V^2$ the resistance being in Newton's and velocity V in Kph in each case. Assuming that the power output at an engine speed corresponding to 48kph is 25KW with a transmission efficiency of 84% and the inertia corresponds to a mass of 1250 kg. Calculate the maximum possible acceleration in m/s^2 when running on level road under these conditions.

(20marks)