KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2009/2010 ACADEMIC YEAR

FOR THE CERTIFICATE OF PRE- UNIVERSITY

PHYSICS

COURSE CODE: PPHYS 021

COURSE TITLE: MECHANICS

STREAM: SEMESTER TWO

DAY: WEDNESDAY

TIME: 9.00 – 11.00 A.M.

DATE: 09/12/2009

INSTRUCTIONS:

Answer question **ONE** and any other **TWO**.
Take g = 10 m/s^2

PLEASE TURN OVER

QUESTION 1 (30 MARKS)

(i) Distinguish between a scalar and a vector and give an example of each (3 mks)

(ii) Explain the following two forces

I. Contact force (1 mks)

II. Field force (1 mks)

(iii) Explain the three kinds of friction (6 mks)

(iv) I. state Hooke's law (1 mk)

II. Show that the potential energy stored in a stretched or compressed spring is given by $PE = \frac{1}{2}kx^2$ where k is the spring constant and x is the compression or the stretch. (4mks)

(v) I. Define Power.

II. Explain the difference between instantaneous power and average power. (2 mks)

(vi) Provide a comparison between equations of linear and equations of angular motion. (6 mks)

(vii) A bicycle wheel of radius r = 1.5 m starts from rest and rolls 100 m without slipping in 30 s. Calculate

I. the number of revolutions the wheel makes, (2 mks)

II. the number of radians through which it turns, (2 mks)

III. the average angular velocity. (2 mks)

QUESTION 2 (20 MARKS)

(a) State the differences between instantaneous velocity and average velocity. (2 marks)

(b) Table 1 gives data on the position of a runner on a track at various times.

Table 1: Time and position for a runner.

t(s)	x(m)
1.00	1.00
1.01	1.02
1.10	1.21
1.20	1.44
1.50	2.25
2.00	4.00
3.00	9.00

(i) Plot the distance - time graph based on the data in Table 1.
(ii) Find the runner's instantaneous velocity at $t = 1.00$ s.
(iii) F the average velocity for the total observed part of the run.
(8 marks)

(c) (i) State the 3 Newton's laws of motion (3 marks)
(ii) A 4 kg mass travelling at constant velocity 15 m/s has a 10 N force applied to it against the direction of motion.
I. Sketch a diagram illustrating the situation. (1 mark)
II. What is the deceleration produced? (3 marks)
III. How long will it take before the mass is brought to rest? (3 marks)

QUESTION 3 (20 MARKS)

(a) Define and give an example of each of the following:
(i) Conservative force (3 marks)
(ii) Non-Conservative Force (3 marks)

(b) (i) Define impulse and show that $impulse = m\Delta v$ where m is mass and Δv is change in velocity. (3 marks)
(ii) A particle of mass 0.5 kg moves with a constant velocity of (3i + 5j) m/s. After being given an impulse, the particle then moves off with a constant velocity of (2i - 3j) m/s.
Calculate:
I. the impulse (5 marks)
II. the magnitude of the impulse (3 marks)
III. the direction of the impulse(degrees to the x-axis) (3 marks)

QUESTION 4 (20 MARKS)

(a) When is a collision said to be
(i) Elastic (2 marks)
(ii) Inelastic (2 marks)

(b) A driver of a car breaks suddenly just before hitting a pedestrian. A traffic policeman rushes to the scene to measure the distance the tyres skid as a result of breaking. Explain how the policeman would use the data to estimate the speed of the car just before the accident. (4 marks)

(b) A 1.0 kg object travelling at 1.0 m/s collides head on with a 2.0 kg object initially at rest.

(i) Find the velocity of each object after impact if the collision is perfectly elastic (6 marks)

(ii) Suppose the collision in the previous problem was completely inelastic. Find

I. the velocity of the objects after impact and (3 marks)

II. the fraction of the kinetic energy lost during the collision. (3 marks)