



**UNIVERSITI KUALA LUMPUR
Malaysia France Institute**

**FINAL EXAMINATION
JANUARY 2011 SESSION**

SUBJECT CODE : FMB 11102
SUBJECT TITLE : STATICS & DYNAMICS
LEVEL : BACHELOR
TIME / DURATION : 9.00 am – 11.30 am
(2.5 HOURS)
DATE : 06 MAY 2011

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper **CAREFULLY**.
 2. This question paper is printed on both sides of the paper.
 3. Please write your answers on the answer booklet provided.
 4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
 5. This question paper consists of one (1) section only. Answer **FOUR (4)** questions only.
 6. Answer all questions in English **ONLY**.
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THERE ARE 2 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer only FOUR (4) questions.

Please use the answer booklet provided.

Question 1

Determine the resultant force, F_R for a system of forces that meet at the origin (0, 0, 0) with values given as $P_1 = 25 \text{ N @ } 35^\circ$, $P_2 = 45 \text{ N @ } 55^\circ$, $P_3 = 65 \text{ N @ } 75^\circ$, $P_4 = 85 \text{ N @ } 95^\circ$. Also, use the graphical method to confirm the value obtained for the resultant force.

(25 marks)

Question 2

(a) Find the moment of a force, $P = (2i + 3j + 4k) \text{ N}$ acting through the point (1, 2, 3) with respect to a line that goes through the points (5, 7, 9) and (11, 13, 15). The coordinates are given in centimeters.

(15 marks)

(b) The rectangular components of a force are given as $P_x = 23 \text{ N}$, $P_y = 45 \text{ N}$ and $P_z = 67 \text{ N}$. Calculate the moment of the force about a line that passes through the coordinates (0, 0, 0) and (40, 50, 60). The coordinates are in millimeters.

(10 marks)

Question 3

(a) Define and explain the following terms:- coefficient of static and kinetic friction, angle of repose, limiting friction.

(10 marks)

(b) A wooden box has a mass of 70 kg. It is pushed up a surface that is inclined 50 degrees to the horizontal. Given that the coefficients of static and kinetic friction are 0.23 and 0.34 respectively, calculate the force necessary to push the box up the inclined surface.

(15 marks)

Question 4

- (a) A particle's displacement is 100 m, and its velocity 33 m/s after half a minute, moving along a vertical path with an acceleration, $a = (3v + 2)$. Determine the displacement, velocity and acceleration of the particle when the time elapsed has reached 90 s.
(15 marks)
- (b) Find the vertical distance above the ground where 2 objects will coincide (i.e. meet) if they are thrown up (against gravity) with an interval of 45 seconds. The first and second objects have a velocity of 100 m/s and 150 m/s respectively.
(10 marks)

Question 5

- (a) A particle moves on a path with a velocity vector of $v = (0.5t^2 \mathbf{i} - 1.5t \mathbf{j} + 2.5 \mathbf{k}) \text{ m/s}$. Find the particle's position (i.e. coordinates) after 20 s, and the equation of its path. After another 30 s, find the projection of the velocity vector in the direction of the vector, $n = (1\mathbf{i} + 2\mathbf{j} - 3\mathbf{k})$.
(12 marks)
- (b) The coefficients of static and friction for a flat surface are 0.22 and 0.44 respectively. If the surface is 25 m in length, and inclined 25 degrees to the horizontal, find the velocity needed for a ball to roll up the surface 10 m. Also, calculate the kinetic energy needed for the ball to move up that distance.
(13 marks)

END OF QUESTION