TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN MECHANICAL ENGINEERING (PLANT)
DIPLOMA IN AUTOMOTIVE ENGINEERING
(Y 3 S2)

AMA 2351: ENGINEERING MATHEMATICS VI

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2014
TIME ALLOWED: 2 HOURS

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

- *Answer Booklet*

This paper consist of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (Compulsory)

a) (i) Given $\underset{\sim}{A} = 2i + 3j + 4k$ and $\underset{\sim}{B} = 4i - 3j + 2k$, determine the direction cosines of $\underset{\sim}{A}$ and $\underset{\sim}{B}$ and hence the angle between them. **(6 marks)**

(ii) Given $\underset{\sim}{A} = 2i + 4j + 3k$ and $\underset{\sim}{B} = i + 5j - 2k$ determine $\underset{\sim}{A} \times \underset{\sim}{B}$ **(4 marks)**

b) Evaluate the following integrals;

(i) $\int_1^2 \int_0^3 x^2 y \; dxdy$ **(4 marks)**

(ii) $\int_1^2 \int_0^\pi (3 + \sin\theta) d\theta dr$ **(4 marks)**

c) A solid is enclosed by the planes z = 0, x = 1, x = 4, y = 2, y = 5 and the surface z = x + y. Determine the volume of the solid **(6 marks)**

d) (i) A machine produces 94% defective components. In a sample of 4 drawn at random, determine the probability there will be 2 defective items. **(3 marks)**

(ii) If 2% of components by a company are defective, determine the probability that a sample of 60 components will have 3 components defective. **(3 marks)**

Question Two

a) If $\underset{\sim}{F} = 3ui + u^2 j + (u+2)k$ and $\underset{\sim}{V} = 2ui + 3uj + (u-2)k$, determine $\int_0^2 \left(\underset{\sim}{F} \times \underset{\sim}{V}\right) \; du$ **(7 marks)**

b) (i) Given $\phi = x^2yz^3 + xy^2z^2$, determine grad ϕ at point P(1, 3, 2) **(5 marks)**

(ii) Given $\underset{\sim}{V} = xy^2 i + 2xyzj - 3yz^2 k,$ determine curl V at pt P (1, -1, 1) **(8 marks)**

Question Three

a) Evaluate the following integrals:

(i) $\int_0^3 \int_1^2 (x^2 + y^2) dydx$ **(4 marks)**

(ii) $\int_0^4 \int_y^{2y} (2x + 3y) dx \; dy$ **(4 marks)**

(iii) $\int_2^3 \int_0^1 \left(x - x^2\right) dy\ dx$ **(4 marks)**

b) Use double integral to determine the are enclosed by the polar curve $r = 4(1 + \cos\theta)$ and the radius vectors at $\theta = 0$ and $\theta = \pi$ **(8 marks)**

Question Four

a) A machine produces 20% defective components. In a sample of four drawn at random, determine the probability that there will be at most two defectives. **(5 marks)**

b) A survey reveals that in a sample of twenty bulbs produced by a company, two bulbs are defective. Determine the probability that there will be at least three defectives. **(6 marks)**

c) A machine produces components having mean length of 15cm and standard deviation of 0.2cm. Assuming lengths are normally distributed, determine in batch of 1000 components.

(i) Number of components likely to have lengths less than 14.95cm

(ii) Number of components likely to lie between 14.95 and 15.15cm

(iii) Number of components likely to be larger than 15.43cm **(9 marks)**

Question Five

a) Given $\underset{\sim}{A} = x^2 yi + yz^3 j - zx^3 k,$ determine grade ¿ A **(5 marks)**

b) Evaluate $\int\int_R xy\ \ dx$ where R is a triangle with vertices (0, 0),(10, 1) and (1, 1) **(9 marks)**

c) Determine the volume of the solid bounded by the planes z = 0, x = 1, x = 2, y = -1, y = 1 and the surface $z = x^2 + y^2$ **(6 marks)**