



# TECHNICAL UNIVERSITY OF MOMBASA

## Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS  
DIPLOMA IN BUILDING & CIVIL ENGINEERING

AMA 2351: ENGINEERING MATHEMATICS VI

**END OF SEMESTER EXAMINATION**  
**SERIES: DECEMBER 2014**  
**TIME ALLOWED: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Answer Booklet*
- *Scientific Calculator*
- *Tables*

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) The mean length of 500 poles is 170cm and the standard deviation is 9cm. Assuming the lengths are normally distributed, determine the number of poles likely to have a length between 150cm and 195cm. **(5 marks)**
- (ii) A bag of potato chips is packaged by weight. A total of nine bags are purchased, weighed and the mean weight of these nine bags is 10.5kg. Suppose that the standard deviation of the population of all such bags of chips is 0.6kg. The stated weight on all packages is 11kg. Using a level of significance at 0.01, determine whether the sample support the hypothesis that true population mean is less than 11kg. **(5 marks)**
- b) A batch of 1500 lemonade bottles have an average contents of 753ml and the standard deviation of the contents is 1.8ml. If the volumes of the content are normally distributed. Determine the number of bottles likely to contain:
- (i) Less than 750ml
  - (ii) Between 752ml and 754ml
  - (iii) More than 757ml
  - (iv) Between 750 and 751ml
- (10 marks)**
- c) X is a normally distributed variable with mean  $\mu=30$  and standard deviation  $\sigma = 4$ , Find:
- (i)  $P(x < 40)$
  - (ii)  $P(x > 23)$
  - (iii)  $P(30 < x < 35)$
- (10 marks)**

### Question Two

- a) (i) A component is classed as defective. If it has a diameter of less than 69mm. In a batch of 350 components, the mean diameter is 75mm and standard deviation is 2.8mm. Assume the diameter are normally distributed, determine how many are likely to be classed defective. **(5 marks)**
- (ii) If the cholesterol level of healthy men is normally distributed with a mean of 180 and a standard deviation of 20, and men with cholesterol levels over 225 are diagnosed as not healthy. Determine probability of a Type II error **(5 marks)**
- b) (i) Differentiate between type I error and type I error. **(2 marks)**
- (ii) The manager of a fitness club claims its now more popular. Studies show that previous mean time per visit was 36 minutes, with a standard deviation of 11 minutes. Using a random sample of  $n = 220$  visits and current sample mean is 36.8 minutes. Confirm the manager's claim using alpha of 0.05 level **(8 marks)**

### Question Three

- a) The mean height of 350 students is 145cm and the standard deviation is 9cm. Assuming the heights are normally distributed. Determine:
- (i) Number of students likely to have heights less than 155cm
  - (ii) Number of students likely to have heights of more than 175cm **(8 marks)**
- b) (i) A glass company has a contract to supply plate glass for home and commercial windows. The contract specifies that the mean thickness of the glass must be 0.375 inches. The standard deviation  $\sigma$  is known to be 0.05 inc. The company wishes to test whether they are meeting the requirements by selecting a random sample of  $n = 100$  thickness measurements. Determine whether they are meeting the requirements using this sample size **(7 marks)**
- (ii) The mean thickness of 200 bricks is 750mm and the standard deviation is 14mm. Assuming normal distribution, determine number of bricks likely to have thickness less than 700mm. **(5 marks)**

### Question Four

- a) (i) Suppose a university is considering changing its class schedule to accommodate students working long hours. The registrar stated changes are required due to the mean number of hours worked by Diploma students is more than 20 per week. Formulate the appropriate null and alternative hypothesis. **(2 marks)**
- (ii) A study claims the mean commute time for all employees working at X county exceeds 40 minutes. This figure is higher than what has been assumed in the past. Using a significance level of 0.05 and a sample size of  $n = 100$  commuters, with the population standard deviation of  $\sigma = 8$  minutes, test this claim **(8 marks)**
- b) 500 tins of paint have a mean content of 1010ml and the standard deviation of the contents is 8.7ml. Assuming the volumes are normally distributed. Determine:  
Number of tins likely to have contents whose volumes are less than:
- (i) 1025ml
  - (ii) 1000ml
  - (iii) 995ml **(10 marks)**

### Question Five

- a) A heart institute performed many open-heart surgery procedures. Research physicians at the institute have developed a new heart bypass surgery procedure that they believe will reduce the average recovery time. The hospital board will not recommend the new procedure unless there is substantial evidence to suggest that it is better than the existing procedure. records indicate that the current mean recovery rate for the standard procedure is 42 days, with a standard deviation of 5 days. Determine whether the new procedure actually results in a lower mean recovery time when it was performed on a random of 30 patients. **(10 marks)**
- b) A communication company operates service centres in various cities where customers can call to get answers to questions about their bills. Previous studios indicate that the distribution of time required for each call is normally distributed, with a mean equal to 540 seconds. The company officials have

selected a random sample of 16 calls. Determine whether the mean call time is now fewer than 540 seconds after an in-house training. **(10 marks)**