TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN BUILDING & CIVIL ENGINEERING

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*
- *Drawing Instruments*

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 **FOUR** printed pages

Question One (Compulsory)

a) Differentiate the following terms/phrase as used in test of hypothesis.
    (i)   Type 1 error and Type II error   **(2 marks)**
    (ii)   Acceptance and rejection region   **(2 marks)**

b) Given that the peak temperature T is normally distributed with mean 85 and standard deviation 10.
Find Prob ($60 < T \leq 100$)   **(5 marks)**

c) A population of size 20 is sampled without replacement. The standard deviation of the population is 0.35. We require the standard error of the mean to be no more than 0.15 what is the minimum sample size.   **(5 marks)**

d) A new concrete mix is being evaluated. The plan is to sample 100 concrete made with the new mix, compute the sample mean comprehensive strength $\overline{X}$ and then test $Ho : \mu \leq 1350$ versus $Hi = \mu > 1350$ the standard deviation $\sigma = 70$. Find the critical point and the rejection region if the test will be conducted at a significance level of 5%.   **(5 marks)**

e) An air freight company wishes to test whether or not the mean weight of parcel shipped on a particular route exceeds 10 pounds. A random sample of 49 shipping orders was examined and found to have average weight of 11 pound. Assume that the standard deviation of the weights is 2.8 pounds.

f) 5% of the tools produced by a certain process are defective. Find the probability that in a sample of 40 tools chosen at random, exactly three will be defective calculate:
    (i)   Using binomial distribution   **(3 marks)**
    (ii)   Using a Poisson distribution as an approximation   **(3 marks)**

Question Two

a) Two additives to Portland cement are being tested for their effect on the strength of a concrete. 21batches were made with additive A, and their strengths showed standard deviation $S_A = 41.3$; 16 batches were made with the same percentage of additive B and their strength showed standard deviation $S_B = 26.2$. Assume that the strength of concrete follow a normal distribution. Is there evidence at the 1% level of significance that the concrete made with additive A is more variable than concrete made with additive B.   **(6 marks)**

b) A city installed 2000 electric lamps for street lighting. These lamps have a mean burning life of 1000 hours with standard deviation of 200 hours. The normal distribution is a close approximation to this case.
    (i)   What is the probability that a lamp will fail in the first 700 burning hours?   **(3 marks)**
    (ii)   What is the probability that a lamp will fail between 900 and 1300 burning hours.   **(5 marks)**
    (iii)   How many lamps are expected to fail between 900 and 1300 burning hours.   **(2 marks)**

c) A certain dimension is measured on four successive items coming off a production line this sample gives $\bar{x} = 2.384$ and $s = 0.048$ on basis of this sample what is the 95% confidence interval for the population mean. **(4 marks)**

Question Three

a) We are interested in testing whether or not a coin is balance based on the number of heads x. On 30 tosses of the coin. Assume that rejection region $\{|x - 18| \geq 4\}$.

   (i) What is the value of (level of significance) **(5 marks)**

   (ii) What is the value of β if P = 0.7 **(4 marks)**

b) The mean outer diameter of skateboard bearing is supposed to be 22 millimeters. The outer diameter vary normally with standard deviations $\sigma = 0.010mm$ when a lot of bearing arrives the skateboard manufacture takes a sample of 5 bearing from the lot and measures their outer diameter the manufacturer rejects the bearing if the sample mean diameter is significantly different from 22 at the 55 significance level.

   (i) Determine the critical region of the test **(3 marks)**

   (ii) If a bearing measures 0.015mm away from 22 should it be rejected. **(4 marks)**

c) The safety commissioner in a large city want to estimate the proportion of buildings in the city that are violation of the fire codes. A random sample of 40 building is chosen for inspection and 4 of them are found to have fire code violation estimate the proportion of buildings in the city that have fire code violations and find the uncertainty in the estimate. **(4 marks)**

Question Four

a) The standard deviation of measurements of a linear dimension of a mechanical part is 0.14mm. What sample size is required if the standard error of the mean must be not more than:

   (i) 0.04mm

   (ii) 0.02mm

   (iii) Compare

   (iv) (i) and (ii) **(8 marks)**

b) A company manufacturing RAM chips claims the defective rate of the population is 5%. Use a sample of 100 chips to test the claim.:

   (i) If 5 defectives are observed in the sample. **(3 marks)**

   $Ho : p = 0.05$

   $H_1 : p = 0.1$

   (ii) If

   β

   compute **(4 marks)**

c) A batch of 100 resistors have an average of 101.5 ohms. If the population is normally distributed:

(i) Test whether the population mean in 1000 hms at a level of significance 0.05. **(3 marks)**

(ii) Compute p – value **(2 marks)**

Question Five

a) State THREE sampling methods. **(3 marks)**

b) Differentiate between sampling with replacement and sampling without replacement. **(4 marks)**

c) What are the benefits of sampling. **(4 marks)**

d) 85% of the general public is right handed. A survey of 300 chief executive officers of large corporation found that 95% were right handed IS this difference in percentages statistically significant $\alpha = 0.01$

. Use   find the p-value for the test