Machakos University College

ISO 9001:2008 Certified

(A Constituent College of Kenyatta University)
University Examinations for Semester II July 2014

DEPARTMENT OF MATHEMATICS AND STATISTICS
DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

Examination for Diploma in Civil Engineering (Module III) and

Mathematics III and Surveying III

Date: 2014/07/21   Time: 3 Hours (08:30-11:30)

Instructions:

   a. *You require the following for this examination*
      - *Answer booklet*
      - *Scientific calculator*
   b. *Fill in all personal details as required on the answer booklet provided*
   c. *This paper has two sections A and B. Answer a total of **Five** questions choosing at least **Two** questions from each section. The fifth question can be chosen from either section, all the questions carry equal marks.*

SECTION A: MATHEMATICS III

Answer at least two questions from this section

1.a) Distinguish between the following terms as used in Statistics and Probability:

   (i)   Compound and Disjoint events
   (ii)   Independent and Mutually exclusive events

 b) Maina goes for a malaria test that is known to be 90% accurate after her single mosquito bite but it is also known to give false-positive results at 50% of the time. If the probability of transmitting sporozoites for any single bite by infected Anopheles mosquito is approximately 15%. What is the probability that Maina has malaria given his results turned to be positive?

c) The probability that a contractor will get a plumbing contract is 2/3 and the probability that he will not get the electric contract is 5/9.If the probability of getting at least one contract is 4/5, what is the probability that he will get both?   **(20 Marks)**

2. (a) Three machines are designed to process same product but at different rates. The first machine, B_1, process 40 per cent, the second machine, B_2, processes 35 per cent and the third machine, B_3, processes 25 per cent of the products. The first machine has a defective rate of 0.04, the second has a defective rate of 0.06 and the third has a defective rate of 0.03. A product selected at random from a day's output was found to be defective. What is the probability that the product was processed by the first, second, or third machine, respectively.

(b) A bag contains 8 red and 5 white balls. The successive drawings of 3 balls are made such that
(i) balls are replaced before the second trial.

(ii) The balls are not replaced before the second trial.

Find the probability that the first drawing will give 3 white and the second 3 red balls in each case.

(c) Given

$U= \left\{ \frac{x}{x} \, is \; positive \; integer \right\}$

$A = \{1,3,5\}$

$B = \{3,4,5,6\}$ Determine (i) AUB   (ii) B-A   **(20 Marks)**

3.(a) A candidate is selected for interview of construction trainees for 3 companies. For the first company there are 12 candidates, for the second there are 15 candidates and for the third, there are 10 candidates. What are the chances of him getting a job at least in one of the company?

(b) Two computers A and B are to be marketed. A salesman who is assigned the job of finding customers for them has 60% and 40% chances respectively of succeeding in case of computer A and B. The computers can be sold independently. Given that he was able to sell at least one computer, what is the probability that computer A has been sold?

(c) Jane's chance of passing a statistics exam is 0.9 if a question on regression appears, otherwise her chance of passing is 0.7. If there is a 0.6 chance that, the question appears. What is the probability that she passes the exam?   **(20 Marks)**

4. (a) Use the forward Gregory-Newton interpolation formula with the table below to compute

   i.   f(-3.7)
  ii.   f(6.5)

$$x:\quad -4\ -2\ \ 0\ \ 2\ \ 4\ \ 6\ \ 8$$
$$f(x):-44\ \ 6\ \ 8\ 10\ 60\ 206\ 496 \hspace{4cm} \text{(10 Marks)}$$

(b) Given that the given approximation of root of the equation $x^3 + 2x^2 - 5x = 1$ is x_0 apply Newton- Raphson method to show that a better approximation is

$$4_{n+1} = \frac{2x^3+2x^2+1}{3x^2+4x-5}$$

Hence calculate the root of the equation starting $4_0 = 1.4$ correct to 2dp   (10 Marks)

SECTION B – SURVEYING III

*This section consists of **four** questions. Answer at least **two** questions from this section.*

5.   a) Define the following terms

      i) A prismoid
      ii) Prismoidal correction   (5 marks)

   b) Five cross-sectional areas A_1, A_2, A_3, A_4 and A_5 were taken at right angles to a longitudinal embankment formation and the interval between successive cross-sections 'd' was kept constant. Derive;
      i)   The prismoidal formula for calculating the volume of fill between cross-sectional areas A_1 and A_5
      ii)   The formula for the prismoidal excess   (15 marks)

6.   a) Explain the process of setting out as applied to in surveying   (6 marks)

   b) A section of a sewer 60m long is to be laid between two manholes A and B. the invert of manhole A is 30.02m. The gradient between A and B is to be 1:100 falling from A to B. if a 3.75m traveler is available and the ground levels at A and B are 32.90m and 31.95m respectively. Calculate;

      i)   Reduced level of sight rail at A
      ii)   Invert reduced level at B
      iii)   Reduced level of sight rail at B
      iv)   The staff readings necessary to fix positions of sight rails at A and B if a reduced level setup nearby has a height of collimation of 34.845m.
      v)   Depths of excavation at A and B   (14 marks)

7   a) Define the following terms as used in Mass Haul Diagrams.

   i)   Haul
   ii)   Free haul distance
   iii)   Over haul volume
   iv)   Overhaul   (4 marks)

   b) The formation width of two cross-sections of a road 50m apart is 10m, and the side slope for
      cutting is 1:1 and for filling is 2:1. The transverse slope of the ground is 1 in 5. The depths of
       excavations at the centerline of the two cross-sections are 0.50m and 0.70m respectively. Find the
       volume of cutting and filling using the average end areas formula.
       Apply prismoidal corrections for the computed areas   (16 marks)

8   a) The areas between the consecutive contours measured with the help of a plannimeter were recorded

       as follows;

Contour (m)	Area (m^2)
200	3850
195	3450
190	2600
185	800
180	450

   Estimate the capacity of the reservoir taking datum level at 180m using;
   i)   Prismoidal formula
   ii)   Trapezoidal formula   (6 marks)

   b) An embankment is made on a ground having a transverse slope of 1 in 10. The width of the bank at
      the formation level is 10m. The side slope of the embankment is 2:1. The heights of the bank of the
      centre-line of the formation level are 3m, 3.5m, and 4m at three consecutive sections spaced at15m
       apart. Find;

   i)   The side widths
   ii)   The cross-sectional areas
   iii)   The volume of earthwork assuming the centerline to be straight using the prismoidal rule
                                                                                    (14 marks)