MACHAKOS UNIVERSITY

University Examinations for 2021/2022 Academic Year

DIRECTORATE OF TVET

FIRST YEAR SECOND TERM EXAMINATION FOR

DIPLOMA IN MECHANICAL ENGINEERING (PRODUCTION OPTION)

DIPLOMA IN MECHANICAL ENGINEERING (PLANT OPTION)

DIPLOMA IN AUTOMOTIVE ENGINEERING

MATHEMATICS 11

DATE: 22/7/2022 **TIME: 8.30-11.30 AM**

INSTRUCTIONS

You should have the following for this examination:

Mathematical tables/ Non programmable scientific calculator

Answer any five questions in the answer booklet provided.

All questions carry equal marks.

1. a) A continuous random variable has a probability density function given by;

$$f(t)=\begin{cases}\frac{k^2}{3}e^{-kt} & ,t>0\\ 0 & ,elsewhere\end{cases}$$ where k is a positive constant.

Determine the;

i. value of k

ii. mean

iii. variance

iv. median (14 marks)

b) In a binomial experiment of 11 trials, the variance was found to be 1.76. If the probability of success in the experiment does not exceed 30%, determine the probability of obtaining atleast 2 successes. (6 marks)

2. a) Given that $(t-2),(2t-6)$ *and* $(4t-8)$ form the first three terms of an arithmetic progression, determine the;

i. value of t

ii. sum of the first twenty terms. (7 marks)

b) The sum of the consecutive numbers of an arithmetic progression is 9 and their product is 20.25. Determine the three consecutive numbers. (7 marks)

c) A woman deposited Sh 4,000 in a savings scheme in the first month. Thereafter she increased her deposits by Sh 400 per month for fifty months. Determine;

i. last amount deposited.

ii. Total amount saved in the fifty months. (6 marks)

3. a) Given that $y = x\ln x$,determine $\frac{dy}{dx}$ (4 marks)

b) Given the function $y = x^2e^{2x}$ determine the;

i. equation of the tangent at the point where x=2

ii. Stationary points and their nature. (16 marks)

4. a) Table 1 below shows the height of students in a class.

Height (cm)	10-14	15-19	20-24	25-29	30-34	35-39	40-44
frequency	10	22	40	56	44	18	10

Using an assumed mean of 27cm, calculate the;

i. mode

ii. median

iii. standard deviation (10 marks)

b) A production line produces 6% defective components. For a random sample of 10 Components, determine the probability that there is;

i. 2 defective components

ii. More than 3 defective components. (7 marks)

c) The number of accidents per day in a factory follows the Poisson distribution with a mean of 2. Find the probability that on a particular date, at least two accidents will occur. (3 marks)

5. a) Find $\frac{dy}{dx}$ from the first principle, given that $y = \frac{x}{x+4}$ (5 marks)

b) The lifetime of a light bulb is normally distributed with a mean of 1500 hours and a standard deviation of 40 hours. In a batch of 1200 bulbs, determine the number of bulbs likely to;

i. fail before 1400 hours

ii. last for more than 1550 hours

iii. last between 1465 hours and 1575 hours. (10 marks)

c) A trader deposit Sh 2,000,000 at a compound interest rate of 5% per annum. Determine the minimum number of years to be taken for the amount to accumulate to at least twice the initial amount. (5 marks)

6. a) Evaluate $\int_0^1 xe^{5x}dx$ (6 marks)

b) Two functions are given by $y^2 = 16x$ and $y = \frac{x^2}{9}$;

i. Sketch the graph to show the area enclosed between the curves.

ii. Determine the coordinates of the centroid of the area. (14 marks)

7. a) The table below shows marks scored by 94 students in a mathematical test. If the modal mark is 54, determine x and y (8 marks)

Marks	No. of students
0-20	10
20-40	X
40-60	30
60-80	Y
80-100	14

b) The diameters in millimeters of 40 bearings were determined with the following results;

16.6 15.3 16.3 14.2 16.7 17.3 18.2 15.6 14.9 14.7

17.2 8.7 16.4 19.0 15.8 18.4 15.1 17.0 19.2 16.2

18.9 18.3 15.9 13.6 18.3 17.2 18.0 15.8 17.3 17.4

16.8 17.7 16.8 17.9 17.3 16.6 15.3 16.4 16.9 15.6

Group the data in to a frequency distribution using classes 13.5-14.4, 14.5-15.4……hence

Determine the standard deviation (12 marks)