



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND YEAR FIRST SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

DIPLOMA IN BUILDING AND CIVIL ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

SPECIAL EXAMINATION

CALCULUS II/MATHEMATICS IV

DATE: 30/5/2017

TIME:8:30 – 10:30 AM

INSTRUCTION TO CANDIDATES:

Answer Questions One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Evaluate the integrals

i) $\int \frac{(2+x)^2}{\sqrt{x}} dx$ (6 marks)

ii) $\int \cos 6x \cos 4x dx$ (4 marks)

b) Determine $I = \int (8x^3 + 3x^2 - 6x + 7)dx$ given that $x = 2$ when $I = 50$

(6 marks)

c) i) $\int \sin (6x + 5) dx$

(4 marks)

ii) $\int \frac{4x^2 - 9x - 19}{2x^2 - 7x - 4} dx$ (5 marks)

iii) $\int \frac{1}{1+x^2} dx$ (5 marks)

QUESTION TWO (20 MARKS)

Evaluate the definite integrals

i) $\int_0^2 \frac{x-1}{(x+2)^2} dx$ (5 marks)

ii) $\int_1^2 xe^x dx$ (5 marks)

iii) $\int_0^\pi x^2 \sin x dx$ (5 marks)

iv) $\int_0^3 3x\sqrt{(3x^2 + 9)} dx$ (5 marks)

QUESTION THREE (20 MARKS)

a) Use the reduction formulae to determine

$$I = \int x^n e^{2x} dx \text{ hence evaluate } \int x^3 e^{2x} dx \quad (10 \text{ marks})$$

b) Use integration by parts to evaluate $\int x^3 \cos x^2 dx$ (5 marks)

c) Evaluate $\int \frac{x-8}{x^2-x-2} dx$ (5 marks)

QUESTION FOUR (20 MARKS)

a) If $x = 3e^{2x}$ $y = 3e^{-x}$ find the area under the curve between

$$x = 1 \quad y = 2 \quad (5 \text{ marks})$$

b) Calculate the RMS value of $I = 20 + 100\sin 100\pi t$ between

$$t = 0 \text{ and } t = \frac{1}{50} \quad (5 \text{ marks})$$

c) If $i = I\sin\omega t$ and $v = i \frac{di}{dt} + Ri$ find the mean value of the product vi between $t =$

$$0 \text{ and } t = \frac{2\pi}{\omega} \quad (5 \text{ marks})$$

d) Find the area generated when the curve $x = a(\theta - \sin \theta)$

$$y = a(1 - \cos\theta) \text{ between } \theta = 0 \quad \theta = \pi \text{ is rotated about the x-axis through a complete revolution.} \quad (5 \text{ marks})$$

QUESTION FIVE (20 MARKS)

Evaluate the integrals

i) $\int_0^{\pi/2} 3t \cos 2t \, dx$ (5 marks)

ii) $\int_1^2 \frac{2e^t}{3+e^t} \, dx$ (5 marks)

iii) $I = \int (4e^{2x+4} + \frac{3}{4x}) \, dx$ (5 marks)

iv) $\int x \cos 3x \, dx$ (5 marks)