



UNIVERSITY OF NAIROBI
SECOND SEMESTER EXAMINATIONS 2013/2014

FIRST YEAR EXAMINATIONS FOR THE DEGREES OF BACHELOR OF SCIENCE
IN ENGINEERING

FEE 122 : ELECTRICAL AND ELECTRONIC ENGINEERING
FME 172 : MECHANICAL ENGINEERING

PURE MATHEMATICS B

DATE: AUGUST 7, 2014

TIME: 9,00 A.M. – 11.00 A.M.

Instructions: Answer question ONE compulsory and any other TWO.

QUESTION ONE (30 MARKS)

a) Find the volume generated when the area bounded by the curves $y = 2x - x^2$ and $y = 0$ is revolved about the x-axis. [4 marks]

b) Integrate $\int x^2 e^x dx$ by using integration by parts method [5 marks]

c) Evaluate

i. $\int \sin 4x \sin 3x dx$ [4 marks]

ii. $\int \frac{dx}{\sqrt{4-9x^2}}$ [4 marks]

d) Use trapezoidal rule to estimate $\int_0^1 \frac{dx}{1+x^2}$. Take $n = 4$ and give your answer correct to 4 d.p. [4 marks]

e) Find the value of $\int_1^2 \frac{\ln x}{x} dx$ [5 marks]

f) Determine the arc length of the curve $2y = x^2 + 5$ between the points $x=0$ to

$x = \frac{\pi}{4}$ [4marks]

QUESTION TWO (20 MARKS)

(a) Show that

i) $\int_0^{\frac{\pi}{6}} \frac{1}{1-\sqrt{3}\tan x} dx = 1 + \sqrt{3}$ [4 Marks]

ii) $\int \sin^{-2} x dx = \ln \left| \tan \frac{x}{2} \right| + C$ [8 Marks]

(b) Find the area of the surface generated by revolving about the

y axis the curve $x=y^3$ from $y=0$ to $y=2$ [8 Marks]

QUESTION THREE (20 MARKS)

(a) Find the maxima and minima of $y = x^3 - 3x + 7$. [5 marks]

(b) Evaluate $\int \frac{x^3 - 2x^2 - 4x - 4}{x^2 + x - 2} dx$ [10 marks]

(c) Determine the area enclosed by $y = x^2 + 1$ and $y = 7 - x$. [5 marks]

QUESTION FOUR (20 MARKS)

a) Express the integral $\int_0^1 x^2$ as a limit of a sum and use the result to evaluate the given integral [10 marks]

b) Use Simpson's rule with $n = 10$ to approximate $\int \frac{dx}{x}$ [10 marks]

QUESTION FIVE (20 MARKS)

(a) Determine $\int_0^2 \frac{3x}{\sqrt{2x^2+1}} dx$ [4 marks]

(b) Determine $\int \frac{5}{16+9\theta^2} d\theta$ [5 marks]

(c) Determine the area enclosed by $y = 2x + 3$, the x-axis and the ordinates $x=1$ and $x=4$. [5 marks]

(d) Find the volume of the solid of revolution formed when the curve $y = 2$ is rotated 360° about the x-axis between the limits $x = 0$ and $x = 3$.

[6 marks]

$$\int \frac{1}{\sin x} dx$$

$$\int (\sin x)^{-1} dx = \cos$$