NUI Galway
OÉ Gaillimh

Semester II Examinations 2017-18 (SAMPLE PAPER)

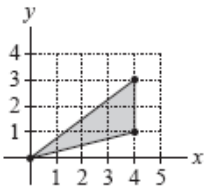
Exam Code(s)	2BCS1, 2BA1, 1OA1, 2BPT1, 2BS1
Exam	Second Year
Module	MATHEMATICAL STUDIES
Module Code	MA212
External Examiner(s)	Prof. T. Brady
Internal Examiner(s)	Prof. G. Ellis
	Dr K. Jennings*
Instructions	Answer all three questions.
Duration	2 hours
No. of Pages	2 pages (including this cover page)
Discipline	Mathematics
Requirements:	
Release to Library:	Yes
Other Materials	Non-programmable calculators & log books

1.

(a) Find the volume of the solid that lies under the hyperbolic paraboloid $z = 3y^2x^2+5$ and above the rectangle $R = [1, 1] \times [1, 2]$. [10 marks]

(b) .

Calculate the double integral of $f(x, y)$ over the triangle indicated in the following figure, where $f(x, y) = 22ye^x$:



[10 marks]

(c) Use a double integral to find the area of one loop of the rose $r = 6\cos(3\theta)$.

[15 marks]

2.

(a) A lamina occupies the region inside the circle $x^2 + y^2 = 14y$ but outside the circle $x^2 + y^2 = 49$. The density at each point is inversely proportional to its distance from the orgin.

Where is the center of mass? [10 marks]

(b) Find the mass of the rectangular box B where B is the box determined by $0 \leq x \leq 4, 0 \leq y \leq 3$, and $0 \leq z \leq 2$, and with density function $\rho(x, y, z) = ze^x + y$.

[10 marks]

(c) A lamina occupies the part of the disc $x^2 + y^2 \leq 16$ in the first quadrant and the density at each point is given by the function $\rho(x, y) = 3(x^2 + y^2)$. Find its total mass and the location of its centre of mass.

[15 marks]

3. Evaluate the following integral:

$$\int_C [\sin(x) + y]\, dx + [\cos(y) - x]\, dy,$$

where C is the boundary of the region below $y = x^2$ up to the point $(2, 4)$ in the first quadrant, oriented anticlockwise,

(a) using Green's theorem,

[15 marks]

(b) without using Green's theorem. [Note that C is made up of the smooth curves C_1: the line segment joining $(0, 0)$ to $(2, 0)$, C_2: the line segment joining $(2, 0)$ to $(2, 4)$ and C_3 the parabolic curve joining $(2, 4)$ to $(0, 0)$.]

[20 marks]