Stage 1 and Stage 2 examinations

ACM

Effective as of December 2016, Stage 1 and Stage 2 ACM final examinations will all adhere to a common format, with one exception[1]. This is on foot of a recommendation by the subject external examiner, who has asked for this particular format. The rationale for the examiner's recommendation is that the exam should

- Cover all learning outcomes of the module.
- Give scope for students to exhibit a depth of understanding of the same.

Accordingly, the standard format for the ACM examinations in Stage 1 and Stage 2 will be as follows:

- Part A – 10 questions, answer all 10 questions.
- Part B – 3 questions, answer 2 questions out of 3.

Each section will carry equal marks. Therefore, assuming (arbitrarily) that the exam is marked out of 100, Part A will count for 50 marks, Part B for 50 marks, with the following further division among the different questions:

- Part A – each question carries 5 marks, for a total of **50 marks**.
- Part B – each of the two questions to be answered carries 25 marks, for a total of **50 marks**.

Note that this marking scheme is indicative, as the exam can be marked out of any positive integer, and the resulting mark can be rescaled appropriately.

No other changes will be made to the exam format. Note that this is **not** a change in the assessment strategy. Therefore, the weighting given to the final exam and to the continuous assessment **will not change** relative to what is stated in the module descriptor.

Lecturers will give further advice pertinent to their own module in a manner deemed appropriate by them. Some lecturers may provide a sample exam paper, but this is at their discretion. A sample of the new exam format is included in the remainder of this document.

[1] ACM 20030, in view of the practical aspects involved in the assessment strategy

University College Dublin
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SEMESTER I EXAMINATION 2016/2017

ACM 20000

Applied Codology Theory

Professor G. McGuire

Dr Iam. A Phibber *

Time Allowed: 2 hours

Instructions for Candidates

Answer **all** questions from **Section A**
Answer **two** questions from **Section B**
Section A and Section B carry equal marks

Note for Invigilators

Non-programmable calculators are permitted

Section A – *Answer all questions in this section. Each question in this section carries equal marks.*

1. Short question here.

2. Short question here.

3. Short question here.

4. Short question here.

5. Short question here.

6. Short question here.

7. Short question here.

8. Short question here.

9. Short question here.

10. Short question here.

Section B – *Answer two questions in this section. Each question in this section carries equal marks.*

11. Long question here

- Possibly with multiple parts.
- Very similar to the long questions from previous years' exams.

12. Long question here

13. Long question here

- Sans Serif Font for the main text, to enhance legibility, with standard Latex font in the equation environments, like this:

$$\int x^2 \, \mathrm{d}x = \tfrac{1}{3}x^3 + C$$

- **Or** use the kurier package to render both text and maths in sans serif font

Formulæ in the Differential and Integral Calculus

Derivatives

y	$\mathrm{d}y/\mathrm{d}x$	y	$\mathrm{d}y/\mathrm{d}x$	y	$\mathrm{d}y/\mathrm{d}x$
x^n	nx^{n-1}	$\sec x$	$\tan x\ \sec x$ $= \sin x/\cos^2 x$	$\sec^{-1}\frac{x}{a}$	$\frac{a}{x\sqrt{x^2-a^2}}$
$\sin x$	$\cos x$	$\sin^{-1}\frac{x}{a}$	$\frac{1}{\sqrt{a^2-x^2}}$	e^x	e^x
$\cos x$	$-\sin x$	$\cos^{-1}\frac{x}{a}$	$-\frac{1}{\sqrt{a^2-x^2}}$	e^{ax}	ae^{ax}
$\tan x$	$\sec^2 x$	$\tan^{-1}\frac{x}{a}$	$\frac{a}{a^2+x^2}$	a^x	$a^x \ln a$
$\cot x$	$-\csc^2 x$	$\cot^{-1}\frac{x}{a}$	$-\frac{a}{a^2+x^2}$	$\ln x$	$\frac{1}{x}$
$\csc x$	$-\cot x\ \csc x$ $= -\cos x/\sin^2 x$	$\csc^{-1}\frac{x}{a}$	$-\frac{a}{x\sqrt{x^2-a^2}}$		

Integrals

y	$\int y\mathrm{d}x$	y	$\int y\mathrm{d}x$	y	$\int y\mathrm{d}x$
x^n	$\frac{x^{n+1}}{n+1}\ n\neq -1$	$\cot x\ \csc x$	$-\csc x$	$\frac{1}{x}$	$\ln x$
$\sin x$	$-\cos x$	$\frac{1}{\sqrt{a^2-x^2}}$	$\sin^{-1}\frac{x}{a}$ or $-\cos^{-1}\frac{x}{a}$	$\sinh x$	$\cosh x$
$\cos x$	$\sin x$	$\frac{a}{a^2+x^2}$	$\tan^{-1}\frac{x}{a}$ or $-\cot^{-1}\frac{x}{a}$	$\mathrm{sech}^2 x$	$\tanh x$
$\sec^2 x$	$\tan x$	$\frac{a}{x\sqrt{x^2-a^2}}$	$\sec^{-1}\frac{x}{a}$ or $-\csc^{-1}\frac{x}{a}$	$\frac{1}{\sqrt{x^2+a^2}}$	$\sinh^{-1}\frac{x}{a}$ $= \ln\frac{x+\sqrt{x^2+a^2}}{a}$
$\csc^2 x$	$-\cot x$	e^{ax}	$\frac{e^{ax}}{a}$	$\frac{1}{\sqrt{x^2-a^2}}$	$\cosh^{-1}\frac{x}{a}$ $= \ln\frac{x+\sqrt{x^2-a^2}}{a}$
$\tan\ x\ \sec x$	$\sec x$	a^x	$\frac{a^x}{\ln a}$	$\frac{1}{a^2-x^2}$	$\frac{1}{a}\tanh^{-1}\frac{x}{a}$ $= \frac{1}{2a}\ln\frac{a+x}{a-x}$

Other Formulæ

Derivative of Product: $y = uv, \quad \frac{\mathrm{d}y}{\mathrm{d}x} = v\frac{\mathrm{d}u}{\mathrm{d}x} + u\frac{\mathrm{d}v}{\mathrm{d}x}$.
Derivative of Quotient: $y = u/v, \quad \frac{\mathrm{d}y}{\mathrm{d}x} = \left(v\frac{\mathrm{d}u}{\mathrm{d}x} - u\frac{\mathrm{d}v}{\mathrm{d}x}\right)/v^2$.
Integration by Parts: $\int u\mathrm{d}v = uv - \int v\mathrm{d}u$.
Binomial Theorem: $(1 \pm x)^n = 1 \pm nx + \frac{n(n-1)}{1\cdot 2}x^2 \pm \frac{n(n-1)(n-2)}{1\cdot 2\cdot 3}x^3 + \ldots$
Maclaurin's Theorem: $f(x) = f(0) + xf'(0) + \frac{x^2}{1\cdot 2}f''(0) + \ldots$
Taylor's Theorem: $f(x+h) = f(x) + hf'(x) + \frac{h^2}{1\cdot 2}f''(x) + \ldots$

Moments of Inertia

Body of Mass M	**Position of Axis**	**Moment of Inertia**
Uniform thin rod of length $2a$	Through middle perpendicular to length	$\frac{1}{3}Ma^2$
Rectangular lamina of sides $2a$ and $2b$	Through centre of mass, parallel to side $2b$	$\frac{1}{3}Ma^2$
Rectangular solid of sides $2a$, $2b$ and $2c$	Through centre of mass, perpendicular to face ab	$\frac{1}{3}M(a^2+b^2)$
Circular lamina of radius R	Though centre, perpendicular to plane	$\frac{1}{2}MR^2$
Right cylinder of radius R and height h	Axis of cylinder Though centre, perpendicular to axis of cylinder	$\frac{1}{2}MR^2$ $M\left(\frac{1}{12}h^2 + \frac{1}{4}R^2\right)$
Sphere of radius R	Any diameter	$\frac{2}{5}MR^2$

Parallel axis theorem: $I = I_{\mathrm{CM}} + Md^2$, where I is the body's moment of inertia about an axis, I_{CM} is the moment of inertia about a parallel axis going through the body's centre of mass and d is the perpendicular distance between the two axes.

Perpendicular axis theorem: $I_z = I_x + I_y$, where the laminar body lies in the xy-plane, and I_x, I_y and I_z are the body's moments of inertia about, respectively, the x-, y- and z-axes.

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