THE UNIVERSITY *of* EDINBURGH
School of Engineering

CODE12345 Course Title — Month Year (Diet)

This exam paper consists of THREE sections
Candidates should attempt ALL FIVE questions

Candidates should answer exam sections in separate books
A formula sheet is included at the end of the paper

Notes for the ETO

This is a temporary cover page, please replace it
This exam is 95 marks in total and has FIVE questions
Candidates should attempt ALL FIVE questions
This is a CLOSED-book exam
Use of calculators approved by the College of Science and Engineering is permitted

SoE Exam Template, version 1.1, 20-Feb-2020

SECTION A

Question A1

One of these things is not like the others; one of these things is not the same. Which one is different? **(5)**

- ◯ John
- ◯ Paul
- ◯ George
- ◯ Ringo
- ◯ Socrates

Question A2

And this is a completely new multiple choice questions. Which of these options is Red? **(5)**

- ◯ Blue
- ◯ Redish
- ◯ Yellow
- ◯ White
- ◯ Red

Question A3

And this is a completely new multiple choice questions. Which of these options is longer? **(5)**

- ◯ Some long text can go here
- ◯ Red
- ◯ And the text here can be even longer if you want, you can even add equations such as $F = ma$.
- ◯ White
- ◯ Blue

SECTION B

Question B1

Write the main text for the question here. This is an example of an inline equation: $F = ma$, where F is the force, or $E = \frac{1}{2}mv^2$. For SI units use: the force is $F = 1.0$ N or $F = 2.0\,\mathrm{N}$ and the velocity is $v = 3.4\,\mathrm{m/s}$. To add a table to the questions use:

Table B1: This is the caption for this table.

Item		
Property	Value	Units
Force	1.0	N
Acceleration	3.4	$\mathrm{m/s^2}$
Temperature	−250	K
Energy	200	J
Potatoes	Frozen	Count

With this version of the exam paper template it is also possible to add chemical symbols such as H_2O or displayed chemical symbols or reactions, such as

$$x\,\mathrm{Na(NH_4)HPO_4} \xrightarrow{\Delta} (\mathrm{NaPO_3})_x + x\,\mathrm{NH_3}\uparrow + x\,\mathrm{H_2O}$$

(a) This is the text of a part of a question, with a reference to figure B1 below ...

i) This is a subpart of a question **(7)**

ii) And this is another subpart of a question, another subpart of a question. And this is another subpart of a question. And this is another subpart of a question. And this is another subpart of a question. **(3)**

(b) This is the text of a part of a question ... **(5)**

(c) This is the text of a part of a question ... **(5)**

Figure B1: This is the caption for this question.

Question B2

Write the main text for the question here ...

(a) This is the text of a part of a question ... **(3)**

(b) This is the text of a part of a question ... **(5)**

(c) This is the text of a part of a question ... **(7)**

(d) This is the text of a part of a question ... **(5)**

Figure B2: This is the caption for this question.

SECTION C

Question C1

Write the main text for the question here ...

(a) This is the text of a part of a question ... **(3)**

(b) This is the text of a part of a question ... **(5)**

(c) This is the text of a part of a question ... **(7)**

(d) This is the text of a part of a question ... **(5)**

Question C2

Write the main text for the question here ...

(a) This is the text of a part of a question ... **(3)**

(b) This is the text of a part of a question ... **(5)**

(c) This is the text of a part of a question ... **(7)**

(d) This is the text of a part of a question ... **(5)**

Figure C2: This is the caption for this question.

END OF EXAM

Formula Sheet

Course Title (CODE12345)

Month Year (Diet)

Title of group of formulas

$$\frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{\partial T}{\partial \dot{q}_i}\right) - \frac{\partial T}{\partial q_i} + \frac{\partial V}{\partial q_i} = Q_i$$

$$T = \frac{1}{2} m \dot{x}^2$$

$$T = \frac{1}{2} I \dot{\varphi}^2$$

$$V_\mathrm{e} = \frac{1}{2} k \Delta x^2$$

$$V_\mathrm{e} = \frac{1}{2} k_\mathrm{t} \Delta \alpha^2, \qquad k_\mathrm{t} = \frac{G \pi d^4}{32 L}$$

$$V_\mathrm{g} = mgh$$

$$\delta W_i = Q_i \delta q_i$$

Analytical dynamics

$$\frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{\partial T}{\partial \dot{q}_i}\right) - \frac{\partial T}{\partial q_i} + \frac{\partial V}{\partial q_i} = Q_i$$

$$T = \frac{\rho A}{2} \int_0^L \left(\frac{\partial w}{\partial t}\right)^2 \mathrm{d}x$$

$$V_\mathrm{e} = \frac{EI}{2} \int_0^L \left(\frac{\partial^2 w}{\partial x^2}\right)^2 \mathrm{d}x$$

$$V_\mathrm{g} = \rho A g \int_0^L w(x,t) \mathrm{d}x$$

$$Q_i = \varphi_i(b) F$$

$$Q_i(t) = \int_0^L \varphi_i(x) f(x,t) \mathrm{d}x$$

Longitudinal waves

$$\frac{\partial^2 \Phi}{\partial t^2} = c^2 \left(\frac{\partial^2 \Phi}{\partial x^2}\right)$$

$$\frac{\partial^2 u}{\partial t^2} = \frac{E}{\rho} \left(\frac{\partial^2 u}{\partial x^2}\right)$$

$$\frac{\partial^2 w}{\partial t^2} = \frac{T}{\mu} \left(\frac{\partial^2 w}{\partial x^2}\right)$$

$$\frac{\partial^2 \theta}{\partial t^2} = \frac{G}{\rho} \left(\frac{\partial^2 \theta}{\partial x^2}\right)$$

$$u(x,t) = f(x) g(t)$$

Transverse waves

$$\frac{\partial^2 w}{\partial t^2} + \frac{\partial^2}{\partial x^2}\left(\frac{EI}{\rho A}\frac{\partial^2 w}{\partial x^2}\right) = 0$$

$$\rho A \frac{\partial^2 w}{\partial t^2} + EI \frac{\partial^4 w}{\partial x^4} = 0$$

$$w(x,t) = B \sin\left[\frac{2\pi}{\lambda}(x - ct)\right]$$

$$w(x,t) = \phi(x) \cos(\omega t)$$

$$\frac{\partial^4 \phi(x)}{\partial x^4} - k^4 \phi(x) = 0$$

$$\omega = \frac{2\pi c}{\lambda}, \qquad f = \frac{c}{\lambda}$$

$$k^4 = \frac{\rho A \omega^2}{EI}, \qquad k = \frac{\omega}{c}$$

Chemical reactions

$$x\,\mathrm{Na(NH_4)HPO_4} \xrightarrow{\Delta} (\mathrm{NaPO_3})_x + x\,\mathrm{NH_3}\uparrow + x\,\mathrm{H_2O}$$

$$\mathrm{SO_4^{2-}} + \mathrm{Ba^{2+}} \longrightarrow \mathrm{BaSO_4}\downarrow$$

Tables and data

Item		
Property	Value	Units
Force	1.0	N
Acceleration	3.4	$\mathrm{m/s^2}$
Temperature	−250	K
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