Mechanical Engineering Principles – Second edition

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The authors describe this BTech/National text as student friendly, which is teacher-speak for supplying 320 fully worked examples and almost 900 other problems all with answers given and a minimal of text to read.

First published by Elsevier in 2002 the text now covers 1) Revision of Mathematics; 2) Statics and Strength of Materials; 3) Dynamics; 4) Heat Transfer and Fluid Mechanics. Every Chapter begins with a mission statement which tells students what to expect and what is expected of them.'

The first question posed (inside front cover) is: 'Why are competent engineers so vital?' a question which (in the reviewer's opinion) the authors answer with a meanness of spirit and disrespect for other professions. The whole page needs to be rethought, rephrased and rewritten.

Part One – Chapter 1 'Revision of Mathematics' starts by defining the Radian and ends with a simultaneous equation: there being a mix of trivia and the essential in between.

Part Two 'Statics and Strength of Materials' begins, not with statics, but with the statement:

'A good knowledge of some of the constants used in the study of the properties of materials is vital'.

Then, in section 2.1

'The unit of force is the Newton, N'

The Stroud convention is used without comment. The SI system of units is not mentioned; nor is the importance of using a coherent dimensional system discussed. Chapter 2 (the first) is thus all about Stress and Strain, with support from Chapter 3 on Tensile Testing where yield point, ultimate strength and modulus are explained.

The mathematical basis of Equilibrium (traditional statics) is not discussed in 'Forces Acting at a Point' – Chapter 4 – but the graphical resolution of forces is covered rather well. But then, instead of moving logically on to determine member forces in pin-jointed trusses, Chapter 5 on 'Simply Supported Beams' pops up before 'Forces in Structures' – Chapter 6 – are determined by graphical and analytical methods.

The action of shear forces and bending moments is made clear in Chapter 7 and well supported by calculations relating to first and second moments of area in Chapter 8. The Engineers Theory of Bending is developed in Chapter 9, torque in Chapter 10 and the Engineers Theory of Torsion in Chapter 11.

Part Three 'Dynamics' begins at Chapter 12 where, for some odd reason, Radian Measure is in pole position followed by an alternating and confusing mix of linear/angular developments. NB: Most lecturers of the old school would have taught linear motion first, followed by angular motion before blending the two together. Table 12.1 separates the two and presents Linear and Angular equations in rational order, albeit eight of the 17 equations quoted are without units.

Chapter 13 'Linear Momentum and Impulse' covers Newton's First Law of Motion. Linear velocities and forces are calculated but displacements which deform the impacted body are not. Chapter 14 'Force, Mass and Acceleration' introduces Newton's Second Law of Motion and includes a 'red herring' (reiterated from Section 2.1) likely to wrong foot the reader a second time. Motion not change in shape is here the operative word and the two should not be signposted as equals. Newton's Third Law is also poorly explained.

'Work, Energy and Power' – Chapter 15 – covers conservation of energy and efficiency. Chapter 16 'Friction' contains much about forces and motion up and down an incline plane – before the author gets carried away calculating the efficiency of a screw jack (using Maths far beyond Part One) and three chapters before the most basic of machines have been considered. The difference between centripetal and centrifugal accelerations and forces is explained by way of rail tracks and wagons in Chapter 17. '*Simple Harmonic Motion*' – Chapter 18 – covers Spring-Mass-Systems including Torsional Vibration, introduced too early.

The most basic machines are glossed over in Chapter 19 '*Simple Machines*', where force ratio and movement ratio doubles for the time honoured terms mechanical advantage and velocity ratio. The law to simple machines and the concept of limiting efficiency is developed mathematically, without the aid of a diagram when the authors should know that the concept of limiting efficiency is not self-evident at this level of study.

The examples of simple machines discussed may be those specified in the syllabus, but so basic they are unlikely to inspire students who, the authors hope, are destined to design and 'build tall buildings and long bridges that may last for a thousand years or more' (See inside front cover).

Part Four '*Heat Transfer and Fluid Mechanics*' comprises six chapters of commendable quality. '*Heat Energy and Transfer*' – Chapter 20 – covers: change of state, latent heat of fusion, vaporisation, conduction, convection and radiation. Linear, superficial and cubic thermal expansion coefficients are explained in Chapter 21, while Chapter 22 '*Hydrostatics*' provides a clear understanding of pressure and its measurement, the high point being a method used to determine the pressure on submerged surfaces with calculations given.

Chapter 23 '*Fluid Flow*' covers instrumentation and measurement techniques, from the simple orifice plate to an electromagnetic device used for conductive fluids to the hot wire anemometer used for gases. The continuity equation and 'Bernoulli' are of course included. In contrast to the above Chapter 24 '*Ideal Gas Laws*' is almost entirely algebraic/numerical problem solving and Chapter 25 covers industrial methods of measuring temperature.

Although the authors deserve full credit for collating so many wide-ranging fully worked examples in a single volume, much of the supporting text is poorly organised and in places poorly expressed. However, given the first named author's close ties with BTech and Baccalaureate examination boards, the book is sure to appeal to colleges and lecturers who 'teach to the test' and to students desperate to get their hands on ready-made answers before sitting their exams.

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Understanding Aerodynamics: Arguing from the Real Physics

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Doug McLean is a Technical Fellow (retired), Boeing Commercial Airplanes and his distinguished career with that company equips him well to write a book such as this, an endeavour in which he succeeds admirably.