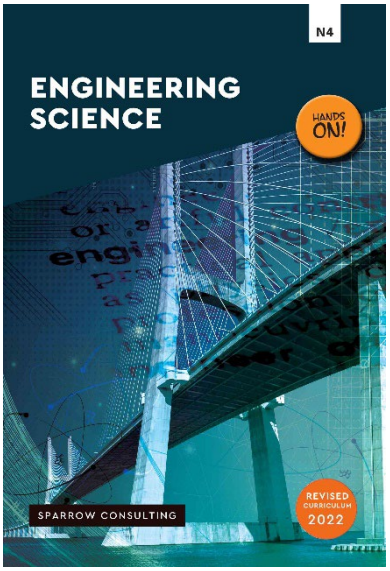
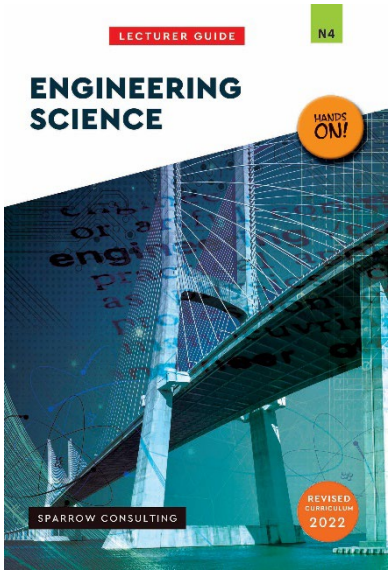
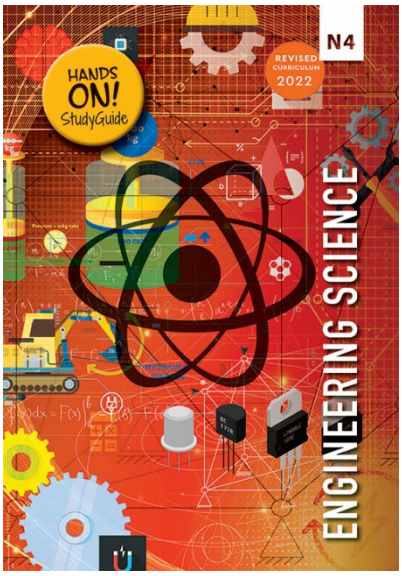
N4 Engineering Science syllabus comparison

As you're aware, the N4 Engineering Science syllabus was revised. We have compared the old with new and have outlined any changes in this document.







The module subjects and order stays *exactly* the same as indicated below:

MODULES	WEIGHTING	OLD WEIGHTING
1. Kinematics	15	15
2. Angular motion	12	9
3. Dynamics	14	12
4. Statics	15	15
5. Hydraulics	15	20
6. Stress, strain and Young's modulus	14	14
7. Heat	15	15
TOTAL	**100**	**100**

What has changed slightly, however, are the weightings per module, and the new weightings are indicated in the first orange column in the table above.

For the most part, the module weightings have changed only slightly. The result is that all seven modules have a more equal degree of importance in the revised syllabus.

Work schedule

Below is a suggested trimester work schedule for getting through the learning material of this syllabus, week by week.

Week	Topic	Content	Hours
1–2	**Module 1** Kinematics	1.1 Relative velocity 1.2 Resulting velocity 1.3 Projectiles	15 hours
3–4	**Module 2** Angular motion	2.1 Angular displacement 2.2 Angular velocity 2.3 Angular acceleration 2.4 Relationship between linear and angular quantities 2.5 Torque, work done and power	12 hours
5–6	**Module 3** Dynamics	3.1 Newton's three laws of motion 3.2 Kinetic and potential energy 3.3 Conservation of energy	14 hours
6–7	**Module 4** Statics	4.1 Simply supported beams and cantilevers with point loads and uniformly distributed loads 4.2 Centroids of laminae 4.3 Centre of gravity of solid shapes	15 hours
8–9	**Module 5** Hydraulics	5.1 Hydraulic presses 5.2 Hydraulic pumps 5.3 Hydraulic accumulators	15 hours
9–10	**Module 6** Stress, strain and Young'smodulus	6.1 Stress types 6.2 Young's modulus	14 hours
11–12	**Module 7** Heat	7.1 Volumetric change in solids 7.2 Volumetric change in liquids 7.3 Volumetric change in gases 7.4 Gas processes	15 hours
TOTAL			**100 hours**

The information which follows is a module-by-module breakdown and description of the syllabus changes.

Module 1: Kinematics

By the end of this module, students should be able to:

Relative velocity

• solve problems dealing with linear motion analytically;

• determine the relative velocity, shortest distance, time intersections, overtaking and actual velocity;

Resultant velocity

• calculate resultant velocity and direction;

Projectiles

• do calculations dealing with projectiles that are launched horizontally from a certain vertical height or launched at an angle from the horizontal landing on the same horizontal plane; and

• calculate the maximum height reached by an object as well as time of flight and range, as well as the velocity of projection, the angle of projection and the height and velocity at any part of the projectile path.

In the new syllabus this module is a lot more detailed and outlines exactly what the lecturers need to focus on.

Module 1 is still concerned with **relative-** and **resultant velocity** as well **projectile motion**.

Module 2: Angular motion

By the end of this module, students should be able to:

Angular displacement

• calculate angular displacement;

Angular velocity

• calculate angular velocity;

Angular acceleration

• calculate angular acceleration;

• calculate linear acceleration and distance moved by an object;

Linear and angular quantities

• understand the relationship between linear and angular quantities;

Torque, work and power

• calculate accelerating and decelerating torque if the mass of inertia of an

object is given; and

• calculate work done.

In the new syllabus, Module 2 hasn't changed too much in terms of the learning outcome areas, which are:

- angular displacement;
- angular velocity;
- angular acceleration;
- linear and angular quantities; and
- torque, work and power.

The revised syllabus has clarified the objectives by creating five submodules, making it clearer to lecturers what students are required to know in the exam.

Module 3: Dynamics

By the end of this module, students should be able to:

Newton's laws of motion

• state Newton's three Laws of Motion;

• apply Newton's second law of motion;

• sketch free body diagrams of vehicles travelling on horizontal or inclined planes while moving at constant speed, accelerating, or decelerating;

• calculate the tractive effort and braking effort required for motion on horizontal and inclined planes with regard to practical problems, including gravitational force, rolling resistance force and inertia force;

• calculate work done over a given distance or during a given time;

• calculate power at a given instant or at a given velocity;

• define the concept of kinetic and potential energy;

Kinetic and potential energy

• calculate kinetic and potential energies and energy loss; and

Conservation of energy

• apply the conservation of energy equation for vehicles travelling on horizontal and inclined planes due to its own weight only (no tractive effort or braking effort applied).

In the new syllabus, Module 3 doesn't change too much, except that the learning outcomes concerning Newton's three laws of motion are provided in greater detail which is beneficial to students and lecturers.

Therefore **Newton's laws of motion**, **kinetic and potential energy** and the **conservation of energy** remain the subsections of Module 3.

Module 4: Statics

By the end of this module, students should be able to:

Beams and cantilevers with loads

• calculate reactions at each support;

• draw a shear force diagram;

• calculate and draw a bending moment diagram;

• calculate the point of inflection;

Centroids of laminae

• calculate centroids of different shapes rectangles, triangles, semicircles and compound shapes made up from these shapes;

Centre of gravity of solid shapes

• calculate the centre of gravity of different shapes like cylinders, cones, spheres and semi-spheres, including compound shapes made up from such shapes.

This module still deals with the loading of beams and centroids, and Module 4's layout remains much the same.

The main change to the section on beams and loads is the inclusion of **cantilevers** when calculating reactions in support structures. The beams and cantilevers section also requires the calculation of the **point of inflection**, an outcome which has been moved from the N5 Strength of Materials and Structures syllabus (Module 5 Loading of beams).

Thereafter the syllabus continues with submodules on the **centroids of laminae** and the **centre of gravity of solid shapes**.

Module 5: Hydraulics

By the end of this module, students should be able to:

Hydraulic presses

• calculate the volume of liquid required per stroke by the press (slip to be

taken into account);

• calculate the diameter of the ram of the process or force exerted by the ram;

• calculate pressure in the liquid to overcome a given load;

• calculate the work done by the press (efficiency to be taken into account);

Hydraulic pumps

• calculate the volume of liquid delivered per stroke for a reciprocating pump (slip to be taken into account;

• calculate the theoretical and actual flow rate of a reciprocating pump;

• calculate the pressure in the liquid and force on the plunger;

• calculate rotational frequency of a pump to deliver a given flow rate of water;

• calculate the time taken to fill or empty a reservoir for a given flow rate;

• calculate power required and efficiency with input power given in the case of single, double and three-cylinder single acting pumps;

Hydraulic accumulators

• name the types of accumulators found in industry;

• state the functions of an accumulator in a hydraulic system;

• determine the volume of liquid delivered by the accumulator per working stroke of the machine it serves or the volume delivered in a given time;

• calculate the diameter of the ram and the load required on the accumulator to keep the pressure required constant during the working stroke;

• calculate the distance travelled by the accumulator ram during the working stroke;

• calculate the transfer of pressure in the liquid between the accumulator and the machine;

• calculate the work done and power with efficiency (slip to be taken into account); and

• draw sketches, which illustrate the working of an accumulator.

Module 5 remains the same and is concerned with calculations concerning hydraulic presses, pumps and accumulators.

Module 6: Stress, strain and Young's modulus

By the end of this module, students should be able to:

Stress types

• name the three main types of stresses (direct, shear and bending);

• calculate direct stresses including determination of cross-sectional areas as well as load or dimensions of a member (the nature of the stresses should be mentioned);

• calculate shear stress including determination of cross-sectional areas as well as load or dimensions of a member;

• calculations on single and double shear should be included;

• calculations on stress, strain and Young's modulus for the material;

Young's modulus

• calculate stress and strain;

• state Hooke's Law and define Young's modulus;

• draw stress and strain graph or force-distance graph. (limited to elastic limit) with clear reference to the direct proportionality between stress and strain; and

• calculate change in length or total change in length for compound rods.

Module 6 is still concerned with **stresses**, **strain** and **Young's modulus**.

The new syllabus goes into more detail with these learning outcomes.

Module 7: Heat

By the end of this module, students should be able to:

Volumetric change in solids

• calculate the volumetric coefficient of expansion given the linear coefficient of expansion;

• calculate the change in volume and final volume due to temperature change;

• calculate the percentage change in volume;

Volumetric change in liquids

• explain the anomaly in the expansion of water;

• calculate the change in volume and final volume;

• calculate the change in the level of the liquid in a container due to temperature change;

• calculate overflow in a container filled with liquid due to temperature change;

Volumetric change in gases

• state the characteristic gas law with relevant formula;

• state Boyle's Law with relevant formula and PV graph;

• state Charles's Law with relevant formula and VT graph;

• state Gay-Lussac's Law with relevant formula and PT graph;

• do calculations on pressure, volume, temperature, mass and gas constant on all four different processes;

Gas processes

• define the three basic gas processes (isochoric, isobaric and isothermal);

• sketch the PV diagrams for isochoric, isobaric and isothermal processes;

• do calculations on work done, change in internal energy and heat flow for all three processes;

• sketch PV diagrams of a maximum of two successive gas processes; and

• do calculations on work done, change in internal energy and heat flow for the two successive processes.

The new syllabus deals with the same concepts of expansion, gas laws and equations, however this is structured a lot better and with greater detail.

In Module 7 the syllabus outcomes are a lot clearer when it comes to outlining learning material such as **volumetric changes in solids, liquids and gases**, as well as **gas processes**.