



ETC International College

Programme Specification: HNC & HND Mechanical Engineering

January 2021

1. Course Details

Awarding Organisation: Pearson Education Ltd

Teaching Institution: ETC International College
Bournemouth, Dorset, UK

Award Titles & Qualification Codes:

Pearson BTEC Level 4 Higher National Certificate in Engineering (Mechanical Engineering) – 603/0450/9

Pearson BTEC Level 5 Higher National Diploma in Engineering (Mechanical Engineering) – 603/0451/0

2. Course Aims & Learning Outcomes

Course Aims:

The programme is intended to;

- Equip individuals with the knowledge, understanding and skills to be successful in employment in the Mechanical engineering or related sectors.
- Enable progression to complete an undergraduate degree or further professional qualification in Mechanical engineering.
- Provide opportunities for specialist study relevant to individual vocations.
- Develop the individual's ability to make an immediate contribution to employment in the Mechanical engineering sector.
- Develop a range of skills and techniques, personal qualities and attributes essential for successful performance in working life.
- Provide opportunities for learners to gain a nationally-recognised vocationally-specific qualification.
- Provide the opportunity for international students to develop general & technical English language skills related to their chosen career.

Professional Benchmarks & Learning Outcomes:

In addition to the specific Learning Outcomes for each unit of study (see Appendix 1), the programme provides opportunities for students to develop and demonstrate the following:

Basic Knowledge & Understanding;

- Knowledge of a range of engineering tools, techniques and processes.
- Analytical methods relevant to Mechanical Engineering, including the application of computers for quantitative analysis, simulation, problem-solving and the manipulation and presentation of engineering information (PLC, CAD / CAM).
- Current regulatory, industry standard & best practices in engineering.
- Scientific principles and application of theory, such as energy transfer systems, mechanical loading, material selection and failure.
- General principles and techniques of design and the characteristics of basic engineering materials and components.

Higher level academic/ intellectual skills including ability to:

- Plan, conduct and report a programme of research.
- Plan and execute safely a series of experiments.
- Use laboratory equipment and software packages to generate, analyse data and solve engineering problems, including the use of commercial software packages.
- Design a system, component or process to meet a need, and evaluate designs to make improvements.
- Be creative in the solution of problems and in the development of designs.
- Integrate and evaluate information and data from a variety of sources.

Higher practical and professional skills including the ability to:

- Design a system, component or process to meet a need.
- Manage engineering and business practices, including project management.
- Integrate and evaluate information and data from a variety of sources.
- Effective problem solving and decision making using appropriate quantitative and qualitative skills including identifying, formulating and solving problems.
- The ability to use ICT and Management Information Systems in a Mechanical engineering setting.

Higher Level transferable skills development including:

- Effective use of communication and information technology for Mechanical related areas.
- Effective self-management in terms of time, planning, resilience, self-starting and individual initiative.
- Effective performance within a team environment including leadership, team building, influencing and project management skills.
- Interpersonal skills, e.g. effective listening, negotiating, persuading and presentation.
- Numeric and quantitative skills including data analysis, interpretation and extrapolation.
- Read and use appropriate literature with a full and critical understanding.
- Think independently and take responsibility for their own learning whilst recognising their preferred learning style(s).

3. Course Structure, Delivery and Assessment

Course Description & Duration:

HNC Certificate:

- 8 modules + English modules (as necessary), spread over 36 teaching weeks (3 terms of 12 weeks)
- Total of 120 credits

HND Diploma:

- 8 modules + English modules (as necessary), spread over 36 teaching weeks (3 terms of 12 weeks)
- Total of 120 credits

(NOTE: In the situation where a student fails to meet the required standard for a BTEC award, the college may issue ETC certification to record the scope of successful completion)

Entry Requirements:

- **Qualifications:** Foundation course (level 3) or equivalent (A-levels / High School Diploma); must include Maths & Science to level 3
- **English:** IELTS 6 overall (minimum of 5.5 in any component), CEFR B2 or equivalent
- **Minimum Age:** 18 years

Weekly Hours: Between 18 and 22.5 Guided Learning (contact) hours, dependant on individual requirements for additional English lessons.

Number of Lessons: Between 12 and 15 lessons per week (nominally 90 minutes per lesson)

Entry Points: There are 2 entry points each year; September and January. Students may be individually assessed for entry at other times of the year, depending on prior education, but the overall requirements for credits and guided learning hours must be preserved to achieve the overall award.

Minimum No. of students per class: Nominally 4.

Sample Timetable:

Engineering Year 1 Group B - January 2020					
Session	Mon	Tue	Wed	Thu	Fri
	06/01/2020	07/01/2020	08/01/2020	09/01/2020	10/01/2020
08:45 - 10:15	E1B EEP Praneeta Phadke RM 20	E1B EEP Praneeta Phadke RM 20	E1B EEP Praneeta Phadke RM 20	E1B EEP Praneeta Phadke RM 20	
Break	Break	Break	Break	Break	Break
10:45 - 12:15	E1B Design Viktoria Orszagh RM 16a	E1B Design Viktoria Orszagh RM 16a	E1B Design Viktoria Orszagh RM 16a	E1B Design Viktoria Orszagh RM 16a	
Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
13:15 - 14:45	E1B Eng Science Sai Priya Dandothkar RM 20	E1B Eng Science Sai Priya Dandothkar RM 20	E1B Eng Science Sai Priya Dandothkar RM 20	E1B Eng Science Sai Priya Dandothkar RM 20	
14:45 - 15:15	Break	Break	Break	Break	Break
15:15 - 16:45	TT2 Lang Support Viktoria Orszagh RM 16	TT2 Lang Support Viktoria Orszagh RM 16	TT2 Lang Support Sumana Subramanayam RM 16	TT2 Lang Support Viktoria Orszagh RM 16	

NOTE: EEP = Electrical & Electronic Principles

Unit Hours: Each unit of study will consist of 60 guided learning hours. In addition, 90 hours recommended personal study time and all necessary invigilated assessments will be expected to take place outside of normal lessons.

Units of Work: Each award comprises the following taught units:

HNC Certificate – 120 credits at level 4

Unit Title	Credits	Unit Type
1 Engineering Design	15	Mandatory
2 Engineering Maths	15	Mandatory
3 Engineering Science	15	Mandatory
4 Managing a Professional Engineering Project	15	Mandatory
8 Mechanical Principles	15	Mandatory
23 CAD (Computer Aided Design)	15	
13 Fundamentals of Thermodynamics	15	Mandatory
19 Electrical & Electronic Principles	15	
Total	120	

HND Diploma – 240 credits (120 credits at level 5 + 120 credits at level 4)

Unit Title	Credits	Unit Type
34 Research Project	30	Mandatory
35 Professional Engineering Management	15	Mandatory
36 Advanced Mechanical Principles	15	Mandatory
37 Virtual Engineering	15	Mandatory
39 Further Mathematics	15	Mandatory
45 Industrial Systems	15	
64 Thermofluids	15	
Total	120	

Methodology: Learners will experience a wide range of teaching methodologies covering lectures, presentations, seminars, classroom discussions, field trips, team work, projects, quizzes, case studies, audio-visual materials.

Assessment: These may take the form of individual and team based projects and presentations / seminars, tests, personal learning journals, exams, continuous assessment, portfolios, mind maps, organising events, all based on the college fair assessment policy (see appendix 2).

All final unit grades will be agreed at formal Assessment and Award Boards held at regular intervals throughout the year at the College.

Pearson's rules and guidelines for BTEC Higher National qualifications will be followed. Full details are available in ETC Unit Handbooks, on the ETC website and on the Pearson's website.

Resubmissions: If a student is unable to pass an assessment the first time, (s)he will be given constructive feedback on how to improve and offered a viva / resit or resubmission of work, according to the college Fair Assessment policy.

Certificates and Transcripts: Certificates will only be issued to students who have attended 80% or more of lessons or of each module, and achieved all relevant assessment tasks. Transcripts will record only the grades of modules that a student has successfully passed.

English Result: English levels are only recorded on certificates and transcripts if students have passed the ETC proficiency English tests or have been awarded an IELTS certificate within the duration of the course.





Awarding Body: Pearson, the awarding body, publish guidance and rules for the successful completion of BTEC Higher Nationals. The college and therefore enrolled students will be bound by these as a minimum, including any changes that may be enforced by Pearson.

Pearson also makes available documents and supporting material to assist students, including the HN Global site. ETC students will be directed to these resources as necessary, and key documents will be linked via the college VLE.

Independent Work: Students are encouraged to complete project work, revision, research, flipped learning and consolidation tasks, and to develop robust study skills.

Tutorials: Tutorials are completed periodically to monitor & support students in all areas of their studies. This includes attendance, progress and engagement.

4. Delivery Staff

 <p>Chris Parker Head of HE/FE</p>	<p>Nadia Ghwedar Admin Support Officer</p>
 <p>Praneeta Phadke Senior Engineering lecturer</p>	 <p>Sumana Subramanyam Senior Engineering lecturer</p>
 <p>Sai Priya Dandothkar Engineering lecturer</p>	

Please note, Language Support lessons will be taught by our qualified English teachers in our General English department.

All staff can be contacted via the College reception or the FEHE Office (room 51 in Durley Road building), or through the course / FEHE email accounts.

Other specialist teachers, industry representatives or visitors may be used to teach learning outcomes or topics, as required.

APPENDIX 1: Unit Specifications

The following units are taught in accordance with the BTEC HNC HND engineering specification. Details of learning outcomes and assessment criteria for each unit are given in the individual unit induction booklets, which are available on the college VLE (Virtual Learning Environment). Further information is also available on the Pearson BTEC Higher Nationals website, and HNGlobal.

Learning Outcomes and Assessment Criteria and methods are detailed in individual ETC Unit Handbooks.

HNC Units – Year 1

Unit 1 Engineering Design

This unit shows students how to prepare an engineering design specification that satisfies stakeholder's requirements, implement best practice when analysing and evaluating possible design solutions, and prepare a written technical design report and present finalised design to a customer or audience.

Unit 2 Engineering Maths

This unit aims to employ mathematical methods within a variety of contextualised examples, interpret data using statistical techniques, and use analytical and computational methods to evaluate and solve engineering problems.

Unit 3 Engineering Science

This unit aims to interpret and present qualitative and quantitative data using computer software, calculate unknown parameters within mechanical systems, explain a variety of material properties and use electromagnetic theory in an applied context.

Unit 4 Managing a Professional Engineering Project

This unit aims to conceive, plan, develop and execute a successful engineering project, and produce and present a project report outlining and reflecting on the outcomes of each of the project processes and stages using critical thinking, analysis, reasoning, interpretation, decision-making, information literacy, and information and communication technology, and skills in professional and confident self-presentation.

Unit 8 Mechanical Principles

The unit aims to introduce students to essential mechanical principles associated with engineering applications by explaining the underlying principles, requirements and limitations of mechanical systems.

Unit 13 Fundamentals of Thermodynamics and Heat Engines

The unit aims to investigate fundamental thermodynamic systems and their properties, apply the steady flow energy equation to plant equipment, examine the principles of heat transfer to industrial applications, and determine the performance of internal combustion engines.

Unit 19 Electrical and Electronic Principles

This unit provides a good and wide-ranging grasp of the underlying principles of electrical and electronic circuits and devices, by introducing semiconductor theory, analogue and digital electronics and describing simple applications of each.

Unit 23 CAD (Computer Aided Design)

This unit introduces students to all the stages of the CAD/CAM process and to the process of modelling components using CAD software specifically suitable for transferring to CAM software. Among the topics included in this unit are: programming methods, component set-up, tooling, solid modelling, geometry manipulation, component drawing, importing solid model, manufacturing simulation, data transfer, CNC machine types and inspections.

HND Units – Year 2

Unit 34 Research Project

This unit introduces students to deliver a complex and independent research project in line with the original objectives, explain the critical thinking skills associated with solving engineering problems, consider multiple perspectives in reaching a balanced and justifiable conclusion, and communicate effectively a research project's outcome.

Unit 35 Professional Engineering Management

This unit aims to construct a coherent engineering services delivery plan to meet the requirements of a sector-specific organisation or business by displaying personal commitment to professional standards and obligations to society, the engineering profession and the environment.

Unit 36 Advanced Mechanical Principles

This unit aims to provide more advanced knowledge of mechanical principles to determine the behavioural characteristics of materials subjected to complex loading; assess the strength of loaded beams and pressurised vessels; determine specifications of power transmission system elements; and examine operational constraints of dynamic rotating systems.

Unit 37 Virtual Engineering

This unit provides knowledge to perform computational fluid dynamics (CFD) simulations, develop finite element product and system models, explain the identification of faults in the application of simulation techniques and discuss the modelling method and data accuracy.

Unit 39 Further Mathematics

This unit aims to use applications of number theory in practical engineering situations, solve systems of linear equations relevant to engineering applications using matrix methods, approximate solutions of contextualised examples with graphical and numerical methods, and review models of engineering systems using ordinary differential equations.

Unit 45 Industrial Systems

This unit aims to describe system elements and consider their overall characteristics by providing an opportunity for analytically assessing the accuracy and repeatability of electronic instruments.

Unit 64 Thermofluids

The aim of this unit is to provide a rational understanding of functional thermodynamics and fluid mechanics in common industrial applications. The unit promotes a problem-based approach to solving realistic work-related quandaries such as steam plant efficiency and fluid flow capacities. Students will

examine fundamental thermodynamic principles, steam and gas turbine systems and viscosity in fluids, along with static and dynamic fluid systems. Each element of the unit will identify a variety of engineering challenges and assess how problems are overcome in real-life industrial situations.

English for Academic Purposes

Students may also study English alongside their vocational studies. This prepares students for the academic part of the programme, through research methods, understanding lectures note-taking, summarising, adding own ideas, structuring essays, preparing and giving seminars and presentations.

Reading

- Preparing for lectures
- Reading and understanding handouts / books / internet quotes / newspapers
- Identifying main points of text paragraphs
- Gist / Skimming for themes / Scanning for detail
- Developing opinions on the text
- Using text information for referencing/building a bibliography

Listening

- Note taking
- Identifying key points in lectures/seminars/videos/TV/Radio
- Following lines of discussion
- Listening for detail
- Following Cause/Effect arguments
- Understanding how examples support theories
- Identifying different opinions
- Adding own opinions
- Using auditory source information for referencing/building a bibliography

Speaking

- Working in teams:
- Prioritising
- People Management
- Resource Management
- Time Management
- Stress Management
- Crisis Management
- Discussion Skills
- Seminars and Presentations
- Group
- Individual
- Preparing
- Practising
- Presenting
- Evaluating

- Participating
- Structuring talks
- Formatting Slides
- Speaking from notes
- Developing an original style

Writing

- Structuring assignments
- Establishing a thesis statement
- Writing a methodology
- Writing a literature review
- Designing questionnaires
- Presenting graphs and tables
- Conducting primary/secondary research
- Analysing and interpreting data
- Triangulating data
- Upgrading vocabulary
- Efficient task achievement
- Developing cohesive arguments
- Referencing and Bibliography skills
- Using examples to support ideas
- Adding own opinion
- Introductions and conclusions
- Using cause / effect arguments
- Research skills
- Process writing – drafting and redrafting
- Reviewing original thesis

Vocabulary

- Predictive skills
- Decoding text - auditory and written
- Recycling new vocabulary
- Identifying register / range / genre
- Encoding text – spoken and written
- Word / sentence transformations

Language

- Grammar rules / forms / patterns
- Collocations
- Phonemes
- Fluency
- Stress / rhythm / intonation
- Phatic language
- Embedded words
- Ellipsis / elision / contractions / accents

5. APPENDIX 2: ETC Fair Assessment Policy (summary)

The **ETC Fair Assessment Policy** is designed to ensure that all candidates have equal and fair access to assessment procedures. It enables the delivery of internally verified assessments according to the learning outcomes at the level of your chosen course.

The full & updated version of this policy can be found on the ETC website. Below is a summary of the main points;

Assessments follow strict industry guidelines and do not allow discriminatory practices on the basis of race, gender, age, disability or other unique factors affecting candidates.

All assessments are written by qualified educational practitioners and are verified according to the fair assessment policy guidelines.

The fair assessment policy also operates according to the guiding principle of a variety of academic awarding bodies that continually monitor the quality of the college's systems and procedures.

The policy explains what you can do if you wish to dispute or appeal a result, as well as advising teachers on how to get students to the next step if they are unable to achieve at any stage of the assessment process.

Assessments

Assessments can take the form of formative or summative assessment whereby the former would consist of continuous assessment, homework, assignments, presentations, personal learning journals, essays, progress tests, reports, mind maps, projects, role plays etc. and the latter of exams or Spoken Question and Answer Sessions or end of term presentation.

You are normally given a minimum of 4 weeks to prepare the assessment depending on the length of the course with an opportunity for meeting the tutor prior to submission to discuss the first draft of the assessment or presentation. At this point, the tutor may give general guidance on how to improve the assessment / presentation but may not comment on specific details or actual answers to learning outcomes addressed by the assessment.

You then have a further 14 days to follow through the advice of the tutor and complete your assignments before handing them in to reception or other designated office and sending them electronically to the e-mail addresses on the front of the assessment.

Assessors are normally then given 7 working days to mark the assignments. You are immediately informed of the results by the tutor and told that the result is subject to internal and external verification, which may increase or decrease the value of the result.

The roles and responsibilities and expectations for students regarding assessments are detailed in the policy.

All students' work is expected to be their own, correctly referenced and free from any plagiarism or other infringement of college rules. Any suspicion of malpractice will be dealt with in line with college procedures and BTEC guidelines.

Assessment Boards

ETC holds assessment boards a minimum of each term for all BTEC Higher National programmes. The main purpose of ETC's Assessment Board is to make recommendations on:

- The grades achieved by students on the individual units
- Extenuating circumstances
- Cases of cheating and plagiarism
- Progression of students on to the next stage of the programme
- The awards to be made to students
- Referrals and deferrals.

ETC's Assessment Board may also monitor academic standards. The main boards are normally held at the end of each term

6. APPENDIX 3: Appeals Process

Students may appeal assessment decisions as outlined in the ETC Fair Assessment Policy. Students also have the right to appeal to Pearson and the Office of the Independent Adjudicator. The situations and methods of these processes are detailed on the Pearson website.

In addition, ETC has a Complaints Procedure, detailed in student induction and on the ETC website. Members of ETC staff will be able to direct students to the correct source of information.

1. The ETC Complaints Procedure covers the following steps;
2. Reporting
3. Investigation / processing
4. Action / resolution
5. Appeal
6. External – other actions that clients may wish to take

APPENDIX 4: Progression**Academic Counselling / Choice of University and Degree Course**

ETC has formed links with several British and international colleges and universities.

Our team of academic counsellors will be delighted to help students to choose the course and institution most suited to them and assist them in their application to these organizations.

Students' choice of university and degree course will be determined by their own academic record and by the different specializations offered by each university. (Certain universities are famous for particular subjects, and some courses are only offered by a small number of universities).

Former ETC students have entered a great number of colleges and universities, in the UK and overseas, including the following:

Cambridge University	University of Buckingham
London School of Economics	Cardiff University
UCL (London)	Bournemouth University
Warwick University	Bournemouth and Poole College
University of Derby.	The Arts University College, Bournemouth
Nottingham University	University of Waikato, New Zealand
Oxford Brookes University.	Middlesex University
University of Manchester	Winchester University
University of Birmingham	University of Chichester
Birmingham City University	University of Plymouth
University of Brighton	

7. APPENDIX 5: Vocational Key Texts & Resources

Units have core texts and recommended reading, as well as other materials available in ETC library, the VLE or online generally. Academic staff will detail these resources in unit inductions. Through the process of completing units, tutorials and in general discussion, staff will be available to recommend further material, according to an individual student's needs.

Pearson produce two core texts to cover mandatory units, which are highly recommended:

Higher Nationals in Engineering Core Textbook: Volume 1

Publisher: Pearson

ISBN: 9781787260665

Higher Nationals in Engineering Core Textbook: Volume 2

Publisher: Pearson

ISBN: 9781787260689



The following is a summary of other key texts & resources.

Unit 1 – Engineering Design

Textbooks

DUL, J. and WEERDMEESTER, B. (2008) Ergonomics for beginners. 3rd Ed. Boca Raton: CRC Press.

DYM, C.L., LITTLE, P. and ORWIN, E. (2014) Engineering Design: a Project Based Introduction. 4th Ed. Wiley.

GRIFFITHS, B. (2003) Engineering Drawing for Manufacture. Kogan Page Science.

REDDY, K.V. (2008) Textbook of Engineering Drawing. 2nd Ed. Hyderabad: BS Publications.

Websites

www.epsrc.ac.uk Engineering and Physical Sciences Research Council (General Reference)

www.imeche.org Institution of Mechanical Engineers (General Reference)

Unit 2 – Engineering Maths**Textbooks**

SINGH, K. (2011) Engineering Mathematics Through Applications. 2nd Ed.

Basingstoke: Palgrave Macmillan.

STROUD, K.A. and BOOTH, D.J. (2013) Engineering Mathematics. 7th Ed.

Basingstoke: Palgrave Macmillan.

Websites

<http://www.mathcentre.ac.uk/> Maths Centre (Tutorials)

<http://www.mathtutor.ac.uk/> Maths Tutor

Unit 3 – Engineering Science**Textbooks**

BIRD, J. (2012) Science for Engineering. 4th Ed. London: Routledge.

BOLTON, W. (2006) Engineering Science. 5th Ed. London: Routledge.

TOOLEY, M. and DINGLE, L. (2012) Engineering Science: For Foundation Degree and Higher National. London: Routledge.

Journals

International Journal of Engineering Science.

International Journal of Engineering Science and Innovative Technology.

Websites

<https://www.khanacademy.org/> Khan Academy Physics (Tutorials)

Unit 4 – Managing a Professional Engineering Project**Textbooks**

PUGH, P. S. (1990) Total Design: Integrated Methods for Successful Product Engineering. Prentice Hall.

STRIEBIG, B., OGUNDIPE, A. and PAPADAKIS, M. (2015) Engineering Applications in Sustainable Design and Development. Cengage Learning.

ULRICH, K. and EPPINGER, S. (2011) Product Design and Development. 5th Ed. McGraw-Hill Higher Education.

Journals

Journal of Engineering Design.

Unit 34: Research Project, Unit 35: Professional Engineering Management

Unit 8 – Mechanical Principles

Textbooks

BIRD, J. and ROSS, C. (2014) Mechanical Engineering Principles. 3rd Ed. London: Routledge.

TOOLEY, M. and DINGLE, L. (2012) Engineering Science: For Foundation Degree and Higher National. London: Routledge.

Websites

<https://www.khanacademy.org/> Khan Academy (Tutorials)

Unit 13 – Fundamentals of Thermodynamics and Heat Engines

Textbooks

DUNN, D. (2001) Fundamental Engineering Thermodynamics. Longman.

EASTOP, T.D. and MCCONKEY, A. (1996) Applied Thermodynamics for Engineering Technologists. 5th Ed. Prentice Hall.

EASTOP, T.D. and MCCONKEY, A. (1997) Applied Thermodynamics for Engineering Technologists Student Solution Manual. 5th Ed. Prentice Hall.

RAYNER, J. (2008) Basic Engineering Thermodynamics. 5th Ed. Pearson.

ROGERS, G.F.C. and MAYHEW, Y.R. (1994) Thermodynamic and Transport Properties of Fluids: S. I. Units. 5th Ed. Wiley-Blackwell.

Unit 19 – Electrical and Electronic Principles

Textbooks

Textbooks BIRD, J. (2013) Electrical Circuit Theory and Technology. Routledge.

HUGHES, E., HILEY, J., BROWN, K. and MCKENZIE-SMITH, I. (2012) Electrical and Electronic Technology. Pearson.

SINGH, K. (2011) Engineering Mathematics through Applications. Palgrave.

BTEC Higher Nationals Study Guide (2011) Custom Publishing. Pearson.

Unit 23 – CAD (Computer Aided Design)

Textbooks

KUNWOO, L. (2000) Principles of CAD/CAM/CAE. Pearson. McMAHAN, C. and BROWNE, J. (1999) CAD/CAM: Principles, Practice and Manufacturing Management. Prentice Hall.

Unit 34 – Research Project

Textbooks

LEONG, E.C., LEE-HSIA, C.H. and WEE ONG, K.K. (2015) Guide to Research Projects for Engineering Students: Planning, Writing and Presenting. Apple Academic Press Inc.

OBERLENDER, G.D. (2014) Project Management for Engineering and Construction. 3rd Ed. McGraw-Hill Education.

Websites

<https://www.apm.org.uk/> Association for Project Management (General Reference)

Unit 35 - Professional Engineering Management

Textbooks

BURNS, B. (2014) Managing Change. 6th Ed. Pearson.

DEARDEN, H. (2013) Professional Engineering Practice: Reflections on the Role of the Professional Engineer. CreateSpace Independent Publishing Platform.

KARTEN, N. (2010) Presentation Skills for Technical Professionals. IT Governance Ltd.

LOCK, D. (2013) Project Management. 10th Ed. Routledge.

Websites

<http://www.engc.org.uk/> Engineering Council UK-SPEC UK Standard for Professional Engineering Competence (E-Books)

<http://www.ewb-uk.org/> Engineering without Borders (General Reference)

Unit 36 – Advanced Mechanical Principles

Textbooks

BIRD, J. and ROSS, C. (2014) Mechanical Engineering Principles. 3rd Ed. London: Routledge.

KHURMI, R.S. and GUPTA, J.K. (2005) Textbook of Machine Design. New Delhi: S. Chand Publishing.

TOOLEY, M. and DINGLE, L. (2012) Engineering Science: For Foundation Degree and Higher National. London: Routledge.

Websites

<https://www.khanacademy.org/> Khan Academy Physics (Tutorials)

Unit 37 – Virtual Engineering

Textbooks

DATE, A.W. (2005) Introduction to Computational Fluid Dynamics. Cambridge University Press.

FISH, J. and BELYTSCHKO, T. (2007) A First Course in Finite Elements. Wiley.

TREVOR, H. and BECKER, A.A. (2013) Finite Element Analysis for Engineers. A Primer, National Agency for Finite Element Methods & Standards.

Websites

www.tandfonline.com Taylor & Francis Online International Journal of Computational (Journal)

<http://www.inderscience.com/> Inder Science Publishers Progress in Computational Fluid Dynamics, An International Journal (Journal)

<https://www.nafems.org> NAFEMS

International Journal of CFD Case Studies (Journal)

Unit 39 - Further Mathematics

Textbooks

BIRD, J. (2014) Higher Engineering Mathematics. 7th Ed. London: Routledge.

SINGH, K. (2011) Engineering Mathematics Through Applications. Basingstoke, Palgrave Macmillan.

STROUD, K.A. and BOOTH, D.J. (2013) Engineering Mathematics. 7th Ed: Basingstoke, Palgrave Macmillan.

Journals

Communications on Pure and Applied Mathematics. Wiley.

Journal of Engineering Mathematics. Springer.

Journal of Mathematical Physics. American Institute of Physics.

Websites

<http://www.mathcentre.ac.uk/> Maths Centre (Tutorials)

<http://www.mathtutor.ac.uk/> Maths Tutor (Tutorials)

Unit 45– Industrial Systems

Textbooks

BIRD, J. (2013) Electrical Circuit Theory and Technology. Routledge.

HUGHES, E. et al. (2012) Electrical and Electronic Technology. Pearson.

REHG, J.A. and SARTORI, G.J. (2005) Industrial Electronics. Prentice-Hall.

WILAMOWSKI, B.M. and IRWIN, J.D. (2011) The Industrial Electronic Handbook: Fundamentals of Industrial Electronics. CRC Press.

Websites

<http://www.bath.ac.uk/> University of Bath Patents (General Reference)

<http://www.bsigroup.com/> Business Standards Institution Standards Catalogue (General Reference)

<https://www.ieee.org/> Institute of Electrical and Electronics Engineers Standards (General Reference)

<http://www.theiet.org/> Institution of Engineering and Technology (General Reference)

<http://www.newelectronics.co.uk/> New Electronics Digital Magazine (Journals)

<http://www.theiet.org/> Institution of Engineering and Technology (Journals)

<http://www.epemag.com/> Everyday Practical Electronics (Journals) <https://www.ieee.org/> Institute of Electrical and Electronics Engineers (Journals) Pearson BTEC Levels 4 and 5 Higher Nationals in Engineering Specification – Issue 5 – October 2017 © Pearson Education Limited 2017 306

Unit 64 – Thermofluids

Textbooks

DUNN, D. (2001) Fundamental Engineering Thermodynamics. Longman. EASTOP, T.D. and

MCCONKEY, A. (1996) Applied Thermodynamics for Engineering Technologists. 5th Ed. Prentice

Hall. MASSEY, B.S. and WARD-SMITH, J. (2011) Mechanics of Fluids. 9th Ed. Oxford: Spon Press.

ROGERS, G.F.C and MAYHEW, Y.R (1994) Thermodynamic and Transport Properties of Fluids: S. I. Units. 5th Ed. Wiley-Blackwell.

Websites

<http://www.freestudy.co.uk> Free Study (Tutorials)

<http://www.khanacademy.org> Khan Academy (Tutorials)