



MODULAR PROGRAMME IN SCIENCE & TECHNOLOGY STUDIES

Degree Cycle Modules – Unit Topics

Please note that curriculum development is continuous process and all module outlines are subject to change. Elective Streams will be developed subject to funding. Modules are delivered subject to minimum student numbers.

Module Title	Category	Author / Tutor	Page
Core Modules (10 compulsory taught modules and 2 compulsory project modules)			
Product & Process Development	Core	Ann Ledwith & John Nicholas	6
Health & Safety Systems	Core	Sillke Kleefeld	6
Project Management	Core	Dan Ahearn	6
Applied Innovation	Core	David O'Sullivan / Fiona Masterson	7
Management Information Systems	Core	Emma O'Brien	7
Materials Science & Processes	Core	Seamus Clifford	8
Research Methodology	Core	Brian Coll	8
Environmental Science	Core	Judith Wurmel	9
Regulatory Compliance	Core	JJ Tobin	9
Technology Innovation & Entrepreneurship	Core	Kathryn Cormican / Fiona Masterson	10
Project 3	Core	Derek O'Keefe	10
Project 4	Core	Derek O'Keefe	10

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Elective Streams available from August 2009 (2 elective streams of 4 modules each required for the Degree cycle)

Lean & Quality Systems

Elective Stream

UL Aug 2009 to May 2010

- Lean Thinking / Lean Tools
- Quality Science – Six Sigma
- Problem Solving Tools & Techniques
- Enterprise Modelling & Simulation

Elective

Maeve Fitzpatrick

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Elective

Gerry Golding / Patrick Walsh

[12](#)

Elective

Patrick Walsh

[12](#)

Elective

Ingrid Hunt / Emma O'Brien

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Medical Device Science

Elective Stream

NUIG Aug 2009 to May 2010

- Anatomy
- Biocompatibility & Device Design
- Mechanics of Solids
- Medical Device Science

Elective

Derek O'Keeffe

[14](#)

Elective

Dimitrios Zeugolis

[14](#)

Elective

Daniela Butan & Ioan Butan

[15](#)

Elective

Karen Coglan

[15](#)

Environmental Sustainability

Elective Stream

NUIG Aug 2009 to May 2010

- Sustainable Energy
- Environmental Management Systems
- Environmental Impact Assessment
- Design for Environment

Elective

Patrick Creed

[17](#)

Elective

Noel Connaughton

[17](#)

Elective

Noel Connaughton

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Elective

Paul Folan & David Tormey

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Module Title	Category	Author / Tutor	Page
Elective Streams delivery schedule to be confirmed			
Form & Function of the Human Body	Elective Stream	NUIG Aug 2010 to May 2011	
▪ Anatomy	Elective	Derek O'Keeffe	14
▪ Biocompatibility & Device Design	Elective	Dimitrios Zeugolis	14
▪ Cell Biology	Elective	Sheila Faherty	23
▪ Immunology & Human Therapeutics	Elective	Joan O'Keeffe	23
Automation & Control	Elective Stream	UL Aug 2010 to May 2011	
▪ Automation 1	Elective	Patrick Walsh	24
▪ Manufacturing Technology	Elective	Patrick Walsh	24
• CAD Modelling OR	Elective	Anthony Rynne	20
• Automation 2	Elective	David O'Sullivan	24
○ Machine Design OR	Elective	TBC	21
○ Enterprise Modelling & Simulation	Elective	Ingrid Hunt / Emma O'Brien	13

Module Title	Category	Author / Tutor	Page
Elective Streams development to be confirmed			
Mechanical Design	Elective Stream - TBC		
<ul style="list-style-type: none"> ▪ Mechanical Modelling (3 options) <ul style="list-style-type: none"> ○ CAD Modelling OR ○ Design of Engineering Systems OR ○ Engineering Mechanics ▪ Mechanics of Solids ▪ Machine Design ▪ Biomechanics 	<ul style="list-style-type: none"> Elective Option Elective Option Elective Option Elective Elective Elective 	<ul style="list-style-type: none"> Anthony Rynne Daniela Butan Dermot Geraghty Daniela Butan TBC Tim Mcloughlin 	<ul style="list-style-type: none"> 20 20 21 15 21 21
Bio-processing Technology	Elective Stream - TBC		
<ul style="list-style-type: none"> ▪ Glycobiology ▪ Bioprocess Technology ▪ Cell & Tissue Culture ▪ Upstream & Downstream Processing 	<ul style="list-style-type: none"> Elective Elective Elective Elective 		<ul style="list-style-type: none"> 26 26 26 27
Biomedical Informatics	Elective Stream - TBC		
<ul style="list-style-type: none"> ▪ Biomedical Imaging Technologies ▪ Biomedical Data Management ▪ Next Generation Sequencing Technologies ▪ Genome Technologies 	<ul style="list-style-type: none"> Elective Elective Elective Elective 		<ul style="list-style-type: none"> 28 28 28 28
Marketing & Sales	Elective Stream - TBC		
<ul style="list-style-type: none"> ▪ Introduction to Marketing ▪ Marketing Information & Research 	<ul style="list-style-type: none"> Elective Elective 		<ul style="list-style-type: none"> 29 29

- Marketing Policy & Planning Elective [29](#)
- Selling & Sales Management Elective [20](#)

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Module Outlines

Product & Process Development

Module Type: Core

Module Introduction
New Product Development Process Models
New Product Planning
The Product Development Team
The Role of Supplier and Buyer in NPD
Rapid Prototyping and Product Data Technologies
Identification of Customer Needs
Product Specification, Concept Generation
Concept Selection and Concept Testing
Product Architecture
Industrial Design and Design for Manufacturing
NPD Tools and Emerging NPD Paradigms

Health & Safety Systems

Module Type: Core

Introduction to safety concepts and terminology
Incident/accident root analysis
Risk perception
Theories of loss causation
Principles of behaviour
Risk methodologies
Safety Statements
Introduction to Safety Legislation

Project Management

Module Type: Core

Networks and work breakdown structures (WBS), job ordering procedures, multiple projects, concurrent engineering, Milestones, review points and slip charts.
Project life-cycles: from concept through design-validation-production-service and support and disposal, Computer programs for Project Management, Effective communications, cross-functional experience and

relationships, organisational make-up, change management, Estimating resource, time and cost requirements and constraints.

Life-cycle costs, detailed & parametric cost estimating models, 3-estimate method. Opportunity costs of project delays, Budget determination, opening and maintaining accounts. Basic profit & loss determination.

Project appraisal criteria: Pay-back period, time value of money and DCF, NPV, IRR. After-tax cash flows.

A 10-step cycle, system boundary, incremental cost & benefit determination, Sensitivity analysis, Risk & Uncertainty, Decision Trees, Non-financial criteria.

Applied Innovation

Module Type: Core

Unit 1 DEFINING INNOVATION

Unit 2 MAKING CHANGES

Unit 3 MANAGING INNOVATION

Unit 4 PROCESSING INNOVATION

Unit 5 DEFINING GOALS

Unit 6 UNDERSTANDING REQUIREMENTS

Unit 7 DEFINING OBJECTIVES

Unit 8 MANAGING INDICATORS

Unit 9 GENERATING IDEAS

Unit 10 MANAGING PROJECTS

Unit 11 MANAGING PORTFOLIOS

Unit 12 LEADING INNOVATION

Unit 13 BUILDING TEAMS

Unit 14 MOTIVATING PERFORMANCE

Unit 15 MONITORING RESULTS

Unit 16 MAPPING RELATIONSHIPS

Management Information Systems

Module Type: Core

Unit 1 STRATEGIC MANAGEMENT: THEORY AND PRACTICE

Unit 2 IS/IT IN THE DIGITAL ECONOMY- CONCEPTS

THE EVOLVING ROLE OF IS AND IT

ELECTRONIC BUSINESS

MOBILE COMMERCE

KNOWLEDGE MANAGEMENT

BUSINESS INTELLIGENCE

DECISION SUPPORT SYSTEMS
IT STRATEGY AND PLANNING
PRODUCT DATA MANAGEMENT SYSTEM
APPROACHES TO INFORMATION SYSTEM DEVELOPMENT
UNIT 12 GLOBAL SOFTWARE DEVELOPMENT

Materials Science & Processes

Module Type: Core

The Elastic moduli (bonding between atoms, packing of atoms in solids, physical basis of Young's modulus
Yield strength, tensile strength and ductility (dislocations and yielding in crystals, strengthening methods and
plasticity of polycrystals)

Fast fracture and toughness (micromechanisms of fast fracture)

Fatigue failure (fatigue of cracked and uncracked components, mechanisms, design against fatigue)

Creep and creep fracture (kinetic theory of diffusion, mechanisms of creep and creep-resistant materials)

Ceramics and glasses (structure of ceramics, mechanical properties of ceramics, cements and concretes).

Polymers & composites (structure of polymers, mechanical behaviour of polymers, composites: fibrous,
particulate and foamed, wood).

Designing with metals, ceramics, polymers & composites.

Case Studies incorporating examples of mechanical testing, failure analysis, design and materials selection.

Safety in the Laboratory. Production of materials- metals, wood-based and plastics.

Properties of materials. Factors influencing the selection and processing of materials.

Engineering measurement. Measuring instruments.

Basic machining. Cutting tool geometry and materials. Chip formation. Hand processing and surface
treatment of materials.

Projection systems - orthographic, isometric and oblique. Freehand sketching - translation of simple
drawings. [BS308 conventional representation] of features. Sectional views. Detail and assembly drawings.

Dimensioning of parts. Limits and fits.

Research Methodology

Module Type: Core

a) Theoretical approaches to research including

- The art of framing hypotheses and prediction
- Different experimental designs
- Taking measurements
- The art of analysis and presentation of data

b) Practical application of theoretical knowledge including

- Development of topic-specific research plan
- Poster presentation of research coupled with poster evaluation

Environmental Science

Module Type: Core

Module Prerequisite: Introduction to Environmental Science

Unit 1 TOWARDS SUSTAINABILITY

Unit 2 EARTH'S SOIL AND AGRICULTURE

Unit 3 BIOGEOCHEMICAL CYCLES

Unit 4 POLLUTION OF THE SOIL

Unit 5 PROTECTION NATURAL RESOURCES THROUGH SUSTAINABLE AGRICULTURAL METHODS

Unit 6 ATMOSPHERIC POLLUTION

Unit 7 GLOBAL CLIMATE CHANGE AND THE GREENHOUSE EFFECT

Unit 8 MEASUREMENT AND TREATMENT OF ATMOSPHERIC POLLUTION

Unit 9 WATER POLLUTION

Unit 10 TREATMENT OF WATER POLLUTION

Unit 11 WASTEWATER TREATMENT

Unit 12 TOXICOLOGY

Unit 13 DRUGS FROM PLANT SOURCES

Unit 14 ENVIRONMENTAL ECONOMICS

Unit 15 ENVIRONMENTAL LAW

Unit 16 ENVIRONMENTAL ETHICS

Regulatory Compliance

Module Type: Core

Unit 1 THE AIMS AND STRUCTURE OF REGULATIONS

Unit 2 REGULATORY STRATEGY

Unit 3 REGULATORY BODIES

Unit 4 DRUG DEVELOPMENT

Unit 5 NON-CLINICAL EVALUATIONS

Unit 6 CLINICAL TRIALS – GENERAL PRINCIPLES

Unit 7 CONDUCTING CLINICAL TRIALS – PRACTICAL REGULATORY REQUIREMENTS

Unit 8 DRUG MARKETING AUTHORISATION – DOSSIER STRUCTURE AND CONTENT

Unit 9 MARKETING AUTHORISATION - SUBMISSION AND REVIEW PROCESS

Unit 10 AUTHORISATION OF VETERINARY DRUGS

Unit 11 VARIATIONS TO THE DRUG AUTHORISATION PROCESS

Unit 12 MEDICAL DEVICES
Unit 13 AUTHORISATION OF MEDICAL DEVICES
Unit 14 GMP
Unit 15 OVERSIGHT OF MANUFACTURING OPERATIONS
Unit 16 MARKET VIGILANCE

Technology Innovation & Entrepreneurship

Module Type: Core

Unit 1 OVERVIEW
Unit 2 INTRODUCTION TO INNOVATION
Unit 3 DYNAMICS OF TECHNOLOGY INNOVATION
Unit 4 IMPLEMENTING TECHNOLOGY INNOVATION
Unit 5 INTRODUCTION TO ENTREPRENEURSHIP
Unit 6 DYNAMICS OF ENTREPRENEURSHIP
Unit 7 OPPORTUNITY RECOGNITION 83
Unit 8 MARKET ANALYSIS
Unit 9 GENERATING FINANCE
Unit 10 DEVELOPING A FEASIBILITY STUDY
Unit 11 WRITING A BUSINESS PLAN
Unit 12 MANAGING INTELLECTUAL PROPERTY
Unit 13 MANAGING PROJECTS
Unit 14 MANAGING PORTFOLIOS
Unit 15 MANAGING TEAMS
Unit 16 EXIT STRATEGIES

Project 3

Module Type: Core

This module will be driven an overall project theme of enquiry which will have useful learning outcomes for both the student and relevant company if applicable. There is no specific syllabus for the project but it will require the application of the concepts learned throughout the various programme modules.

The aim of company based-projects will be to improve work practices or efficiency or to develop new products, services or systems.

The student will submit a project proposal and a literature review. Module assessment will examine the selection, justification and planning of the project.

Project 4

Module Type: Core

Module Prerequisite: Project 3

The Project module will provide the student with experience in planning a work programme to a defined set of research objectives, in data acquisition and analysis, and the interpretation of the results in the light of a relevant literature review.

There is no specific syllabus for the project. It will be driven by related taught modules and an overall project theme of enquiry which will have useful learning outcomes for both the student and relevant company if applicable. It is envisaged that the student and company will agree the success metrics for the project as part of the topic selection process.

If feasible Project 4 will ideally be based on work performed in Project 3

Module assessment will examine the selection, justification, planning, implementation and analysis of the project. The student will submit a stand alone report structured in the form of a journal article which outlines the context of the project, its implementation, results, and conclusions and recommendations. It is envisaged that the student and company will agree the success metrics for the project as part of the topic selection process.

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Lean & Quality Systems

Lean Thinking / Lean Tools

Module Type: Elective

Unit 1: History and Application of Lean Thinking

Unit 2: Value Stream Mapping

Unit 3: Cellular Manufacturing

Unit 4: Work Standardisation and Standard Work

Unit 5: Just-In-Time Manufacturing and Kanbans

Unit 6: Single Minute Exchange of Dies (SMED)

Unit 7: Creating and Sustaining an Orderly Work Environment with 5S

Unit 8: Kaizen

Unit 9: Visual Management and the Visual Factory

Unit 10: Overall Equipment Effectiveness (OEE)

Unit 11: Total Preventive Maintenance (TPM)

Unit 12: Jidoka, Poke Yoke, and Quality

Unit 13: Lean Supply Chains

Unit 14: Lean Product Development and Quality Function Deployment

Unit 15: Building a Lean Organisation

Unit 16: Lean Systems: Case Studies

Quality Science – Six Sigma

Module Type: Elective

Module Prerequisite: Maths 1 & Statistics

- Process Capability Indices & the Central Limit Theorem
- Statistical Process Control
- Statistical Process Control for Variable Data
- Statistical Process Control for Attribute Data
- Short Run SPC
- Minor Project
- Individuals and Moving Range Charts

Problem Solving Tools & Techniques

Module Type: Elective

Unit 1 Foundations of Six Sigma: Principles of Quality Management

Unit 2 Principles of Six Sigma

Unit 3 Project Management
Unit 4 Project Selection and Definition
Unit 5 Process Measurement – Part I
Unit 6 Process Measurement – Part II
Unit 7 Process Analysis – Part I
Unit 8 Process Analysis – Part II
Unit 9 Process Improvement – Part I
Unit 10 Process Improvement – Part 2
Unit 11 Process Control – Part I
Unit 12 Process Control – Part II
Unit 13 Design for Six Sigma: Concept and Design Development – Part 1
Unit 14 Design for Six Sigma: Concept and Design Development – Part 2
Unit 15 Design for Six Sigma: Optimisation and Verification
Unit 16 Design for Six Sigma Implementation

Enterprise Modelling & Simulation

Module Type: Elective

- Product Modelling
- Why Model
- BPR- Overview
- BPM Methods and Tools
- Enterprise Modelling Techniques
- Enterprise Modelling with CIMOSA
- Enterprise Modelling for Business Process Improvement
- Product Data Management Systems
- Simulation
- Food Supply Chain Modelling and Simulation
- Animal Feed Supply Chain Modelling and Simulation

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Medical Device Science

Anatomy

Module Type: Elective

- Unit 1 THE HUMAN BODY
- Unit 2 THE INTEGUMENTARY SYSTEM
- Unit 3 THE SKELETAL SYSTEM
- Unit 4 THE MUSCULAR SYSTEM
- Unit 5 THE NERVOUS SYSTEM
- Unit 6 THE ENDOCRINE SYSTEM
- Unit 7 THE CARDIOVASCULAR SYSTEM
- Unit 8 THE HAEMATOLOGICAL SYSTEM
- Unit 9 THE LYMPHATIC SYSTEM
- Unit 10 THE RESPIRATORY SYSTEM
- Unit 11 THE DIGESTIVE SYSTEM
- Unit 12 THE URINARY SYSTEM
- Unit 13 THE REPRODUCTIVE SYSTEM
- Unit 14 PREGNANCY
- Unit 15 THE SENSES
- Unit 16 THE BRAIN

Biocompatibility & Device Design

Module Type: Elective

- Unit 1 INTRODUCTION TO BIOMATERIALS AND MEDICAL DEVICES
- Unit 2 INTRODUCTION TO CLASSES OF BIOMATERIALS
- Unit 3 INTRODUCTION TO TISSUE ENGINEERING
- Unit 4 INTRODUCTION TO DEVICE DESIGN
- Unit 5 INTRODUCTION TO BIOMATERIALS PROCESSING
- Unit 6 INTRODUCTION TO DEVICE FABRICATION
- Unit 7 INTRODUCTION TO DEVICE CHARACTERISATION - SURFACE PROPERTIES
- Unit 8 INTRODUCTION TO DEVICE CHARACTERISATION – BULK PROPERTIES
- Unit 9 INTRODUCTION TO DEVICE CHARACTERISATION – IN VITRO STUDIES / BIOLOGICAL
- Unit 10 INTRODUCTION TO DEVICE CHARACTERISATION – IN VIVO STUDIES
- Unit 11 INTRODUCTION TO DEVICES DEGRADATION & FAILURE
- Unit 12 INFLAMMATION
- Unit 13 WOUND HEALING
- Unit 14 INFECTION

Unit 15 FUTURE DIRECTIONS

Unit 16 CLINICAL TRIALS

Mechanics of Solids

Module Type: Elective

Module Prerequisite: Physics 1

- Uniaxial stress and biaxial strain fields
- Constitutive relations
- Shear force and bending moment diagrams
- Bending of beams
- Transverse shear stress in beams
- Composite beams
- Temperature stress
- Torsion of cylindrical sections
- Analysis of stress at a point in 2D
- Principal stress and Mohr's stress circle
- Thin cylinders and thin spherical vessels

Medical Device Science

Module Type: Elective

Module Prerequisite: Material Science & Processes & Mechanics of Solids 1

- Overview of medical engineering materials and their functional properties
- Practical aspects of stress analysis and biomechanics in medical appliances and devices
- Stability of design elements
- Aspects of component life, cost and reliability
- Review of the history of medical device design
- Fatigue behaviour of medical devices
- Wear and strength of medical devices
- Mechanical testing of medical devices
- Use of fatigue data, load and environment factors in design and selection
- Use of standards
- Bio-materials and life considerations
- Corrosion protection
- Safety and the work environment
- Testing and certification
- Medical device legislation and regulation
- Clinical use of devices and design constraint

- Case studies in design from Medical Device Industry

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Environmental Sustainability

Sustainable Energy

Module Type: Elective

- Energy trends (current options - their relative usage and impacts, emerging technologies)
- Renewable energy options and limits (actual vs potential options, advantages, limits to use)
- Harnessing energy resources:
 - Production (scales of production, decentralised production)
 - Conversion e.g. biomass (use of heat) vs wind (storage issues)
 - Distribution (grid and smart grid)
- Utilisation (sustainable consumption and energy lifecycle)
- Sustainable building
- Case studies:
 - smart house (energy ratings, insulation, sensors etc)
 - process industry/production line
 - transport system
 - town e.g. Freiberg

Environmental Management Systems

Module Type: Elective

Unit 1 OVERVIEW OF ENVIRONMENTAL ISSUES AND ENVIRONMENTAL MANAGEMENT

Unit 2 INTRODUCTION TO ENVIRONMENTAL MANAGEMENT SYSTEMS

Unit 3 PLANNING THE ENVIRONMENTAL REVIEW

Unit 4 ENVIRONMENTAL POLICY

Unit 5 ENVIRONMENTAL OBJECTIVES AND TARGETS

Unit 6 ROLES AND RESPONSIBILITIES FOR DEVELOPING AND IMPLEMENTING THE
ENVIRONMENTAL MANAGEMENT SYSTEM

Unit 7 ENVIRONMENTAL AWARENESS AND TRAINING

Unit 8 ENVIRONMENTAL COMMUNICATIONS AND DOCUMENTATION

Unit 9 OPERATIONAL CONTROL

Unit 10 EMERGENCY PREPAREDNESS AND RESPONSE

Unit 11 ENVIRONMENTAL MONITORING AND MEASUREMENT

Unit 12 ENVIRONMENTAL AUDITING

Unit 13 CORRECTIVE ACTION

Unit 14 ENVIRONMENTAL MANAGEMENT REVIEW

Unit 15 ENVIRONMENTAL PERFORMANCE REPORTING

Unit 16 REVIEW OF THIS MODULE

Environmental Impact Assessment

Module Type: Elective

- Unit 1 OVERVIEW OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
- Unit 2 LEGAL FRAMEWORK FOR EIA
- Unit 3 EIA TOPICS THAT MUST BE ADDRESSED
- Unit 4 SCREENING FOR EIA
- Unit 5 SCOPING FOR EIA
- Unit 6 NATURE AND SIGNIFICANCE OF ENVIRONMENTAL IMPACTS
- Unit 7 MITIGATION MEASURES FOR EIA
- Unit 8 ENVIRONMENTAL IMPACT STATEMENT (EIS)
- Unit 9 MANAGING EIA PROJECTS
- Unit 10 REVIEW OF EISs
- Unit 11 ROLES OF PARTICIPANTS IN PRACTICE
- Unit 12 DECISION MAKING IN EIA PROCESS
- Unit 13 POST – DECISION FOLLOW-UP
- Unit 14 CRITICAL ASSESSMENT OF THE EIA PROCESS
- Unit 15 STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)
- Unit 16 REVIEW OF THIS MODULE

Design for Environment

Module Type: Elective

- Unit 1 INTRODUCTION TO PARAMETRIC MODELLING WITH SOLIDWORKS
- Unit 2 INTRODUCTION TO SKETCHING AND EXTRUDED FEATURES
- Unit 3 FUNDAMENTALS OF PART MODELLING 1
- Unit 4 FUNDAMENTALS OF PART MODELLING 2
- Unit 5 REVOLVED FEATURES
- Unit 6 PATTERNING
- Unit 7 DESIGN CHANGES AND FIXING ERRORS IN PARTS
- Unit 8 PLASTIC PART DESIGN
- Unit 9 PART CONFIGURATIONS, DESIGN TABLES AND EQUATIONS
- Unit 10 SWEEPS, LOFTS AND MULTIBODY SOLIDS
- Unit 11 BOTTOM-UP ASSEMBLY MODELLING
- Unit 12 ANALYSING AND WORKING WITH ASSEMBLIES
- Unit 13 PART AND ASSEMBLY DRAWINGS
- Unit 14 DRAWING TEMPLATES AND SHEET FORMATS

Unit 15 PHOTOWORKS RENDERINGS AND SOLIDWORKS ANIMATOR

Unit 16 MISCELLANEOUS MODELLING ISSUES IN SOLIDWORKS

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Mechanical Design

CAD Modelling

Module Type: Elective

Unit 1 INTRODUCTION TO PARAMETRIC MODELLING WITH SOLIDWORKS

Unit 2 INTRODUCTION TO SKETCHING AND EXTRUDED FEATURES

Unit 3 FUNDAMENTALS OF PART MODELLING 1

Unit 4 FUNDAMENTALS OF PART MODELLING 2

Unit 5 REVOLVED FEATURES

Unit 6 PATTERNING

Unit 7 DESIGN CHANGES AND FIXING ERRORS IN PARTS

Unit 8 PLASTIC PART DESIGN

Unit 9 PART CONFIGURATIONS, DESIGN TABLES AND EQUATIONS

Unit 10 SWEEPS, LOFTS AND MULTIBODY SOLIDS

Unit 11 BOTTOM-UP ASSEMBLY MODELLING

Unit 12 ANALYSING AND WORKING WITH ASSEMBLIES

Unit 13 PART AND ASSEMBLY DRAWINGS

Unit 14 DRAWING TEMPLATES AND SHEET FORMATS

Unit 15 PHOTOWORKS RENDERINGS AND SOLIDWORKS ANIMATOR

Unit 16 MISCELLANEOUS MODELLING ISSUES IN SOLIDWORKS

Design of Engineering Systems

Module Type: Elective

Module Prerequisite: Introduction to Operations Engineering

Unit 1 INTRODUCTION TO DESIGN OF ENGINEERING/FUNDAMENTALS 13

Unit 2 SYSTEM/PRODUCT LIFE CYCLE 27

Unit 3 TASK CLARIFICATION/ELABORATE THE DESIGN SPECIFICATION 47

Unit 4 CONCEPTUAL DESIGN 63

Unit 5 COST BENEFIT ANALYSIS AS A METHOD OF DESIGN EVALUATION 81

Unit 6 EMBODIMENT DESIGN 97

Unit 7 DETAIL DESIGN – USE OF STANDARDS/LIMITS AND FITS 115

Unit 8 DESIGN FOR QUALITY AND MINIMUM COST 135

Unit 9 OPTIMISATION IN SYSTEMS DESIGN 153

Unit 10 DESIGN FOR MAXIMUM ENERGY EFFICIENCY 179

Unit 11 SIMULATION 197

Unit 12 SIMULATION MODELLING 215

Unit 13 DESIGN DOCUMENTATION 235

Unit 14 DESIGN IMPLEMENTATION 259

Unit 15 DESIGN FOR ENVIRONMENT — DFE 273

Unit 16 CASE STUDIES: AN EXERCISE IN SYSTEMATIC DESIGN AND FAILURE MODE AND EFFECT ANALYSIS (FMEA) 289

Engineering Mechanics

Module Type: Elective

Application of Newton's Laws to particles and rigid bodies in equilibrium (Dynamics); kinematics of particles, Cartesian, polar, normal and tangential co-ordinates; kinetics of particles, work, kinetic energy, potential energy, impulse and momentum; kinetics of systems of particles; rigid bodies in plane motion, motion relative to rotating axes, mechanisms; rigid bodies in three-dimensional motion, Euler's equations of motion, gyroscopes.

Machine Design

Module Type: Elective

Module Prerequisite: CAD Modelling

Production of assembly and detailed working drawings of machine elements to BS308

drawing of gears, cams, springs and linkages

Engineering materials in machine design

materials selection

specification and identification for bearings, shafts, gears, housings and other machine components

Bill of materials

Bearings, ball and roller bearings

Selection of bearings, bearing mounting arrangements

Machine joint design, fasteners, rivets cotters, keys and welded joints

Stress on machine joint components, factor of safety

Work-holding devices, jig and fixture design, location principles and devices, indexing devices, clamping and clamping devices, rigidity

Jigs and fixtures for milling, turning, grinding and broaching

Fixture balancing

Fixtures for welding and assembly

Biomechanics

Module Type: Elective

Module Prerequisite: Materials Science & Processes, Mechanics of Solids & Machine Design

- Fundamentals, Musculoskeletal dynamics, Mechanics of Hard and Soft Tissues, Mechanics of Muscles, Mechanics of Cells, Mechanics of Tissue Growth, Adaptation and Degeneration
- Orthopaedic Biomechanics, Design of Joint Replacement Implants, Wear and Tribology of Joint Replacements, Design of Fracture Fixation Systems, Design of Implants for the spine.
- Cardiovascular and Respiratory Biomechanics, Biology and Mechanics of Blood Flow, Mechanics of Soft –Tissues, Flow Tissue and Flow Prosthesis Interaction , Design of Cardiovascular Implants and Blood Flow Analysis
- Dental Biomechanics, Design and Analysis of Dental Prostheses, Mechanics of Mandible
- Auditory Biomechanics, Mechanics of Hearing, Design and Analysis of Middle and Inner Ear Prostheses
- Injury Biomechanics, Mechanics of Impact, Dynamics of Man Machine Interaction
- Rehabilitation Biomechanics, Analysis of Locomotion and Gait, Design of Prostheses and Orthoses
- Advanced Topics Preclinical testing of Implants, case studies in Biomechanics and Implant Design
Regulatory issues in Implant Design /Analysis

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Form & Function of the Human Body

Cell Biology

Module Type: Elective

- Unit 1 ANATOMY OF CELLS I
- Unit 2 ANATOMY OF CELLS II
- Unit 3 PHYSIOLOGY OF CELLS I
- Unit 4 PHYSIOLOGY OF CELLS II
- Unit 5 THE NUCLEUS OF THE CELL
- Unit 6 CELL GROWTH
- Unit 7 CELL DEATH
- Unit 8 CELL GROWTH AND DIFFERENTIATION
- Unit 9 TISSUES I
- Unit 10 TISSUES II
- Unit 11 CANCER CELLS
- Unit 12 CELL CULTURE I
- Unit 13 CELL CULTURE II
- Unit 14 BIOCOMPATIBILITY
- Unit 15 BIOCOMPATIBILITY: CYTOTOXICITY
- Unit 16 BIOCOMPATIBILITY: GENOTOXICITY

Immunology & Human Therapeutics

Module Type: Elective

- Unit 01 Basic components of immunity: structure and function
- Unit 02 Immunity to Infection
- Unit 03 Immunodeficiency
- Unit 04 Anaphylaxis and allergy
- Unit 05 Autoimmunity
- Unit 06 Transplantation
- Unit 07 Neuroimmunology
- Unit 08 Immune Manipulation
- Unit 09 Immunisation and infection
- Unit 10 Antibodies
- Unit 11 Monoclonal antibodies in medicine
- Unit 12 Antibodies to cytokines
- Unit 13 Antibodies as therapeutic agents
- Unit 14 Other Immunotherapies

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Automation & Control

Automation 1

Module Type: Elective

- Definition of open and closed loop control. Boolean Algebra, logic elements, counters, scalars and shift registers, basic circuitry, input-output signals.
- Programmable logic controller hardware and software, applying programmable logic controllers to the control of manufacturing equipment. Field bus technology.
- Pneumatics pneumatic control, pneumatic circuit design, electro-pneumatics.
- Hydraulics hydraulic control, hydraulic circuit design
- Interfacing Basic signal types A/D D/A conversion. Data transmission
- Sensors digital and analogue sensors: proximity switches, photoelectric sensors, resistive, capacitive, and inductive sensors, bar codes, vision systems.
- Fault finding Standard Fault finding Techniques
- The use of hoppers, feeders, orienting and indexing mechanisms, transfer equipment and conveyers in Manufacturing Equipment Design.

Manufacturing Technology

Module Type: Elective

Engineering measurement. Length standards. Standard measuring temperature. Process capability. Quality and accuracy. Machining - further consideration of sawing, turning, milling, drilling. Fundamental treatment of the shear plane - relation between the rake angle and the shear plane and implications for power requirements. Workholding - methods of clamping, magnetic workholding, chucks and collets. Welding techniques including : manual metal arc, oxy-acetylene, MIG and TIG welding. Brazing, soldering and adhesive bonding. Mechanical joining. Joint design.

Automation 2

Module Type: Elective

- Machine tool kinematics, the function and design of shafts, slide-ways and power-screws in the generation of shape. The universal dividing head. Variable speed drives, electrical, hydraulic and mechanical drive systems. Power train design, gearboxes, flexible drives and clutches. Speed and feed control. The machine control unit, pulse generation and counting, table speed and position sensors, encoders and tachometers.

- Classification of CNC machines, CNC Machining, programming languages, manual and computer part programming, ISO programming codes, post-processor programmes, the 'Smart-cam' and CAD-key languages, DNC and interactive control of machines.

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Bio-processing Technology

Glycobiology

Module Type: Elective

- The structure of carbohydrates
- The functions of carbohydrates
- The functions and major types of glycoprotein's
- Expression systems for glycoprotein's
- Industrial scale-up systems
- Challenges of glycoprotein recovery
- Medical applications of glycoprotein's

Bioprocess Technology

Module Type: Elective

- Industrial processing plant structure: organisational formats for personnel and equipment/materials.
- Health and safety at work: types of factory environment and their physiological and psychological risks.
- Current legislation in the area of employer and employee liability. Codes of practice.
- The role of management and unions in safety.
- Introduction to process control: basic control modes e.g. P, PI, PID; control system architecture and dynamic behaviour for SISO processes.
- Equipment and instrumentation used in chemical and biochemical processing operations:

Cell & Tissue Culture

Module Type: Elective

- Design and equipment for the cell culture laboratory
- Safety aspects of cell culture
- Ethics and cell culture
- The cell environment
- Cryopreservation and storage of cell lines
- Good cell banking protocols
- Authentication of cell lines
- Cell culture protocols
- Testing for bacteria, fungi and mycoplasma
- Cell vs Tissue culture

Upstream & Downstream Processing

Module Type: Elective

- UPSTREAM PROCESSING:
 - Plants and animals as bioreactors
 - Bioreactor design
 - Genetically modified cells
- DOWNSTREAM PROCESSING:
 - Tools for identification of product
 - Product isolation methods and limitations
 - Product purification challenges and methods

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Biomedical Informatics

Biomedical Imaging Technologies

Module Type: Elective

Concepts in digital imaging; Imaging cells with Confocal Microscopy; Chromosome level imaging with Fluorescent in-situ Hybridization; MRI; X-ray and Ultrasonic imaging; Contexts in each case

Biomedical Data Management

Module Type: Elective

Concepts in data management & databases; LIMS introduction and implementation; Use of MySQL & scripting environment to work with DBs in a biomedical setting; Contexts in each case.

Next Generation Sequencing Technologies

Module Type: Elective

Concepts in genomes & genome sequencing; the Human Genome Project; Algorithms used to re-construct genomes; 'Desktop' sequencing technology - Solexa, 454 and other products; Genome screening & SNPs - the biomedical perspective; Contexts.

Genome Technologies

Module Type: Elective

Concepts in genomes from an information theory perspective; storage of genomes at UCSC, EBI-EMBL; Using browser technologies to examine genomes; Introduction to entry level bioinformatics software; Working with genomes locally in a biomedical context

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Marketing & Sales

Introduction to Marketing

Module Type: Elective

- What is marketing?
- The marketing context.
- Customers and competitors.
- Buyer Behaviour.
- Marketing Research.
- Marketing Strategy.
- Products: Characteristics and Strategies.
- Pricing: Influences, Strategies and Methods.
- Promotions I: Marketing Communications.
- Promotions II: Impersonal Marketing Communications.
- Place: Marketing Channels.
- Marketing Decisions and Planning.

Marketing Information & Research

Module Type: Elective

- Importance of Marketing Research.
- Types of Research.
- Marketing Information Systems.
- Decision Support Systems.
- The Marketing Research Process.
- Secondary Research.
- Collecting Primary Data.
- Analysing Marketing Data.
- Interpreting Research Findings.
- Ethics In Marketing Research

Marketing Policy & Planning

Module Type: Elective

- Policy Perspectives of the Marketing Mix.
- Market Structure and Competitor Analysis.
- New Product Development.

- Product-Lifecycle Management
- Customer Relationship Management.
- Strategies for Service Markets
- The nature of Customer Service
- Measuring Market Opportunities: Forecasting Growth
- Organising and Planning for Effective Implementation.
- Measuring and Delivering Marketing Performance.

Selling & Sales Management

Module Type: Elective

- Nature of personal selling
- Overview of sales management
- Elements of the personal selling process
- Sales prospecting
- Closing the sale
- Customer satisfaction and loyalty
- Management of the sales force
- Recruiting and selecting sales force personnel
- Controlling and evaluating sales force performance

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