AUTOMATION & MECHATRONIC SYSTEMS COURSE MODULES

A bionic arm, a self-driving car and an autopilot train system - these are some icons of the amazing world of automation technology that are brought about by integrating various fields of engineering. If you want to engineer the next generation of smart machines, the Diploma in Automation & Mechatronic Systems [AMS] is your ideal choice.

AMS prepares students for exciting careers in diverse fields ranging from aerospace, marine, industrial systems and healthcare to surgical and consumer product industries. You will learn to use automation and mechatronic technology to develop high-tech solutions for consumer products and industrial applications. What's more, AMS's strong emphasis on De sign Thinking and Practice will give you an edge in creating innovative solutions for using clean energy, developing new materials and processes, and designing high-tech consumer and industrial products.

In the first two years, you will build a strong grounding in the various disciplines of engineering - electrical, electronics, mechanical and computer programming. You will also be equipped with applied design thinking skills.

In your third year, you will learn how to integrate automation systems and manage projects. You will also go on a six-month internship with companies such as ST Kinetics, PSA Singapore, Keppel Offshore & Marine and A*STAR. Or you can choose to work on a final-year project to design and develop a "smart" product prototype. Depending on your interest, you can choose to specialise in one of our three specialisation options: Industrial Systems, Aerospace Systems and Marine & Offshore Systems.

SPECIALISATION OPTIONS

Industrial Systems

You will develop skills and expertise in automation techniques, systems design and integration skills as well as problem -solving techniques used in the design and integration of industrial systems.

Aerospace Systems

You will learn how to apply knowledge in mechanics, structure propulsion and electronics to the design and development of aerospace systems and appreciate the use of automation systems in the aerospace industry**.**

Marine & Offshore Systems

You will be taught the fundamentals of marine engineering, propulsion, as well as ship and oil production to gain an understanding of the various systems used in ship production and offshore facilities.

LEVEL 3.1 & 3.2

Automation Systems Integration

This practical-based module aims to equip students with a working knowledge of advanced process control involving both digital Input/Output and analogue Input/ Output, industrial standard PLC (Programmable Logic Controller) programming using IEC 6113 standard languages. Students will also be exposed to robot applications and programming using academic robots with programming environment.

Students will acquire PLC programming skills using Ladder Diagram, Structures Text (ST), and Sequential Function Chart (SFC) through practical sessions in programming on Modular Production System. Practical sessions in off-line (virtual) robot programming on DENSO VE206A robotic will enable students to understand the implementation of robot motion control for automated process.

Emerging Mechatronic Technologies (Project Track Only)

This module comprises three areas of engineering: Micro Electromechanical Systems (MEMS), Introduction to Digital Image Processing and Applied Optics. The topics covered in MEMS provide an understanding of MEMS devices, their fabrication techniques and applications. Digital Image Processing provides techniques of image processing using

software and GUI commands. Students will also learn about image manipulation, analysis and video tracking. Applied Optics will expose students to the basic optical theories, equipment and effect of different lighting systems.

Final-year Project

In this module, students will work in teams to design and develop a product or system related to the final-year specialisation module. In the project, students learn to apply their knowledge and skills in creative problem solving, engineering and design, teamwork and project management. This module focuses on the identification of problem or need, research and design. Student are required to fabricate the prototype, assemble the parts, test and refine the prototype, and prepare the refined design and a project report. Students are also required to do a final presentation to a panel of examiners.

Project Management

This module aims to provide students with a thorough understanding of Projects and Project Management techniques such as Project Planning, Scheduling and Controlling using network analysis such as Critical Path Method (CPM), Gantt Charts and Program Evaluation & Review Technique (PERT). The major topics include: Introduction to Projects and Project Management, CPM, Resource Scheduling, Project Costs, Project Control and PERT. The course is supplemented with tutorial assignments. Case studies are included to reinforce basic understanding and concepts which can be applied in practical situations.

Six-Month Internship

The six-month internship provides students with the opportunity to apply the knowledge acquired in the classroom to work situations, and demonstrate problem solving, communication and interpersonal skills in a work environment. The programme enables students to hone their ability to work independently and in teams, while they take on one or more practical projects under the supervision of industry practitioners. The objective is to develop a professional approach to work based on the relevant code of practice.

Systems Modelling & Control

The module focuses on modelling the dynamics of process and servo systems and shaping the dynamic response through closed-loop control. Students will learn the principles of systems modelling, simulation, analysis and control, and the application of these principles in systems analysis and synthesis. Major topics include modelling single discipline and mixed systems, Laplace transform, s-plane, standard forms, time-domain specifications, effects of control actions on system performance, and frequency response analysis.

AEROSPACE SYSTEMS SPECIALISATION

Aircraft Propulsion Systems

This module aims to provide students with fundamental knowledge of the aircraft power plant. Students will learn the basic principles of aircraft propulsion systems and a general understanding of the design features of some of the components and subsystems. Topics include gas turbine cycles, various jet and rocket propulsion systems, design features of inlets, compressors, combustion chambers, turbines and other elements of propulsion systems.

Aircraft Structures & Systems

This module aims to provide students with fundamental knowledge of aircraft structures and systems and design features of aircraft structures, general construction of the fuselage and main control surfaces. Auxiliary systems such as hydraulic systems, pneumatic systems, electrical systems, fuel systems, de-icing and anti-icing systems, auxiliary power units, environmental control, communications systems and weapon systems will be explained in this module.

Avionics Theory & Systems

This module covers the various avionics instruments and systems used in modern aircraft, the requirement for zero visibility flying, the functions and operation of various cockpit instruments, flight environmental systems, sensing devices and electrical power systems used in aircraft. Due emphasis is given to electronics for navigation,

communications, surveillance and control.

MARINE & OFFSHORE SYSTEMS SPECIALISATION

Marine Engineering Systems

This module aims to equip students with knowledge of marine piping, pumping, heating and cooling, and auxiliary machinery that supports the diesel propulsion plant. Learning is reinforced through practical work involving common marine equipment. Topics include fluid flows, pipe design, pumping system, heat transfer and heat exchangers, prime movers, fuel system, cooling system and lubricating system.

Offshore Production Systems

This module aims to equip students with the knowledge of offshore oil and gas production systems that include the various offshore oil and gas platforms, marine exploration, well-drilling and floating production systems. Students will be equipped with fundamental knowledge of automation principles about drilling, separation, gas and water treatment, gas flaring, and enhanced recovery and utility systems. Subsea production systems, flow lines and risers dynamics, as well as the dynamics and control of remote-operated vehicles will also be covered.

Shipyard Production Systems

This module aims to equip students with the knowledge of the shipyard production systems involved in the design, engineering and commissioning found in shipbuilding, rig-building, ship repair and conversion. Practical hands-on work includes programming CNC machines, plasma-cutting machines and commissioning equipment. The module has a mini capstone project on designing a shipyard with state-of-the-art automation systems for the next generation shipyard.

INDUSTRIAL SYSTEMS SPECIALISATION

Communication & Vision Systems

The module focuses on 2 areas of engineering: Data Communication and Networking, specifically on Fieldbuses and Industrial Networks, and Computer Vision. The topics covered in Data Communication and Networking provide a basic understanding of both wired and wireless communication technologies based on the various network standards and models. Fieldbuses and Industrial Networks aims to expose students to the various industrial networks protocols used in process control and automation. Computer Vision provides basic knowledge of various image processing techniques.

Industrial Drive Systems

This module builds on modules taught in Level 1 and 2 to equip students with knowledge of both electrical and mechanical drive systems which are the core manipulating and actuating systems of all machines. This module focuses on practical knowledge required to select (sizing), implement (commissioning) and maintain the multi axis system. Topics cover introduction of multi axes system and the components with many variations and types that are available in the industry. Motors, motor drives, encoders, power supply, mechanical drives and brakes, motion controller and structures required to mount these motors are also taught.

Unmanned Systems

This module introduces the system architecture of unmanned systems. Students will gain practical insight into both hardware and software aspects in developing, integrating and operating unmanned systems. Topics of hardware components such as battery systems, navigation sensors, and detection systems along with software components such as operating system and motion planning will be covered. Students will also review case studies of unmanned systems operating across land, sea and sky.

DIPLOMA PLUS PROGRAMME The Diploma Plus Programme (DPP) is designed to provide students with proficiency in a selected domain area, either to broaden or deepen their knowledge/skills in their main discipline of study, or to equip them with additional professional knowledge that would better prepare them for further

study or increase their employability. Students can select elective modules from a wide range of clusters to obtain their Diploma Plus Certificate. DPP is optional and it will not affect the graduating requirement for the award of a diploma.

Students can choose the DPP clusters from the list below. The offer of a DPP cluster is subject to the condition that the minimum class size is met and based on available vacancies.

Engineering clusters

- Applied physics#
- Aviation fundamentals
- Workplace Safety & Health

Other available Diploma Plus Certificates

- Advanced Engineering Mathematics*
- Business**
- Innovation Management
- Foreign Languages

The Applied Physics syllabus is aligned with the NTU's FE1012: Physics A module. NP students who obtain good grades in the Applied Physics modules will be granted exemption from the FE1012: Physics A module.

* The CAEM syllabus is aligned with the 'A' Level H2 Pure Mathematics syllabus. NP graduates who have successfully completed the revised CAEM will be granted exemption from the NUS' MA1301 Proficiency Test.

** Students pursuing the Minor in Business Management cannot take the DPP Certificate in Business (CIB).

COURSE CURRICULUM

Curriculum structure is currently under review and changes are still pending.

YEAR 3

INTERNSHIP

Level 3.1 (28 hours per week)

Automation Systems Integration	4
Project Management	3
Systems Modelling & Control	5
Project ID - Connecting the Dots ^	4

AEROSPACE SYSTEMS SPECIALISATION

Aircraft Propulsion Systems	4
Aircraft Structures & Systems	4
Avionics Theory & Systems	4

MARINE & OFFSHORE SYSTEMS SPECIALISATION

Marine Engineering Systems	4
Offshore Production Systems	4
Shipyard Production Systems	4

INDUSTRIAL SYSTEMS SPECIALISATION

Communication & Vision Systems	4
Industrial Drive Systems	4
Unmanned Systems	4

Level 3.2 (22 hours per week)

6-Month Internship	22

NON-INTERNSHIP

Level 3.1 (28 hours per week)

Automation Systems Integration	4
Project Management	3
Systems Modelling & Control	5
Project ID - Connecting the Dots ^	4

AEROSPACE SYSTEMS SPECIALISATION

Aircraft Propulsion Systems	4
Aircraft Structures & Systems	4
Avionics Theory & Systems	4

MARINE & OFFSHORE SYSTEMS SPECIALISATION

Marine Engineering Systems	4
Offshore Production Systems	4
Shipyard Production Systems	4

INDUSTRIAL SYSTEMS SPECIALISATION

Communication & Vision Systems	4
Industrial Drive Systems	4
Unmanned Systems	4

Level 3.2 (22 hours per week)

Emerging Mechatronic Technologies	5
Final-year Project	17

Notes:

^ For more details on Interdisciplinary Studies (IS) electives, please log on to www.np.edu.sg/is/

IS Modules

The School of Interdisciplinary Studies (IS) delivers a broad-based curriculum, which nurtures a new generation of professionals with multidisciplinary skills and an innovative and entrepreneurial spirit to meet the challenges of a knowledge economy. IS offers both prescribed modules and electives to challenge boundaries. Prescribed modules develop students' competencies in core areas such as Communication, Innovation and Enterprise, Culture and Communication, and Personal Mastery and Development, while elective modules provide insights into Arts and Humanities, Business, Design, and Science and Technology.