Automation Engineering
BEng
AUTOMATION ENGINEERING

Due to competition in the industry and the crisis on labour costs, industrial systems tend
to use automated systems to improve product quality and reduce labour costs by the use of
computer technology and manufacturing information management such as the integration of
Manufacturing Execution System (MES) and the Enterprise Resource Planning (ERP), for the
purposes of planning and manufacturing organisation. Moreover, labour market currently opens
not only the domestic market, but also the global labour market especially in Southeast Asia.
Thailand has a commitment to promote the ASEAN community and liberalisation of goods and
labours between countries in the region. Essentially, we must be able to produce engineers, in
addition to the required knowledge and skills in engineering, who have the skills to communicate
well in English and understand the cultural of different countries in order to work successfully in
the global engineering environment.

KMUTT recognises these needs. As a consequence, the Department of Control Systems
and Instrumentation Engineering, which has expertise in automation and control (level 1 and level
2), and the Department of Computer Engineering, which has expertise in database and
information management (level 3.), have jointly established a new international programme,
namely the Automation Engineering, to produce graduates with skills and knowledge of
automation technology.

![Image of automation and information industry]

Figure 1 Information and automation industry
## Automation Engineering

**COURSE TITLE:** Bachelor of Engineering Program in Automation Engineering

### COURSE STRUCTURE

#### First Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEN 101 Physical Education</td>
<td>1</td>
</tr>
<tr>
<td>LNG 105 Academic English</td>
<td>3</td>
</tr>
<tr>
<td>MTH 101 Calculus and Analytics</td>
<td>3</td>
</tr>
<tr>
<td>PHY 103 General Physics</td>
<td>3</td>
</tr>
<tr>
<td>CPE 110 Computer Exploration</td>
<td>3</td>
</tr>
<tr>
<td>CPE 100 Programming</td>
<td>3</td>
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<tr>
<td>LNG xxx Integrated English:</td>
<td>1</td>
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</table>

**Total Credits: 17**

#### Second Semester

| GEN 111 Man and Ethics of Living | 3       |
| LNG 106 Academic Listening      | 3       |
| MTH 102 Calculus and Analytic   | 3       |
| CPE 112 Discrete Mathematics    | 3       |
| CPE 130 Algorithms and Data     | 3       |
| INC 111 Basic Engineering       | 3       |

**Total Credits: 18**

#### Second Year

<table>
<thead>
<tr>
<th>First Semester</th>
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<tbody>
<tr>
<td>LNG 107 Academic Reading and Writing</td>
<td>3</td>
</tr>
<tr>
<td>MTH 201 Linear Algebra</td>
<td>3</td>
</tr>
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<td>CPE 220 Digital System Design</td>
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<td>CPE 221 Digital System Laboratory</td>
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</tr>
<tr>
<td>CPE 231 Principles Programming Languages</td>
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</tr>
<tr>
<td>INC 211 Mathematics</td>
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**Total Credits: 17**

#### Second Semester

| GEN 121 Learning and Problem Solving Skills | 3       |
| GEN 231 Miracle of Thinking              | 3       |
| STA 302 Statistics for Engineers         | 3       |
| INC 212 Signals and Systems              | 3       |
| INC 221 Electronics Devices              | 3       |
| INC 241 Programmable Logic Control       | 3       |

**Total Credits: 18**
### Third Year

**First Semester**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>MEE 224</td>
<td>Thermal Engineering</td>
<td>3</td>
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<tr>
<td>CPE 332</td>
<td>Database and ERP Systems</td>
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</tr>
<tr>
<td>CPE 325</td>
<td>Computer Architectures and Systems</td>
<td>3</td>
</tr>
<tr>
<td>INC 331</td>
<td>Industrial Process Measurement</td>
<td>3</td>
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<td>INC 341</td>
<td>Feedback Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>INC 352</td>
<td>Process Control and Instrumentation Drawing</td>
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<tr>
<td>LNG xxx</td>
<td>Integrated English : Presentation</td>
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**Second Semester**

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<thead>
<tr>
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<tbody>
<tr>
<td>EEE 118</td>
<td>Electromechanical Energy Conversion</td>
<td>3</td>
</tr>
<tr>
<td>CPE 341</td>
<td>Computer Network</td>
<td>3</td>
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<tr>
<td>CPE 342</td>
<td>Computer Network Laboratory</td>
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<tr>
<td>INC 354</td>
<td>Process Instrumentation Laboratory</td>
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</tr>
<tr>
<td>INC 342</td>
<td>Industrial Process Control</td>
<td>3</td>
</tr>
<tr>
<td>INC 361</td>
<td>Microprocessor Systems and Applications</td>
<td>3</td>
</tr>
<tr>
<td>INC 441</td>
<td>Automation System Technology</td>
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<tr>
<td>LNG xxx</td>
<td>Integrated English : Writing</td>
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**Summer Session**

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<tr>
<td>INC 300</td>
<td>Industrial Training</td>
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### Forth Year

**First Semester**

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<tbody>
<tr>
<td>GEN 241</td>
<td>Beauty of Life</td>
<td>3</td>
</tr>
<tr>
<td>GEN xxx</td>
<td>Approved Elective (GEN)</td>
<td>3</td>
</tr>
<tr>
<td>INC 451</td>
<td>Process Control Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>INC 457</td>
<td>Control and Instrumentation Engineering Project Study</td>
<td>1</td>
</tr>
<tr>
<td>INC xxx</td>
<td>Approved Elective (INC)</td>
<td>3</td>
</tr>
<tr>
<td>PRE 394</td>
<td>Industrial Safety</td>
<td>3</td>
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<tr>
<td>XXX xxx</td>
<td>Free Elective</td>
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<td><strong>Total Credits</strong></td>
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**Second Semester**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>GEN 351</td>
<td>Modern Management and Leadership</td>
<td>3</td>
</tr>
<tr>
<td>GEN xxx</td>
<td>Approved Elective (GEN)</td>
<td>3</td>
</tr>
<tr>
<td>INC xxx</td>
<td>Approved Elective (INC)</td>
<td>3</td>
</tr>
<tr>
<td>INC 458</td>
<td>Control and Instrumentation Engineering Project</td>
<td>3</td>
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<tr>
<td>XXX xxx</td>
<td>Free Elective</td>
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<td></td>
<td><strong>Total Credits</strong></td>
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Curriculum

1. General Education Courses 34 Credits

1.1 Physical Education 1 Credit

GEN 101 Physical Education 1 Credit

1.2 Integration 15 Credits

GEN 111 Man and Ethics of Living 3 Credits
GEN 121 Learning and Problem Solving Skills 3 Credits
GEN 231 Miracle of Thinking 3 Credits
GEN 241 Beauty of Life 3 Credits
GEN 351 Modern Management and Leadership 3 Credits

1.3 Linguistics 12 Credits

LNG 105 Academic English for International Students 3 Credits
LNG 106 Academic Listening and Speaking 3 Credits
LNG 107 Academic Reading and Writing 3 Credits
LNG xxx Integrated English : Listening 1 Credit
LNG xxx Integrated English : Presentation 1 Credit
LNG xxx Integrated English : Writing 1 Credit

NB: LNG xxx represents a course which integrates English with an engineering core course.

1.4 Approved Elective 6 Credits

Students must select at least 2 courses with maximum 6 credits in total.

GEN 211 The Philosophy of Sufficiency Economy 3 Credits
GEN 301  Holistic Health Development  3 Credits
GEN 311  Ethics in Science-based Society  3 Credits
GEN 321  The History of Civilization  3 Credits
GEN 331  Man and Reasoning  3 Credits
GEN 341  Thai Indigenous Knowledge  3 Credits
GEN 352  Technology and Innovation for Sustainable Development  3 Credits
GEN 353  Managerial Psychology  3 Credits
GEN 411  Personnel Development and Public Speaking  3 Credits
GEN 421  Integrative Social Sciences  3 Credits
GEN 441  Culture and Excursion  3 Credits

2. Professional Courses  

2.1 Sciences and Mathematics  

MTH 101  Calculus and Analytic Geometry I  3 Credits
MTH 102  Calculus and Analytic Geometry II  3 Credits
MTH 201  Linear Algebra and Vector Calculus  3 Credits
STA 302  Statistics for Engineers  3 Credits
PHY 103  General Physics I  3 Credits

2.2 Basic Engineering  

EEE 118  Electromechanical Energy Conversion  3 Credits
PRE 394  Industrial Safety  3 (3-0-6)  3 Credits
MEE 224  Thermal Engineering  3 Credits
### 2.3 Computer Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CPE 100</td>
<td>Introduction to Computer Programming</td>
<td>3</td>
</tr>
<tr>
<td>CPE 110</td>
<td>Computer Engineering Exploration</td>
<td>3</td>
</tr>
<tr>
<td>CPE 112</td>
<td>Discrete Mathematics for Computer Engineers</td>
<td>3</td>
</tr>
<tr>
<td>CPE 130</td>
<td>Algorithms and Data Structures</td>
<td>3</td>
</tr>
<tr>
<td>CPE 220</td>
<td>Digital System Design</td>
<td>3</td>
</tr>
<tr>
<td>CPE 221</td>
<td>Digital System Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>CPE 231</td>
<td>Principles of Programming Languages</td>
<td>3</td>
</tr>
<tr>
<td>CPE 325</td>
<td>Computer Architectures and Systems</td>
<td>3</td>
</tr>
<tr>
<td>CPE 332</td>
<td>Database and ERP Systems</td>
<td>3</td>
</tr>
<tr>
<td>CPE 341</td>
<td>Computer Networks</td>
<td>3</td>
</tr>
<tr>
<td>CPE 342</td>
<td>Computer Network Laboratory</td>
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</table>

### 2.4 Control Systems & Instrumentation Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>INC 111</td>
<td>Basic Engineering Circuit Analysis</td>
<td>3</td>
</tr>
<tr>
<td>INC 211</td>
<td>Mathematics for Signals and Systems</td>
<td>3</td>
</tr>
<tr>
<td>INC 212</td>
<td>Signals and Systems</td>
<td>3</td>
</tr>
<tr>
<td>INC 221</td>
<td>Electronics Devices and Circuit Design</td>
<td>3</td>
</tr>
<tr>
<td>INC 241</td>
<td>Programmable Logic Control</td>
<td>3</td>
</tr>
<tr>
<td>INC 331</td>
<td>Industrial Process Measurement</td>
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</tr>
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<td>INC 341</td>
<td>Feedback Control Systems</td>
<td>3</td>
</tr>
</tbody>
</table>
INC 300  Industrial Training          2 (S/U)
INC 342  Industrial Process Control    3 Credits
INC 352  Process Control and Instrumentation Drawing 1 Credit
INC 354  Process Instrumentation Laboratory 1 Credit
INC 361  Microprocessor Systems and Applications  3 Credits
INC 441  Automation System Technology       3 Credits
INC 457  Control and Instrumentation Engineering Project Study 1 Credit
INC 458  Control and Instrumentation Engineering Project 3 Credits
INC 451  Process Control Laboratory        1 Credit
2.4.2 Approved Elective                       6 Credits
INC 332  Reliability Engineering for Instrumentation Systems 3 Credits
INC 412  Digital Filter Design              3 Credits
INC 421  Electrical Motor Drive and Control     3 Credits
INC 422  Control of Power Electronic Circuits and Electrical Motors 3 Credits
INC 431  Experimentation and Uncertainty analysis for Engineer 3 Credits
INC 442  Modern Control Systems             3 Credits
INC 443  Digital Control Systems            3 Credits
INC 444  Distributed Process Control Systems 3 Credits
INC 445  Sequence Control Systems           3 Credits
INC 446  Pneumatic and Hydraulic Systems     3 Credits
INC 447  Automation Manufacturing Systems    3 Credits
INC 461  Fundamental of Discrete Structure and Numerical Processing  3 Credits

INC 462  Application of Industrial Computer  3 Credits

INC 521  System Identification  3 Credits

INC 481  Special Topic in Instrumentation and Control Systems Engineering 1  3 Credits

INC 482  Special Topic in Instrumentation and Control Systems Engineering 2  3 Credits

INC 483  Special Topic in Instrumentation and Control Systems Engineering 3  3 Credits

3. Free Elective Courses not less than 6 Credits
Course Descriptions

I: General Education Subjects

1) Physical Education

GEN 101 Physical Education  1(0-2-2)

This course aims to study and practice sports for health, principles of exercise, care and prevention of athletic injuries, and nutrition and sports science, including basic skills in sports with rules and strategy from popular sports. Students can choose one of several sports provided, according to their own interest. This course will create good health, personality and sportsmanship in learners, as well as develop awareness of etiquette of playing, sport rules, fair play and being good spectators.

2) Integration

GEN 111 Man and Ethics of Living  3(3-0-6)

This course studies the concept of living and working based on principles of religion, philosophy, and psychology by fostering students’ morality and ethics through the use of knowledge and integrative learning approaches. Students will be able to gain desirable characteristics such as faithfulness, social responsibility, respect of others, tolerance, acceptance of differences, self-discipline, respect for democracy, public awareness, and harmonious co-existence.

GEN 121 Learning and Problem Solving Skills  3(3-0-6)

This course aims to equip students with the skills necessary for life-long learning. Students will learn how to generate positive thinking, manage knowledge and be familiar with learning processes through projects based on their interest. These include setting up learning targets; defining the problems; searching for information; distinguishing between data and fact; generating ideas, thinking creatively and laterally; modeling; evaluating; and presenting the project.

GEN 231 Miracle of Thinking  3(3-0-6)

This course aims to define the description, principle, value, concept and nature of thinking to enable developing students to acquire the skills of systematic thinking, systems thinking, critical thinking and analytical thinking. The Six Thinking Hats concept is included. Moreover, idea connection/story line and writing are explored. Examples or case studies are used for problem solving through systematic thinking using the knowledge of science and technology, social science, management, and environment, etc.

GEN 241 Beauty of Life  3(3-0-6)

This course aims to promote the understanding of the relationship between humans and aesthetics amidst the diversity of global culture. It is concerned with the perception, appreciation and expression of humans on aesthetics and value. Students are able to experience learning that stimulates an understanding of the beauty of life, artwork, music and literature, as well as the cultural and natural environments.

GEN 351 Modern Management and Leadership  3(3-0-6)

This course examines the modern management concept including basic functions of management—planning, organizing, controlling, decision-making, communication, motivation, leadership, human resource management, management of information systems, social responsibility—and its application to particular circumstances.
3) Linguistics

**LNG 105 Academic English for International Students 3(3-0-6)**

The course aims at developing academic English skills necessary for learners in an international program. The learning and teaching involves the integration of the four language skills, thinking skills and autonomous learning. In terms of reading, the course focuses on academic reading, reading for main ideas, summarizing skills, critical reading and interpretation skills. In terms of writing, the emphasis is on process writing and academic writing to enable learners to effectively use the information gained from reading to support their statements, and to use appropriate citation to avoid plagiarism. Learners are also going to use dictionaries, grammar books, and appropriate information and communication technology to assist their writing. In terms of speaking, the focus is on impromptu situations, oral presentation, and the sharing and exchanging of ideas on issues related to the learners’ content areas. In terms of listening, the focus is on listening to English lectures and taking notes.

**LNG 106 Academic Listening and Speaking 3(3-0-6)**

This course aims at developing academic listening and speaking skills necessary for learners in international programs. The teaching and learning styles involve an integration of English with content areas related to the learners’ fields. The course aims to enable learners to be able to listen to English lectures in their fields, ask and appropriately respond to questions, share ideas and express opinions, and read and summarize text. Learners will discuss and lead a discussion, make an effective oral presentation, and actively participate in the session.

**LNG 107 Academic Reading and Writing 3(3-0-6)**

The course aims at developing academic reading and writing skills necessary for learners in international programs. The teaching and learning styles involve an integration of English into learners’ content areas to enable them to read academic articles in their chosen fields. Learners will be able to extract main points from the text, purposefully select required information to support their writing, write different forms of reports in their fields, use information obtained from reading and their own experiment in writing an essay, and effectively use references and citations throughout the writing process.

4) Approved Elective

**GEN 301 Holistic Health Development 3(3-0-6)**

The objective of this course is to develop students’ holistic knowledge on health development for good life quality. The course emphasizes both physical and mental health care promotion, including composition of wellness; factors affecting health; integrated health care; nutrition; immunity strengthening; sanitation; competent reinforcement of physical activities to empower the smart personality and the smart mind, and to facilitate healthy and balanced emotional development; preventing and solving problems on mental health; practices in concentration, meditation and self-understanding; definition of wellness by WHO; and information on general health check up and physical fitness tests.

**GEN 211 The Philosophy of Sufficiency Economy 3(3-0-6)**

This course emphasizes the application of previous Thai economic development approaches, the problems and impacts of the development, the rationale for applying the concept of sufficiency economy to Thai society, the meaning and fundamental concept of the philosophy of sufficiency economy, and the application of this philosophy to lifestyles at individual, community, organization, and national levels. The study covers relevant case studies as well as the Royal Projects.

**GEN 311 Ethics in Science Based Society 3(3-0-6)**

This course will explore a variety of ethical and social issues in science and
technology. Students will study basic theories of ethics from the West and the East. They will learn how to apply these theories to contemporary cases. They will be asked to critically evaluate the role of the scientist in society, and to become aware of complex ethical issues facing scientists in different professions. Case studies will be used extensively throughout the course, with an emphasis on critical debate. The goal of the course is to enable each student to develop an understanding of conflicting opinions regarding science and technology, and to define and refine their own ethical code of conduct based on evaluation of arguments from differing viewpoints.

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<tr>
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<tr>
<td>GEN 411</td>
<td>Personality Development and Public Speaking</td>
<td>3(2-2-6)</td>
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<td></td>
<td>This course aims at developing public speaking skills and personalities of students. The course will cover a diverse range of abilities and skills such as good manners, attire, social rules, communication psychology, and verbal and non-verbal languages. Students are expected to gain these useful skills, including giving reasons, discussion, negotiation, persuasion, presentation, and application of technology for communication.</td>
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</tr>
<tr>
<td>GEN 321</td>
<td>The History of Civilization</td>
<td>3(3-0-6)</td>
</tr>
<tr>
<td></td>
<td>This course will explore a variety of ethical and social issues in science and technology. Students will study basic theories of ethics from the West and the East. They will learn how to apply these theories to contemporary cases. They will be asked to critically evaluate the role of the scientist in society, and to become aware of complex ethical issues facing scientists in different professions. Case studies will be used extensively throughout the course, with an emphasis on critical debate. The goal of the course is to enable each student to develop an understanding of conflicting opinions regarding science and technology, and to define and refine their own ethical code of conduct based on evaluation of arguments from differing viewpoints.</td>
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<tr>
<td>GEN 421</td>
<td>Integrative Social Sciences</td>
<td>3(3-0-6)</td>
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<td></td>
<td>This course integrates four major contents in social sciences, i.e., society and culture, economics, politics and laws, and the environment. The course also covers interesting contemporary social issues, such as ethnic problems, resource distribution, political instability, and environmental deterioration.</td>
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<tr>
<td>GEN 331</td>
<td>Man and Reasoning</td>
<td>3(3-0-6)</td>
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<td></td>
<td>The purpose of this course is to develop analytical thinking skills and reasoning; deductive and inductive approaches; reasoning approaches of the East and the West; and, a case study of formal and informal reasoning of everyday life.</td>
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<tr>
<td>GEN 341</td>
<td>Thai Indigenous Knowledge</td>
<td>3(3-0-6)</td>
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<td></td>
<td>This is a study of indigenous knowledge in different regions of Thailand with a holistic approach, including analyses from scientific, technological, social science and anthropological perspectives. Students will learn how to appreciate the value of indigenous knowledge and recognize the ways in which such knowledge has been accumulated—lifelong learning of indigenous people and knowledge transfer between generations. Students will learn to become systematic, self-taught learners.</td>
<td></td>
</tr>
<tr>
<td>GEN 441</td>
<td>Culture and Excursion</td>
<td>3(2-2-6)</td>
</tr>
<tr>
<td></td>
<td>This course aims at developing public speaking skills and personalities of students. The course will cover a diverse range of abilities and skills such as good manners, attire, social rules, communication psychology, and verbal and non-verbal languages. Students are expected to gain these useful skills, including giving reasons, discussion, negotiation, persuasion, presentation, and application of technology for communication.</td>
<td></td>
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</table>
GEN 352  Technology and Innovation for Sustainable Development  3(3-0-6)

This course is the study of the definitions, concepts and roles of technology and innovation in the creation of wealth, and their impact on society and humanity. The course will explore the policies, strategies, and tools for synthesizing and developing technology and innovation for a wisdom-based society together with ethics in management. Students will study the exploitation and protection of intellectual property as a result of technology and innovation.

GEN 353  Managerial Psychology  3(3-0-6)

This course focuses on the fundamental concepts of psychology and management of human behavior in an organization, including psychological factors and their effect on human working behavior such as attitude, communication, social influences and motivation. Moreover, it will incorporate organizational behavior modification, conflict management, and leadership and organizational effectiveness.

II: Professional Subjects

1.) Science and Mathematics

MTH 101  Calculus and Analytic Geometry I  3(3-0-6)

Limits and continuous functions: limits of function, computation of limits, continuous functions, the maximum-value theorem and the intermediate-value theorem. Derivatives: basic concepts of the derivative, anti-derivative. Derivative of algebraic functions, derivative of trigonometric functions, the chain rule. Applications of derivatives: Rolle’s theorem and mean-value theorem, concavity and second derivatives, using the derivative and limits in sketching graph, applied maximum and minimum problems, implicit differentiation, differentials. The definite integral: basic concepts of definite integrals, Fundamental theorem of calculus, properties of anti-derivatives and definite integrals. The number e, logarithmic functions, derivatives of logarithmic functions. Natural logarithm defined as a definite integral, inverse functions and the derivative of b^x, derivatives of inverse trigonometric functions, related rates, L’hopital’s rules. Methods of integration: integration by substitution, integration by partial fractions. Applications of the definite integrals: areas, volumes, centroids, work, arc length, areas of surfaces of revolution, improper integrals.

MTH 102  Calculus and Analytic Geometry II  3(3-0-6)

Plane curve and polar coordinates: areas in the polar coordinate, parametric equations, arc length and speed on a curve, the angle between a line and a tangent line, the second derivative and the curvature of a curve. Complex numbers. Graph of equations. Functions and level curves. Partial derivatives. Differentials. The chain rule. Critical points. Second order partial derivative and relative extreme. Definite integrals over plane and solid regions. Series: sequences, series, the integral test, the comparison test, the ratio test, the alternative series and absolute convergence tests. Binomial expansion. Power series. The Taylor’s formula. Fourier series. Periodic functions. The Euler formula. Convergence of Fourier series. Fourier integral.

MTH 201  Linear Algebra and Vector Calculus  3(3-0-6)

Prerequisite: MTH 102


STA 302  Statistics for Engineers  3(3-0-6)
Prerequisite: MTH 102

Probability theory: axioms for probability in discrete sample space, counting sample point, independent and dependent event. Bayes’ theorem, binomial, poisson, normal distribution, joint distribution, distribution of sums and averages, central limit theorem, covariance and correlation, sampling distribution: F-distribution, estimation and hypothesis testing, least squares methods.

PHY 103  General Physics I  3(3-0-6)


2.) Compulsory Engineering Subjects

EEE 118  Electromechanical Energy Conversion  3(3-0-6)
Prerequisite: EEE 110 or INC 112


PRE 394  Industrial Safety  3(3-0-6)

Nature of accident in industrial and need of accident prevention. Planning for safety such as plant layout, machine guarding, maintenance, etc. Safety in specific hazard such as handling of materials, welding, boiler operation, silo, electricity, toxic materials, flammable and explosive
materials. Organization and administration of safety program. Safety training and cost study in accident anal.

**MEE 224  Thermal Engineering  3(3-0-6)**

Prerequisite: PHY 103


2.) Computer Engineering

**CPE 100  Introduction to Computer Programming  3(2-2-6)**

Programming concepts will be covered while the syntax and semantics of C language will be emphasized. Lab hours will focus on programming experience. Subject matter includes input, output, expression grammar, library function calls, selection structures, looping construction, arrays, writing functions, understanding pointers, file processing, and using structures. An introduction to object-oriented programming with C++ will also be covered.

**CPE 110  Computer Engineering Exploration  3(3-0-6)**

Introduction to practical concepts of computer systems and its components including basic electric circuits, electronic devices, logic gates and digital circuits, and hardware interfacing. Hands-on experience focuses on computer simulations and experiments on the mentioned topics.

**CPE 112  Discrete Mathematics for Computer Engineers  3(3-0-6)**

Basics of logic: relations, mathematical reasoning and logical reasoning, propositional logic, and predicate logic. Introduction to logic programming, graphs, trees, finite automata and context-free grammar, and the Turing machine. Introduction to the complexity analysis of algorithms and to number theory.

**CPE 130  Algorithms and Data Structures  3(3-0-6)**

Prerequisite: CPE 110

Introduction to data representation and structure, array, linked-listed, stacks and queues, trees, graphs, analysis of algorithms, recursion, sorting and searching algorithms, hashing, heap tree, binary search tree, AVL tree, breadth first search, dept first search, string processing, and data compression.

**CPE 220  Digital System Design  3(2-2-8)**

Integration: CPE 221

Number systems, codes, logic gates, Boolean algebra, logic functions, multi-level combinational logic and simplification, flip-flops and related devices, sequential logic design and optimization, types of registers and counters including design and implementation, programmable and steering logic, PALs and PLAs, multiplexers and selectors, logic design in computer simulation program.

**CPE 221  Digital System Laboratory  3(1-3-8)**

Integration: CPE 220

Experiments on digital circuit design using both simulation programs and actual circuits. The
experiments consist of basic logic gates, clock generation circuits, counter circuits, encoder circuits, decoder circuits, shift register current, arithmetic circuits, multiplexer and demultiplexer circuits, digital-to-analog and analog-to-digital circuits, and design and implementation of Field Programmable Gate Array (FPGA) circuits.

**CPE 231  Principles of Programming Languages  3(3-0-6)**
Prerequisite: CPE 130

Programming language paradigms and the principle of programming language design are provided. The structure and design principles of programming languages consist of syntax and semantic, notion of type, role of variable declarations, bindings and scope, sequence control, subprogram control, and abstract data type. Four programming language paradigms include imperative programming, object-oriented programming, functional programming, and script programming.

**CPE 325  Computer Architectures an Systems  3(2-2-8)**
Prerequisite: CPE 220
Integration: CPE 326

Topics cover processor technology, input and output, memory hierarchy, interleaved memory, bus, cache, pipelined architectures, computer arithmetic, and multiprocessors technology. The course will also discuss machine instructions and assembly language to be applied to actual microprocessor design for physical control and data communications.

**CPE 332  Database and ERP Systems  3(3-0-6)**
Prerequisite: CPE 130

Introduction to the practical concepts in database system analysis, design and implementation. Hands-on experience will also be emphasized in developing front-end software for a backend database of a client-server, 3-tier architecture with web browser interface. Theoretical aspects of relational databases general to all database products will be the focus, while specific database products including Microsoft SQL, Oracle, and MySQL will be covered. Database concepts covered include data modeling, SQL, database design, normalization, multi-user databases, access standards such as ODBC, ADO, and XML. Concepts in Enterprise Resource Planning will be covered throughout such as manufacturing, MRP, finance, human resource management, and inventory management.

**INC 341  Computer Networks  3(3-0-6)**
Prerequisite: CPE 340
Integration: CPE 342


**CPE 342  Computer Network Laboratory  2(1-3-8)**
Integration: CPE 341


3.) Control Systems & Instrumentation Engineering
3.1) Core Subjects

INC 111  Basic Engineering Circuit Analysis  3(3-0-6)

Units and scales, charge, current, voltage, power, electrical sources, Ohm’s law, Kirchhoff’s law, resistors in series and parallel, voltage and current division, nodal analysis, mesh analysis, superposition, Thevenin and Norton equivalent circuits, maximum power transfer, delta-wye conversion, capacitance and inductance combinations, basic RL and RC circuits, RLC circuits, natural and force response from RL, RC, and RLC circuits, phasor analysis, AC circuit power analysis.

INC 211  Mathematics for Signals and Systems  (3-0-6)

Introduction to differential and difference equations. Linear constant-coefficient differential and difference equations. Homogeneous and particular solution of linear differential and difference equations with constant coefficients. The Laplace and z-transforms and their applications to solution of systems governed by differential and difference equations. Numerical methods to solve differential equations. Introduction to partial differential equations. Elementary of continuous-time (CT) and discrete-time (DT) signals and systems: classification of signals and system properties. Representation of discrete and continuous linear time invariant (LTI) systems in the time domain with response developed via the convolution sum and the convolution integral.

INC 212  Signals and Systems  3(3-0-6)

Prerequisite: INC 111 or equivalent


INC 221  Electronics Devices and Circuit Design  3(2-3-6)

Prerequisite: INC 111 or equivalent

Basic semiconductor physics and p-n junction theory. Diodes and zener Diodes characteristics and specifications. Wave shaping circuits, simple DC power upply and DC voltage multiplier circuit design. Bipolar Junction Transistor (BJT) and Field Effect Transistor (FET) : operations, characteristics and specifications. DC biasing technique. Analysis and design of BJT and FET amplifiers. Operational amplifiers (op amp) : theory of operation, characteristic and specifications of devices, linear and non-linear applications. Analysis and design of selected electronic circuits such as power supply, filter circuit, and amplifiers. Experiments and application of electronic devices.

INC 241  Programmable Logic Control  3(2-3-6)

Prerequisite: INC 221, INC 222 or equivalent

Introduction to automation, Sensors and actuators, Hardwire control, Structure of PLC: modules and their functionalities: input-output, and power supply. Guidelines for wiring related to PLC, sequence control, programming languages and instruction sets. Laboratories: programming for controlling simulation models: lifts, motor controls, and conveyors. Man-
machine Interface.

**INC 331  Industrial Process Measurement  3(3-0-6)**

Prerequisite: INC 232 or equivalent


**INC 341  Feedback Control Systems  3(3-0-6)**

Prerequisite: INC 212 or equivalent


**INC 300  Industrial Training  2(S/U)**

All students are required to undergo industrial training for a minimum period of six weeks during University’s summer break.

**INC 342  Industrial Process Control  3(3-0-6)**

Prerequisite: INC 341 or equivalent


**INC 352  Process Control and Instrumentation Drawing  1(0-3-3)**


**INC 354  Process Instrumentation Laboratory  1(0-3-3)**

Prerequisite: INC 331

Experiments on measurement of various process variables, such as temperature, pressure, flow, and level. Instrument calibration. Process control. Digital filters.

**INC 361  Microprocessor Systems and Applications  3(3-0-6)**

Prerequisite: INC 111,INC 222 or equivalent

systems and input/output programming. Principles of interrupt and interrupt programming. Background/foreground programming.

**INC 441  Automation System Technology** 3(3-0-6)
Prerequisite: INC 342

**INC 457  Control and Instrumentation Engineering Project Study** 1(0-3-3)
An individual or a group of students proposes a project related to control and instrumentation engineering and works closely with a member of academic staff to study, research and design the overall system.

**INC 458  Control and Instrumentation Engineering Project** 3(0-8-8)
Prerequisite: INC 457
Implement and complete the project proposed in INC 457.

**INC 451  Process Control Laboratory** 1(-3-3)
Prerequisite: INC 342
The aim of the course is to provide a hands-on laboratory course and computer-based laboratory experiences to solve industrial-based problems which integrate the system aspects of industrial control systems, including plant modeling, real-time programming, plant-computer interface and control algorithm design. Students will work as part of terms. Oral group presentation, written group report and demonstration are required as part of the project.

### 3.2) Approved Elective Subjects

**INC 332  Reliability Engineering for Instrumentation Systems** 3(3-0-6)

**INC 412  Digital Filter Design** 3(3-0-6)
Prerequisite: INC 212 or equivalent

**INC 421  Electrical Motor Drive and Control** 3(3-0-6)
Prerequisite: INC 223 or equivalent

**INC 422  Control of Power Electronic Circuits and Electrical Motors** 3(3-0-6)
Prerequisite: INC 223 or equivalent

INC 431 Experimentation and Uncertainty analysis for Engineer 3(3-0-6)
Prerequisite: INC 231 or equivalent

INC 442 Modern Control Systems 3(3-0-6)
Prerequisite: INC 341 or equivalent
This course aims to introduce the state space methods in modeling and control of linear time invariant systems. The concepts induced in this course include modeling of dynamic systems using state-space representations, controllability, observability, and stability analysis. Design methods include pole-placement for state feedback and observer design, and optimal methods. Practical examples are employed throughout, and regular usage of computer aided design is incorporated.

INC 443 Digital Control Systems 3(3-0-6)
Prerequisite: INC 341 or equivalent

INC 444 Distributed Process Control Systems 3(3-0-6)
Prerequisite: INC 342 or equivalent

INC 445 Sequence Control Systems 3(3-0-6)
Prerequisite: INC 241 or equivalent

INC 446 Pneumatic and Hydraulic Systems 3(3-0-6)
Pneumatic and hydraulic devices: symbols, operation and applications to control systems. Operation of basic pneumatic and hydraulic instrument. Applications to process control.

INC 447 Automation Manufacturing Systems 3(3-0-6)
Introduction to automation systems, mechanization of parts handling, automatic production and assembly, flexible manufacturing systems, automatic manufacturing cell, automatic inspections, industrial robots, machine loading, industrial applications of robots.
INC 461  Fundamental of Discrete Structure and Numerical Processing  3(3-0-6)
Prerequisite: INC 111 or equivalent
Fundamental of discrete mathematics: logics, proofs, set, function, sequence and series.
Data structure and its properties: pointers, lists, stacks, queues, hash table, graphs and trees.
Searching and sorting: insertion, bubble, quick, and direct selection sorting. Fundamentals of numerical processing: nonlinear equations, systems of linear equations, differentiation and integration, root finding, optimization and function approximation.

INC 462  Application of Industrial Computer  3(3-0-6)
Computer hardware organizations and functions, input/output operation, peripherals and
human-computer interface devices, computer application in digital process control, computer
aided design systems, computer aided manufacturing systems and computer integrated
manufacturing system.

INC 521  System Identification  3(3-0-6)
Prerequisite: INC 211 or equivalent
Introduction to system identification. Review of random signals and stochastic
processes. White noise, pseudo random binary sequences: Nonparametric Identification,
Parameter Estimation: least squares, generalized least squares, instrumental variables,
prediction error methods. Dynamic models: ARMA and ARMAX. AR spectral estimation.
Structure determination and order estimation. Model validation. MIMO system identification.
Practical issues in system identification

INC 481  Special Topics in Instrumentation and Control Systems  3(3-0-6)
Engineering 1
Prerequisite: as required by the department
Currently interesting or advance topics in the field of instrumentation and control
engineering.

INC 482  Special Topics in Instrumentation and Control Systems  3(3-0-6)
Engineering 2
Prerequisite: as required by the department
Currently interesting or advance topics in the field of instrumentation and control
engineering.

INC 483  Special Topics in Instrumentation and Control Systems  3(3-0-6)
Engineering 3
Prerequisite: as required by the department
Currently interesting or advance topics in the field of instrumentation and control
engineering.
Contact:

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