# Bachelor of Engineering (Electrical)

**BACHELOR OF ENGINEERING (ELECTRICAL)**
**PROGRAMME SPECIFICATIONS**

The Bachelor of Engineering (Electrical) is offered either on a full-time or part-time basis. The full-time programme is offered only at the UTM Main Campus in Johor Bahru while the part-time programme is offered at various learning centres throughout Malaysia. The duration of study for the full-time programme is subjected to the student's entry qualifications and lasts between four (4) years to a maximum of six (6) years.

The programme is offered on full-time basis and is based on a 2-Semester per academic session. Generally, students are expected to undertake courses equivalent to between fifteen (15) to eighteen (18) credit hours per semester. Assessment is based on courseworks and final examinations given throughout the semester.

## General Information

| | | | | |
|---|---|---|---|---|
| 1. Awarding Institution | | | Universiti Teknologi Malaysia | |
| 2. Teaching Institution | | | Universiti Teknologi Malaysia | |
| 3. Programme Name | | | Bachelor of Engineering (Electrical) | |
| 4. Final Award | | | Bachelor of Engineering (Electrical) | |
| 5. Programme Code | | | SKEE | |
| 6. Professional or Statutory Body of Accreditation | | | Board of Engineers Malaysia (BEM) | |
| 7. Language(s) of Instruction | | | English and Bahasa Melayu | |
| 8. Mode of Study (Conventional, distance learning, etc) | | | Conventional | |
| 9. Mode of operation (Franchise, self-govern, etc) | | | Self-governing | |
| 10. Study Scheme (Full Time/Part Time) | | | Full Time | |
| 11. Study Duration | | | Minimum : 4 yrs<br>Maximum : 6 yrs | |
| Type of Semester | No. of Semesters | | No of Weeks/Semester | |
| | Full Time | Part Time | Full Time | Part Time |
| Normal | 8 | - | 18 | - |
| Short | 4 | - | 10 | - |

## Course Classification

### Bachelor of Engineering (Electrical) - SKEE

| No. | Classification | Credit Hours | Percentage |
|---|---|---|---|
| i. | University Courses<br>a. General<br>b. Language<br>c. Entrepreneurship<br>d. Co-Curriculum | <br>23<br>8<br>2<br>3 | 26.3% |
| ii. | Faculty/Programme Core | 86 | 62.8% |

| | | | |
|---|---|---|---|
| iii. | Programme Electives | 15 | 10.9% |
| | **Total** | **137** | **100%** |
| | | | |
| A | Engineering Courses<br>a) Lecture/Project/Laboratory<br>b) Workshop/Field/Design Studio<br>c) Industrial Training<br>d) Final Year Project | <br>89<br>-<br>6<br>6 | 73.7% |
| | **Total Credit Hours for Part A** | **101** | |
| B | Related Courses<br>a) Applied Science/Mathematic/Computer<br>b) Management/Law/Humanities/ Ethics/Economy<br>c) Language<br>d) Co-Curriculum | <br>15<br>10<br>8<br>3 | 26.3% |
| | **Total Credit Hours for Part B** | **36** | |
| | **Total Credit Hours for Part A and B** | **137** | 100% |
| | **Total Credit Hours to Graduate** | **137 credit hours** | |

## Award Requirements

To graduate, students must:

- Attain a total of not less than 137 credit hours (SKEE) with a minimum CGPA of 2.0.
- Complete Professional Skills Certificates (PSC).

## Entry Requirements

The student intake for the Bachelor degree programmes is divided into two

groups, which are first year admission and the direct entry admission to the second and upper year.

**Admission Requirement for Candidates from Matriculation Programme, Ministry of Education, Malaysia (MOEM) / 'Sains Asasi' Programme from UM and 'Asasi' Programme from UiTM.**

*University Entrance Requirement:*

- Passed the Sijil Pelajaran Malaysia (SPM) or equivalent with credit (grade C) in Bahasa Melayu/Bahasa Malaysia;
- Passed the MOEM's Matriculation programme or UM's 'Sains Asasi' or UiTM's Asasi programme with PNGK of at least 2.00 and also pass all the specific courses;

*Programme Entrance Requirement:*

a. Obtained at least a PNGK of 2.80 at the Matriculation/'Asasi' level;

**AND**

b. Obtained at least a grade of 'B' (3.00) at the Matriculation/'Asasi' level in the following two (2) courses:

   i. Mathematics / Engineering Mathematics

   ii. Physics / Engineering Physics

   **OR**

   Obtained at least a grade of 'B' (3.00) in Mathematics and 'B+' (3.33) at the Matriculation/'Asasi' level in the following two (2) courses:

   i. Chemistry / Engineering Chemistry

   ii. Biology

**AND**

c. Obtained at least a grade of 'C' in the following courses at the SPM level:

   i. Mathematics

   ii. Physics

   **OR**

   The candidates who satisfy the requirement in part (b.) above using Biology and Chemistry / Engineering Chemistry at the Matriculation level need to obtain at least a grade of 'B+' for the Physics subject at the SPM level.

**AND**

d. The candidates are not colour blind or disable so as not to hamper from doing practical work.

## Admission Requirement for STPM Candidates

*University Entrance Requirement:*

- Passed the Sijil Pelajaran Malaysia (SPM) or equivalent with good grades;
- Passed with credit in Bahasa Melayu/ Bahasa Malaysia at Sijil Pelajaran Malaysia (SPM) level or equivalent;
- Passed the Sijil Tinggi Pengajian Malaysia (STPM) or equivalent in a single sitting with at least:

  i. Grade '**C**' (NGMP 2.00) in General Studies/ General Paper;

  **AND**

  ii. Grade '**C**' (NGMP 2.00) in two (2) other courses.

*Programme Entrance Requirement:*

a. Obtained at least a PNGK of 2.80 at the STPM level

**AND**

b. Obtained at least a grade of 'B' (NGMP 3.00) at the STPM level in the following two (2) courses:

   i. Mathematics T / Further Mathematics

   ii. Physics

   **OR**

   Obtained at least a grade of 'B' (NGMP 3.00) in Mathematics T and a grade of 'B+' (NGMP 3.33) at the STPM level in the following two (2) courses:

   i. Chemistry

   ii. Biology

**AND**

c. Obtained at least a grade of 'C' in the following courses at the Sijil Pelajaran Malaysia (SPM) level:

   i. Mathematics

   ii. Physics

**OR**

The candidates who satisfy the requirement in part (b.) above using Biology and Chemistry at the STPM level must obtain at least a grade of 'B+' for the Physics subject at the SPM level.

**AND**

d. The candidates should satisfy Band 2 MUET.

**AND**

e. The candidates are not colour blind or disable so as not to hamper from doing practical work.

## Admission Requirement for Direct Entry (Diploma / Equivalent) Candidates

*University Entrance Requirement:*

- Passed the Sijil Pelajaran Malaysia (SPM) or equivalent with credit in Bahasa Melayu/ Bahasa Malaysia;
- Passed the Diploma or equivalent programme recognized by the Government and approved by the Senate of UTM

  **OR**

  Passed the STPM for the year 2015 or before with at least:

  i. Grade '**C**' (NGMP 2.00) in General Studies/ General Paper;

  **AND**

  ii. Grade '**C**' (NGMP 2.00) in two (2) other courses.

  **OR**

  Passed the MOEM's Matriculation programme or UM's 'Sains Asasi' or UiTM's Asasi programme for the year 2015 or before with PNGK of at least 2.00 and also pass all the specific courses;

*Programme Entrance Requirement:*

a. Holds a Diploma in Electrical Engineering (Power / Communication / Electronics / Mechatronics) from UTM or Public Institute of Higher Learning (IPTA) or Private Institute of Higher Learning (IPTS) or equivalent with PNGK of at least 3.00;

**AND**

b. Obtained at least a grade of 'C' in the following courses at the Sijil Pelajaran Malaysia (SPM) level:

i. Mathematics

ii. Physics

**OR**

Obtained at least a grade of 'B' at the Diploma level in any of the Mathematics and Physics subjects.

c. Obtained at least a Band 2 in Malaysian University English Test (MUET);

d. The candidates are not colour blind or disable so as not to hamper from doing practical work.

Subject to the University's Academic Regulation, credit exemption will be given to direct entry students after registration according to the grade of the courses obtained and the courses are recognized by the Faculty and University. The actual year of entry and duration of study are subject to credit exemptions approved by the University.

## Programme Educational Objectives (PEO)

After having exposed to 3 to 5 years working experience, our graduates should become professionals who demonstrate the following competencies:

| Code | Intended Educational Objectives |
|---|---|
| PEO1 | Become Electrical Engineers who are competent, innovative, and productive in addressing customer needs. |
| PEO2 | Grow professionally with proficient soft skills. |
| PEO3 | Demonstrate high standards of ethical conduct, positive attitude, and societal responsibilities. |

## Programme Learning Outcomes (PLO)

After having completed the programme, graduates should be able to demonstrate the following competencies:

| Code | Programme Learning Outcomes |
|---|---|
| PLO1 | Ability to apply knowledge of mathematics, science and electrical engineering to the solution of complex engineering problems. |
| PLO2 | Ability to perform research-based analysis, conduct experiments and interpret data for complex engineering problems. |
| PLO3 | Ability to identify, formulate, conduct research literature to analyse complex engineering problems using engineering knowledge. |
| PLO4 | Ability to apply engineering practice and use modern engineering, and IT tools for complex engineering problem with an understanding the limitations of the technology. |
| PLO5 | Ability to design solutions for complex engineering problems and design systems and processes that meet specified needs with appropriate consideration for public health and safety, culture, society, and environment. |
| PLO6 | Ability to articulate ideas, communicate effectively, in writing and verbally, on complex engineering activities with the engineering community and with society at large. |
| PLO7 | Ability to function effectively as an individual, as a member or as a leader in diverse teams. |
| PLO8 | Ability to recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the |

| | |
|---|---|
| | broadest context of technological change. |
| PLO9 | Ability to comprehend the impact of global and contemporary issues, the role of engineers on society including, health, safety, legal and cultural issues, and the consequent responsibilities relevant to professional engineering practices and engineering problems. |
| PLO10 | Ability to comprehend and evaluate the sustainability and impact of professional engineering work in the solutions of complex engineering problems in societal and environmental contexts. |
| PLO11 | Ability to grasp and execute responsibility professionally and ethically in professional engineering practices. |
| PLO12 | Ability to demonstrate knowledge and understanding of engineering and management principles, and economic decision-making to manage projects in multidisciplinary environments. |

## PROFESSIONAL SKILLS CERTIFICATE (PSC)

Students are given a chance to enrol in certificate programmes offered by the Centres of Excellence in the University and the School of Professional and Continuing Education (SPACE) during semester breaks

1. How to Get Yourself Employed (HTGYE)
2. ISO 9001: 2008 Quality Management System Requirement (ISO)
3. Occupational Safety and Health Awareness (OSHA)
4. How to Manage Your Personal Finance (HTMYPF)
5. Test of English Communication Skills for Graduating Students (TECS):
   (i) TECS 1001 (Paper I – Oral Interaction)
   (ii) TECS 1002 (Paper II - Writing)

**COURSE MENU**

**Bachelor of Engineering (Electrical) - SKEE**

| YEAR 1: SEMESTER 1 | | | |
|---|---|---|---|
| **Code** | **Course** | **Credit** | **Pre-requisite** |
| SKEE 1012 | Introduction to Electrical Engineering | 2 | |
| SKEE 1013 | Electrical Circuit Analysis | 3 | |
| SCSP 1103 | C Programming Techniques | 3 | |
| SSCE 1693 | Engineering Mathematics I | 3 | |
| ULAB 1122 | Academic English Skills | 2 | |
| UHAS 1172 | Malaysian Dynamics (*Local Students*) | 2 | |
| UHAK 1022 | Malaysian Studies (Arts, Custom and Belief of Malaysians) (*International Students*) | | |
| | TOTAL CREDIT | 15 | |
| | CUMULATIVE CREDITS | 15 | |

| YEAR 1: SEMESTER 2 | | | |
|---|---|---|---|
| **Code** | **Course** | **Credit** | **Pre-requisite** |
| SKEE 1022 | Introduction to Scientific Programming | 2 | |
| SKEE 1073 | Electronic Devices and Circuits | 3 | SKEE 1013 |

| | | | |
|---|---|---|---|
| SKEE 1223 | Digital Electronics | 3 | |
| SKMU 2113 | Engineering Science | 3 | |
| SSCE 1793 | Differential Equations | 3 | |
| UICI 1012 | Islamic and Asia Civilizations (Local Students) | 2 | |
| ULAM 1012 | Malay Language for Communication 2 (International Students) | | |
| | TOTAL CREDIT | 16 | |
| | CUMULATIVE CREDITS | 31 | |

| **YEAR 2: SEMESTER 1** | | | |
|---|---|---|---|
| **Code** | **Course** | **Credit** | **Pre-requisite** |
| SKEE 2073 | Signals and Systems | 3 | |
| SKEE 2133 | Electronic Instrumentation and Measurement | 3 | |
| SKEE 2423 | Fundamentals of Electrical Power Systems | 3 | SKEE 1013 |
| SSCE 1993 | Engineering Mathematics II | 3 | SSCE 1693 |
| UHAK 1012 | Graduate Success Attribute | 2 | |
| ULAB 2122 | Advance Academic English Skills | 2 | |
| | TOTAL CREDIT | 16 | |

| | | | |
|---|---|---|---|
| | CUMULATIVE CREDITS | 47 | |

| YEAR 2: SEMESTER 2 | | | |
|---|---|---|---|
| **Code** | **Course** | **Credit** | **Pre-requisite** |
| SKEE 2263 | Digital Systems | 3 | SKEE 1223 |
| SKEE 2523 | Electromagnetic Field Theory | 3 | SSCE 1993 |
| SKEE 2742 | 2nd Year Electronic Design Laboratory | 2 | |
| SSCE 2193 | Engineering Statistics | 3 | |
| UHAK 1032 | Introduction to Entrepreneurship | 2 | |
| ULAB 3162 | English for Professional Purpose | 2 | |
| UKQ* 2**2 | Elective of Co-Curricular Service Learning | 2 | |
| | TOTAL CREDIT | 17 | |
| | CUMULATIVE CREDITS | 64 | |

| YEAR 3: SEMESTER 1 | | | |
|---|---|---|---|
| **Code** | **Course** | **Credit** | **Pre-requisite** |
| SKEE 3133 | System Modeling and Analysis | 3 | SKEE 2073 |
| SKEE 3223 | Microprocessor | 3 | SKEE 1223 |
| SKEE 3533 | Communication Principles | 3 | SKEE 2073 |

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|---|---|---|---|
| SKEE 3732 | Common 3rd Year Laboratory | 2 | |
| SKEE 4443 | Power System Analysis | 3 | SKEE 2423 |
| SSCE 2393 | Numerical Methods | 3 | |
| | TOTAL CREDIT | 17 | |
| | CUMULATIVE CREDITS | 81 | |

| **YEAR 3: SEMESTER 2** | | | |
|---|---|---|---|
| **Code** | **Course** | **Credit** | **Pre-requisite** |
| SKEE 3143 | Control System Design | 3 | SKEE 3133 |
| SKEE 3742 | Specialized 3rd Year Laboratory | 2 | |
| SKEE 4423 | Power System Engineering | 3 | SKEE 4443 |
| SKEE 4433 | Power Electronics and Drives | 3 | SKEE 2423 |
| SKEE 4463 | High Voltage Technology | 3 | SKEE 4443 |
| ULA* 1112 | Elective of Foreign Language | 2 | |
| UKQ3001 | Extracurricular Experiential Learning (ExCEL) | 1 | |
| | TOTAL CREDIT | 17 | |
| | CUMULATIVE CREDITS | 98 | |

| YEAR 3: SEMESTER 3 | | | |
|---|---|---|---|
| **Code** | **Course** | **Credit** | **Pre-requisite** |
| SKEE 4926 | Practical Training | 6 | |
| | TOTAL CREDIT | 6 | |
| | CUMULATIVE CREDITS | 104 | |

| YEAR 4: SEMESTER 1 | | | |
|---|---|---|---|
| **Code** | **Course** | **Credit** | **Pre-requisite** |
| SHAS 4542 | Engineering Management | 2 | |
| SKEE 4633 | Electrical Machines | 3 | SKEE 2423 |
| SKEE 4723 | Capstone Project | 3 | |
| SKEE 4812 | Final Year Project Part I | 2 | |
| SKE* 4**3 | Field Elective 1 | 3 | |
| SKE* 4**3 | Field Elective 2 | 3 | |
| | TOTAL CREDIT | 16 | |
| | CUMULATIVE CREDITS | 120 | |

| YEAR 4: SEMESTER 2 | | | |
|---|---|---|---|
| **Code** | **Course** | **Credit** | **Pre-requisite** |
| SKEE 4012 | Professional Engineering Practice | 2 | |
| SKEE 4824 | Final Year Project Part II | 4 | SKEE 4812 |
| SKE* 4**3 | Field Elective 3 | 3 | |
| SKE* 4**3 | Field Elective 4 | 3 | |
| SKE* 4**3 | Field Elective 5 | 3 | |
| UICL 2302 | Science and Technology Thinking | 2 | |
| | TOTAL CREDIT | 17 | |
| | CUMULATIVE CREDITS | 137 | |

| FIELD ELECTIVES- POWER ENGINEERING | | | |
|---|---|---|---|
| **Code** | **Course** | **Credit** | **Pre-requisite** |
| SKEE 4453 | Power System Control | 3 | SKEE 4423 |
| SKEE 4613 | High Voltage Testing and Calibration | 3 | SKEE 4463 |
| SKEE 4643 | Control and Design of Power Electronic System | 3 | SKEE 4433 |
| SKEE 4653 | Photovoltaic and Wind Energy Systems | 3 | SKEE 4433 |
| SKEE 4663 | Electricity for Sustainable Energy | 3 | SKEE 4423 |

| | | | |
|---|---|---|---|
| SKEE 4673 | Electricity Market (Electrical Energy Market) | 3 | SKEE 4443 |
| SKEE 4683 | Power System Design and Operation | 3 | SKEE 4443 |

| **FIELD ELECTIVES- CONTROL ENGINEERING** | | | |
|---|---|---|---|
| **Code** | **Course** | **Credit** | **Pre-requisite** |
| SKEE 4113 | Modern Control Theory | 3 | SKEE 3143 |
| SKEE 4153 | Digital Control Systems | 3 | SKEE 3143 |
| SKEE 4173 | Industrial Process Control | 3 | SKEE 3143 |
| SKEI 3133 | Industrial Instrumentations and Applications | 3 | SKEE 2133 |
| SKEI 4173 | Advanced Transducers and Sensors | 3 | SKEI 3133 |
| SKEI 4313 | PLC and SCADA System Design | 3 | SKEE 3143 |
| SKEI 4363 | Industrial Control Network | 3 | SKEE 3143 |
| SKEM 4173 | Artificial Intelligent | 3 | |

| **FIELD ELECTIVES- ELECTRONIC ENGINEERING** | | | |
|---|---|---|---|
| **Code** | **Course** | **Credit** | **Pre-requisite** |
| SKEL 3613 | Semiconductor Materials Engineering | 3 | SKEE 1073 |
| SKEE 3263 | Electronic System | 3 | SKEE 1073 |

| | | | |
|---|---|---|---|
| SKEL 4223 | Digital Signal Processing 1 | 3 | SKEE 2073 |
| SKEL 4273 | CAD with HDL | 3 | SKEE 2263 |
| SKEL 4283 | Analog CMOS IC Design | 3 | SKEE 1073 |
| SKEL 4373 | IC Testing Techniques | 3 | SKEE 2263<br>SKEL 4283 |
| SKEL 4743 | Basic Digital VLSI Design | 3 | SKEE 2263 |

| **FIELD ELECTIVES- COMMUNICATION ENGINEERING** | | | |
|---|---|---|---|
| **Code** | **Course** | **Credit** | **Pre-requisite** |
| SKET 3573 | Microwave Engineering | 3 | SKEE 3533 |
| SKET 3583 | Digital Communication Systems | 3 | SKEE 3533 |
| SKET 3623 | Data Communication and Networks | 3 | SKEE 3533 |
| SKET 4523 | Optical Communication Systems | 3 | SKEE 3533 |
| SKET 4533 | Wireless Communication Systems | 3 | SKET 3573 |
| SKET 4543 | RF Microwave Circuit Design | 3 | SKET 3573 |
| SKET 4593 | Acoustic Engineering | 3 | SKEE 3533 |
| SKET 4613 | Antenna Theory and Design | 3 | SKET 3573 |
| SKET 4623 | Network Programming | 3 | SKET 3623 |

## GRADUATION CHECKLIST

To graduate, students must pass all the stated courses in this checklist. It is the responsibility of the students to ensure that all courses are taken and passed. Students who do not complete any of the course are not allowed to graduate.

### Bachelor of Engineering (Electrical) - SKEE

| NO. | CODE | COURSE | CREDIT EARNED (JKD) | CREDIT COUNTED (JKK) | TICK (√)IF PASSED |
|---|---|---|---|---|---|
| **BACHELOR OF ENGINEERING (ELECTRICAL)** | | | | | |
| 1 | SKEE 1012 | Introduction to Electrical Engineering | 2 | 2 | |
| 2 | SKEE 1013 | Electrical Circuit Analysis | 3 | 3 | |
| 3 | SKEE 1022 | Introduction to Scientific Programming | 2 | 2 | |
| 4 | SKEE 1073 | Electronic Devices and Circuits | 3 | 3 | |
| 5 | SKEE 1223 | Digital Electronics | 3 | 3 | |
| 6 | SKEE 2073 | Signals and Systems | 3 | 3 | |
| 7 | SKEE 2133 | Electronic Instrumentation & Measurement | 3 | 3 | |
| 8 | SKEE 2263 | Digital Systems | 3 | 3 | |

| | | | | | |
|---|---|---|---|---|---|
| 9 | SKEE 2423 | Fundamentals of Electrical Power Systems | 3 | 3 | |
| 10 | SKEE 2523 | Electromagnetic Field Theory | 3 | 3 | |
| 11 | SKEE 2742 | 2nd Year Electronic Design Lab | 2 | 2 | |
| 12 | SKEE 3133 | System Modeling & Analysis | 3 | 3 | |
| 13 | SKEE 3143 | Control System Design | 3 | 3 | |
| 14 | SKEE 3223 | Microprocessor | 3 | 3 | |
| 15 | SKEE 3263 | Electronic Systems | 3 | 3 | |
| 16 | SKEE 3533 | Communication Principles | 3 | 3 | |
| 17 | SKEE 3732 | Common 3rd Year Laboratory | 2 | 2 | |
| 18 | SKEE 3742 | Specialized 3rd Year Laboratory | 2 | 2 | |
| 19 | SKEE 4012 | Professional Engineering Practice | 2 | 2 | |
| 20 | SKEE 4423 | Power System Engineering | 3 | 3 | |
| 21 | SKEE 4433 | Power Electronics and Drives | 3 | 3 | |
| 22 | SKEE 4443 | Power System Analysis | 3 | 3 | |
| 23 | SKEE 4463 | High Voltage Technology | 3 | 3 | |

| | | | | | |
|---|---|---|---|---|---|
| 24 | SKEE 4633 | Electrical Machines | 3 | 3 | |
| 25 | SKEE 4723 | Capstone Project | 3 | 3 | |
| 26 | SKEE 4812 | Final Year Project Part I | 2 | 2 | |
| 27 | SKEE 4824 | Final Year Project Part II | 4 | 4 | |
| 28 | SKEE 4926 | Practical Training | 6 | 6 | |
| 29 | SKE* 4**3 | Field Elective 1 | 3 | 3 | |
| 30 | SKE* 4**3 | Field Elective 2 | 3 | 3 | |
| 31 | SKE* 4**3 | Field Elective 3 | 3 | 3 | |
| 32 | SKE* 4**3 | Field Elective 4 | 3 | 3 | |
| 33 | SKE* 4**3 | Field Elective 5 | 3 | 3 | |
| 34 | SCSP 1103 | C Programming Techniques | 3 | 3 | |
| 35 | SHAS 4542 | Engineering Management | 2 | 2 | |
| | | **TOTAL CREDIT OF ENGINEERING COURSES(a)** | **101** | **95** | |
| **MATHEMATICS COURSES (Faculty of Science)** | | | | | |
| 1 | SSCE 1693 | Engineering Mathematics I | 3 | 3 | |
| 2 | SSCE 1793 | Differential Equations | 3 | 3 | |

| | | | | | |
|---|---|---|---|---|---|
| 3 | SSCE 1993 | Engineering Mathematics II | 3 | 3 | |
| 4 | SSCE 2193 | Engineering Statistics | 3 | 3 | |
| 5 | SSCE 2393 | Numerical Methods | 3 | 3 | |
| | | **TOTAL CREDIT OF MATHEMATICS COURSES (b)** | **15** | **15** | |
| **UNIVERSITY GENERAL COURSES** | | | | | |
| **Kluster 1: Penghayatan Falsafah, Nilai & Sejarah (Faculty of Social Sciences and Humanities)** | | | | | |
| 1 | UHAS 1172 | Malaysia Dynamics (Local Students) | 2 | 2 | |
| | UHAK 1022 | Malaysia Studies (Arts, Custom and Belief of Malaysians) (International Students) | | | |
| 2 | UICI 1012 | Islamic and Asian Civilisation (Local Students) | 2 | 2 | |
| | ULAM1012 | Malay Language for Communication 2 (International Students) | | | |
| **Kluster 2: Kemahiran Insaniah (Soft Skills)** | | | | | |
| 1 | UHAK 1012 | Graduate Success Attributes | 2 | 2 | |

| | | | | | |
|---|---|---|---|---|---|
| 2 | UHAK 1032 | Introduction to Entrepreneurship | 2 | 2 | |
| **Kluster 3: Perluasan Ilmu** | | | | | |
| 1 | UICL 2302 | The Thought of Science and Technology | 2 | 2 | |
| **Kluster 4: Kurikulum Pembelajaran Servis** | | | | | |
| 1 | UKQ# 2##2 | Co-Curriculum & Service Learning | 2 | 2 | |
| 2 | UKQ 3001 | Extracurricular Experiential Learning | 1 | 1 | |
| **Kluster 5: Kemahiran Bahasa (Language Skill) (Language Academy, Faculty of Social Sciences and Humanities)** | | | | | |
| 1 | ULAB 1122 | Academic English Skills | 2 | 2 | |
| 2 | ULAB 2122 | Advanced Academic English Skills | 2 | 2 | |
| 3 | ULAB 3162 | English for Professional Purposes | 2 | 2 | |
| 4 | ULAX 1122 | Elective Of Foreign Language | 2 | 2 | |
| | | **TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c )** | **21** | **21** | |
| | | **TOTAL CREDIT TO GRADUATE (a + b + c)** | **137** | **131** | |

| OTHER COMPULSORY COURSES | | | |
|---|---|---|---|
| **Professional Skills Certificate (PSC) (UTMSPACE/ School)** | | | |
| 1 | GLL 1001 | How to Get Your Self Employed | |
| 2 | GLL 1029 | ISO 9001:2008 Quality Management System Requirement | |
| 3 | GLL 1040 | Occupational Safety, Health and Environment | |
| 4 | GLL 1041 | How to Manage Your Personal Finance | |
| **Test of English Communication Skill (TECS) (Language Academy, Faculty of Social Sciences and Humanities)** | | | |
| 1 | TECS 1001 | Oral Interaction | |
| 2 | TECS 1002 | Writing | |

## COURSE SYNOPSIS

### SKEE 1012 : INTRODUCTION TO ELECTRICAL ENGINEERING

This course serves as a general introduction to electrical engineering programmes offered by the School of Electrical Engineering (SEE), Universiti Teknologi Malaysia (UTM). Students undertaking this course will be exposed to attributes of electrical engineers from both academic and practical points of view. Soft skills and knowledge that are necessary in the engineering world will be introduced to the students. The students will have a clearer understanding on the responsibilities of electrical engineers to the society. By exploring contemporary issues, the students would be able to suggest sustainable solutions to the mankind and its environment.

### SKEE 1013 : ELECTRICAL CIRCUIT ANALYSIS

This course introduces students to the basic laws, methods of analysis and theorems for direct current, DC and alternating current, AC circuit, such as, Ohms Law, Kirchhoff's Current and Voltage Laws, Mesh and Nodal Analysis and Thevenin's and Norton's Theorems. Based on these, the students are expected to be able to solve for variables in any given DC and AC electric circuits. The students also exposed to the steady-state electrical circuit. Afterwards, the relevant concepts in transient circuit analysis for first and second order circuit are taught to the students. With the knowledge learned, the student would be able to apply the basic laws, theorem and methods of analysis for solving completely with confidence various problems in circuit analysis.

### SKEE 1022 : INTRODUCTION TO SCIENTIFIC PROGRAMMING

This course introduces the fundamentals of scientific programming languages and techniques used by engineers to solve engineering problems. Students will be introduced to common scientific programming languages and their comparative advantages and disadvantages. Emphasis is placed on fundamentals of programming, program design, verification and visualization. The goal is to provide the students with the skills in scientific computing, tools, techniques that can be used to solve their own engineering problems. Students will learn to implement algorithms using high level programming language (e.g. MATLAB, Mathematica, FORTRAN). The programming skills acquired in this course will allow students to go beyond what is available in pre-packaged analysis tools, and code their own custom data processing, analysis and visualization for any engineering

problem.

**SKEE 1073 : ELECTRONIC DEVICES & CIRCUITS**
**Pre-requisite: SKEE 1013 Electrical Circuit Analysis**

This course provides introduction to the basic operating principles and applications of discrete electronic devices and circuits. The course content starts with the fundamental solid-state principles and continues the discussions with the constructions and characteristics of diode, Bipolar Junction Transistor (BJT) and Enhancement Metal Oxide
Semiconductor Field Effect Transistor (E-MOSFET). The application of diodes focuses on the basic power supply circuits whereas the applications of the transistors focus on the small-signal amplifier. The course content ends with an introduction to the operating principles of an ideal operational amplifier (op-amp) and discussion about op-amp circuits, performance and applications. To help the students understand the behaviour of the electronic devices and predict the behaviour of the electronic circuits, this course makes use of Multisim simulation software. The goal of this course is to develop excellent understanding of the devices operation for students to be applied in analogue and digital circuit design.

**SKEE 1223 : DIGITAL ELECTRONICS**

This course teaches the fundamental principles of digital systems. From the signal concepts and the importance of numbers systems and codes, it then proceeds to logic gates, their relationship to Boolean algebra and the integration of gates to form complex circuits. The course emphasizes on techniques to design, analyse, plan, and implement simple digital systems using gates and MSI circuits. Simulation software Quartus II version 13 will also be introduced to facilitate learning process.

**SKEE 2073 : SIGNALS AND SYSTEMS**

This course introduces the students the fundamental ideas of signals and system analysis. The signal representations in both time and frequency domains and their effects on systems will be explored. Specifically, the topics covered in the course include basic properties of continuous-time and discrete-time signals, the processing of signals by linear time-invariant (LTI) systems, Fourier series, Fourier and Laplace transforms. Important concepts such as impulse response, frequency response and system transfer functions as well as techniques of filtering and filter design,

modulation, and sampling, are discussed and illustrated. This course will serve as a central building block for students in studying information processing in many engineering fields such as control systems, digital signal processing, communications, circuit design, etc.

**SKEE 2133 : ELECTRONIC INSTRUMENTATION AND MEASUREMENT**

This course introduces students some of the metrological terminologies used in experimental methods, concept of metrology and its application. The course will also provide understanding the concept electrical measurement quantity using analogue and digital instruments. The interfaces of the instruments with embedded sensors and also the quality of the signals acquired are introduced. Besides that, this course also introduces the type of electrical noise and the ways to reduce noise and interference. Finally, the fundamental principle of transducers, transducer operations, characteristic and functions will be discussed. P&ID diagram also introduces to cover the basic process of the system.

**SKEE 2263 : DIGITAL SYSTEMS**
**Pre-requisite: SKEE 1223 Digital Electronics**

This course is a continuation from basic digital logic techniques course. The objective of the course is to introduce students to basic techniques to design and implement complex digital systems It emphasizes on techniques to design, analyse, plan, and implement complex digital systems using programmable logic. To facilitate learning process, computer-aided design (CAD) software is used throughout the course. Actual environment problems and solutions are provided.

**SKEE 2423 : FUNDAMENTALS OF ELECTRICAL POWER SYSTEMS**
**Pre-requisite: SKEE 1013 Electrical Circuit Analysis**

This course introduces fundamental concepts of electric machines and power system. Students should be able to identify components of the system from the course and describe their basic operations from the course having electromagnetic and circuit concepts learned in previous fundamental courses. These fundamental concepts are further elaborated in applications of electric machines - transformers, direct current machines, synchronous machines and induction machines, power in ac circuits, three-phase system, power system component modeling and analysis. At the end of the course, the students are expected to critically analyze the power

system comprising of generation, transmission, and distribution components.

**SKEE 2523 : ELECTROMAGNETIC FIELD THEORY**
**Pre-requisite: SSCE 1993 Engineering Mathematics 2**

This course introduces students to some major views and theories in the area of electrostatic, magnetostatic and electromagnetic fields. This elementary electromagnetic field theory is summarized in Maxwell's equations. It is assumed that students already have appropriate mathematical background including multivariable calculus and some familiarity with the basic concepts typically covered in an introductory circuit theory course such as resistance, capacitance and inductance.

**SKEE 2742 : 2ND YEAR ELECTRONIC DESIGN LABORATORY**

All students will attend three second year laboratories which are the Electrotechnic, Basic Electronic and Digital Electronic Labs. The students will attend a three hour lab per week. The students are expected to complete four experiment topics for each lab in a direct of four week duration. Thus, the student will perform altogether 12 experiments in a semester. All experiments in the laboratories are emphasized on design case for a given complex engineering problem or project. The students will use software simulation tools to assist in their design tasks.

**SKEE 3133 : SYSTEM MODELING AND ANALYSIS**
**Pre-requisite: SKEE 2073 Signals & Systems**

This course introduces the students to the fundamental ideas and definitions of control systems, open loop and close loop control systems, transfer functions and transient and steady state responses. Students will be taught how to obtain mathematical models of actual physical systems such as electrical, mechanical and electromechanical systems in the transfer function form. Methods of system representation such as block diagram representation and signal flow graphs will be discussed. The students will also be exposed to techniques of analysing control systems performance and stability in time and frequency domains. Finally, an introduction to the design and analysis of control systems using MATLAB will also be given.

**SKEE 3143 : CONTROL SYSTEM DESIGN**
**Pre-requisite: SKEE 3133 System Modeling and Analysis**

The course begins with the root locus designs using root locus procedures and MATLAB. Then, PID controller will be designed using root locus approach. The PID controller and lead-lag compensator will be used to improve the transient and steady state performances in time domain using root locus approach. In frequency domain approach, the Bode plot method will be utilised. The lead, lag and lead-lag compensators are used in improving the performance of the control system using the frequency domain approach. Finally, applications of control engineering in various fields will be studied.

**SKEE 3223 : MICROPROCESSOR**
**Pre-requisite: SKEE 1223 Digital Electronics**

This course introduces the principles and applications of microprocessors. Topics emphasized are processor architecture, assembly and HLL language and fundamentals of interfacing in a microprocessor-based embedded system. This course emphasizes on the understanding the fundamentals of microprocessor operation, writing coherent and error-free assembly and HLL language programs, and designing basic interfacing circuits. With the knowledge learned, the student would be able to design microprocessor-based systems using assembly language and HLL programs completely with confidence.

**SKEE 3263 : ELECTRONIC SYSTEMS**
**Pre-requisite: SKEE 1073 Electronic Devices and Circuits**

This course covers some topics in functional electronic circuits. The circuits are derived from a diverse electronic circuitry that exists in many electronic instrumentation. The function, the behaviour and the characteristics of the functional circuits are analysed. Design examples are presented to guide students with the necessary knowledge of how to design the functional electronic circuits based on certain predetermined specifications.

**SKEE 3533 COMMUNICATION PRINCIPLES**
**Pre-requisite: SKEE 2073 Signals & Systems**

This course introduces the students the basic principles of communication system. The fundamental concepts of analogue modulation in particular

amplitude and frequency modulations will be strongly emphasized. Topics include types of modulated waveforms, transmitter and receiver structures, and noise performance. The two most significant limitations on the performance of a communications system; bandwidth and noise will be discussed. The concept of sampling, quantization and line coding techniques in rendering an information signal to be compatible with a digital system are explained prior to the study of coded pulse modulation and pulse code modulation (PCM). The waveforms and spectral analysis of bandpass digital modulations are introduced. The system performance in terms of SNR and bit error rate (BER) will also be covered. Finally, multiplexing, a method to utilize the communication resource efficiently is studied where two main multiplexing techniques will be explored; time-division and frequency-division multiplexing.

## SKEE 3732 : COMMON THIRD YEAR LABORATORY

Third Year Laboratory is a required course for third year students in Bachelor of Engineering degree program. This course requires students to conduct twelve experiments in six different laboratories (Basic Power, Basic Machine, Basic Communication, Instrumentation, Microprocessor and Basic Control). The students are grouped into 3-4 students. Each week, they are required to conduct an experiment in the lab within 3 hours. Each group will submit only one short report at the end of each lab session. Each student is assigned to write only one long report based on one experiment that they have conducted for this course. This long report should be submitted within a week after the student performed the assigned experiment.

## SKEE 3742 : SPECIALISED 3RD YEAR LAB

3rd Year Laboratory is a required course for third year students in Bachelor of Engineering degree program. This course requires students to conduct four experiments in four different laboratories (Basic Power, Power Electronics, Basic Microwave and Applied Control Lab). This laboratory is conducted as a Project Based approach. The students are grouped into 3-4 students, and they will be given problems to solve that require them to conduct experiments in-lab (3 hours/week) and out-of-lab (equivalent to 2 hour/week) within three weeks. The students are required to solve the given project as a team, design suitable experimental procedures and conduct the experiments, present the problem solutions and submit a report following the IEEE standard journal format.

**SKEE 4012 : PROFESSIONAL ENGINEERING PRACTICE**

This course introduces and exposes the students to the concepts, theories and the practice of Professional Engineer. It highlights to the students profession of engineering, relevant acts and regulations, engineering code of ethics, engineers' roles and responsibilities, engineering ethics, the impact of the work of engineer on society, and knowledge to cater the needs for sustainable development. In terms of knowledge of accreditation of engineering programme and the internationalization of engineers, elements of EAC and Washington are also discussed. Based on this knowledge, the students will work on projects to analyze real engineering issues and cases, both individually and in groups.

**SKEE 4113 : MODERN CONTROL SYSTEM**
**Pre-requisite: SKEE 3143 Control System Design**

This course introduces students the modern modeling approach of physical system namely state space. Students are introduced to state space modeling and analysis of several forms of state space representation, conversion and similarity transformation. Students are exposed to solution of state space equation, controller and observer design using pole placement method and optimal control system.

**SKEE 4153 : DIGITAL CONTROL SYSTEMS**
**Pre-requisite: SKEE 3143 Control System Design**

This course introduces students the basic principles underlying the analysis, synthesis and design of digital control systems. Students are introduced to sampling theorem and discretization of continuous time system, data reconstructions, z-transform, mathematical modeling of discrete-time and digital systems, time domain and various stability analysis methods for discrete-time and digital systems, and on the design of various discrete-time and digital controllers. By adapting the knowledge obtained, students will be able to derive the mathematical model of discrete-time control systems and analyze accurately its stability and the time response, as well as the students will be able to design correctly the suitable digital controller to control the discrete-time systems.

**SKEE 4173 : INDUSTRIAL PROCESS CONTROL**
**Pre-requisite: SKEE 3143 Control System Design**

This course introduces process control system application and the wide applicability in the industry. The course initiates with modelling of process plants using fundamental laws of physics and chemistry as well as empirical process modelling. To enhance the performance of an existing process control system, controllers (PID, feedforward, cascade and inferential control) are introduced, designed, tuned and applied. Tuning techniques of Ziegler-Nichols and Cohen-coon are also utilized. Finally, the concept of supervisory, automatic control and data retrieval which relates to IoT in a process plant is introduced. In summary, this course offers students an initial exposure to the process industry and the coveted opportunity to explore more on to endless application.

**SKEE 4423 : POWER SYSTEMS ENGINEERING**
**Pre-requisite: SKEE 4443 Power System Analysis**

This course is designed to introduce the necessary concept and application of power system protection; and stability analysis of power system. Topics include, transducer, protection schemes, power system stability and circuit breaker. At the end of the course, the students are expected to complete a project on the design of a protection system based on an actual power system.

**SKEE 4433 : POWER ELECTRONICS AND DRIVES**
**Pre-requisite: SKEE 2423 Fundamentals of Electrical Power Systems**

This course introduces students to the fundamentals of power electronics, which include power semiconductor switches, rectifier (AC-DC), choppers (DC-DC), and inverters (DC-AC). Emphasis will be on the power converter operations and analysis of their steady state performances. The course also exposes students to some basic converters design and the selection of suitable converters for certain application. In addition, the course covers the operation and selection of converters for DC and AC drive systems. At the end of the course student should be able to critically design power converters at given specification using application software.

**SKEE 4443 : POWER SYSTEM ANALYSIS**
**Pre-requisite: SKEE 2423 Fundamentals of Electrical Power Systems**

This course introduces students to the applications of power system analysis of a practical power system. Topics include: per-unit system, load flow analysis, symmetrical three-phase faults, symmetrical components and unsymmetrical faults. At the end of the course students are expected to apply the analysis concept in solving the real power system problems.

**SKEE 4453 : POWER SYSTEM CONTROL**
**Pre-requisite: SKEE 4423 Power System Engineering**

The course introduces students to the control and operation of a power system and high voltage direct current (HVDC) system. It will discuss the basic principle of SCADA system and its application in power industry, the economic operation of power system under regulated/deregulated environment. The discussion focuses on the control strategies that can be used to generate and deliver power economically and reliably to the power system customers. The course will further discuss on the load frequency control and voltage reactive power control. The course will also introduce the basic operation of converters in HVDC system. At the end of the course, the students are expected to apply the analysis concepts in the operation of power system and HVDC system.

**SKEE 4463 : HIGH VOLTAGE TECHNOLOGY**
**Pre-requisite: SKEE 4443 Power System Analysis**

High voltage engineering is an important area in power system. The students will be exposed to the concept and theory of insulation breakdown. Key principles of high voltage technology and insulation coordination as well as insulation testing (including high voltage generators) are also covered. Lightning overvoltages due to the naturally occurring atmospheric phenomenon are a nuisance to the network and will be discussed along with switching surges. Various types of electrical discharges, some of which are used for condition monitoring applications, are also discussed. The student is expected to be able to communicate effectively as well as to design selected high voltage components and subsystems.

**SKEE 4613 : HIGH VOLTAGE TESTING AND CALIBRATION**
**Pre-requisite: SKEE 4463 High Voltage Technology**

In this course, the students will be exposed to the needs of testing and calibration, especially in the power system industry. Students will be introduced to concepts and theories related to high voltage and high current generation and measurement. Testing techniques related to transformers, cables and switchgears are explained, along with the calibration methods of high voltage meters and high current clamp meters. Students are also explained on matters that concern the quality of testing and calibration activity such as the traceability and uncertainty of a measurement. At the end of the course, students should be able to understand the importance, techniques involved, setting up and proper conduct of high voltage testing and calibration along with the estimation of measurement uncertainty and reporting the testing result.

**SKEE 4633 : ELECTRICAL MACHINES**
**Pre-requisite: SKEE 2423 Fundamentals of Electrical Power Systems**

This course is an extension of the basic power and electric machine course, exclusively offered for the electrical engineering students. The course provides the fundamentals of electric machines, which are synchronous machines, induction machines and DC machines. The course begins with electromechanical energy conversion. Next, students are introduced to principle of operations, constructions and some analysis on steady state performance of the electric machines. The course also introduces special motors and their applications, which includes single-phase induction motors, stepper motors, switch reluctance machines and universal motors. At the end of the course student should be able to perform steady state analysis of electric machines and apply their knowledge to real world applications.

**SKEE 4723 : CAPSTONE PROJECT**

The course provides students with the opportunity to integrate technical knowledge and generic skills attained in the earlier years. It requires students to conceive, engage and provide solution to a real industry/community problem. The solution is expected to be achieved within the context of an engineering project conducted in a small team (typically three or four students) under the supervision of an academic staff and with optional of industry/community partner as advisor. Topics supplementing this course that include project management tools and

practices, organizational structures, engineering standards as well as the social and environmental responsibility of professional engineers are covered in the Professional Ethics and/or Engineering Management courses offered prior to or concurrent with the course.

**SKEE 4812 : FINAL YEAR PROJECT 1**

The aim of the Final Year Project 1 (FYP1) is to allow the students to demonstrate a wide range of skills learned at the SKE through the design, analysis, testing, and evaluation stages in the project. The students will be exposed in identifying and formulate through literature and develop a project proposal. The final year project will include the concept of sustainable development for the project developed. Students will also learn to estimate project cost and manage time to achieve the project objectives. This will help students to develop important skills in summarizing a research area and understanding the research problems.

**SKEE 4824: FINAL YEAR PROJECT 2**
**Pre-requisite: SKEE 4812 Final Year Project 1**

The aim of the Final Year Project 2 (FYP2) is to provide students the opportunity to explore and implement creative and innovative knowledge to solve practical science, mathematical and engineering societal problems. Students are exposed to project management planning and execution. With these skills, it is hoped that the students will gain knowledge and experience in planning, designing and solving problems systematically thus when they graduate, they will be ready to work as reliable and productive engineers.

**SKEE 4926: PRACTICAL TRAINING**

Students will undergo a practical training lasting for a minimum of 10 weeks at an approved private, government or semi-government agency. The Faculty will release the list of participating agencies. Placement at the respective agency will be initiated by the applications from the students. Approval of the application is at the discretion of the Faculty. Undergraduates are expected to acquire hands on experience not only in the engineering aspects of work, but also to other related matters such as administration, accounting, management, safety, etc. during the industrial training period.

**SKEE 4643 : CONTROL AND DESIGN OF POWER ELECTRONIC SYSTEMS**

**Pre-requisite: SKEE 4433 Power Electronics and Drives**

This course covers the knowledge on how to model power electronic converters and design their controller parameters. The course gives a brief explanation on the basic operation of power electronics converters and the necessity of having a feedback control in the system. To design a controller for the converters, averaged models based on state-space and averaged switch are introduced. Then, small-signal models are derived. For controller design, a recap on control theory i.e. open-loop system, closed-loop, phase margin, gain margin and bandwidth will be reviewed. Conventional Proportional-Integral (PI) controller design under voltage mode control (VMC) and current mode control (CMC) strategies will be performed. All the derived models will be implemented in PSPICE/MATLAB software. The course will also introduce the student on the design issues/constraints that may be faced in designing the power converters.

**SKEE 4653 : PHOTOVOLTAIC AND WIND ENERGY SYSTEMS**

**Pre-requisite: SKEE 4433 Power Electronics and Drives**

This course covers the fundamental knowledge on two popular renewable energy systems, namely photovoltaic (PV) and wind energy systems. A brief introduction will be given on the renewable sources of energy. In photovoltaic energy system, the characteristic of PV generation will be described. It follows with the integration of PV array with power electronic converters for energy harvesting. In addition to that, maximum power point tracking which acts as a controller to the PV system will be reviewed. Then, several examples of PV energy system design will be discussed. The PV systems include stand-alone and grid-connected system. At the second stage of the course, wind energy system will be introduced. The general classification of wind turbines, function of generators and speed control of wind turbine will be discussed. Then, the typically used topologies of wind energy system will be described. In this course, students will be introduced with academic service learning, which students will pay visit to local schools to share their knowledge on PV energy systems. It will be a fun learning process where students can also contribute back to the community on what they have learned. At the end of the course, the student should be able to understand the fundamental operation and control of PV and wind energy systems.

**SKEE 4663 : ELECTRICITY FOR SUSTAINABLE ENERGY**
**Pre-requisite: SKEE 4423 Power System Engineering**

The course is designed to give an overview of energy resources such as conventional and non-conventional energy, with an emphasis on electrical energy system as well as understanding of demand growth, impact on environment and energy sustainability. Students will be introduced the various types of energy resources (RE and conventional); demand side management (DSM) options and energy efficiency (EE) measures includes managing energy used. Students will be asked to model renewable energy characteristics, for instance, photovoltaic I-V and P-V characteristics using C/C++, MATLAB and other appropriate tools. Students will also be exposed to design an energy supply system and justify the best choice based on cost benefit analysis by using HOMER software. At the end of the course students are expected to be able to apply and critically evaluate energy resources potential and demand side management options.

**SKEE 4673 : ELECTRICAL ENERGY MARKET**
**Pre-requisite: SKEE 4443 Power System Analysis**

This course introduces the students to the concept of competitive electrical energy market models. At the beginning of the course, the student will learn the difference between the old monopoly electricity market model and the new competitive electricity market model including the advantage and disadvantages of each model. Then the students will learn some of the electricity market models existed in the world in which emphasis will be given on Pool Market and Bilateral Market Model. Some of the technical issues arisen from the deregulated/competitive electricity market will also be covered in this course.

**SKEE 4683: POWER SYSTEM DESIGN & OPERATION**
**Pre-requisite: SKEE 4423 Power System Analysis**

This course embodies the basic principles and objectives of fundamentals of power system analysis. The aim is to instil confidence and apply the basic concepts of power system for further study and practice of electric power engineering. The course also provide an in-depth understanding of the way the entire electricity network is build, i.e. from generation, then onto transmission and finally onto the distribution network. At the end of the course, the student should be able to apply the theorems and concepts in power system design and operation. Upon completion of the course, the students would easily fit into the industry having acquired knowledge.

## SKEI 4233: NANOTECHNOLOGY AND APPLICATION

In this course, students will be presented with concepts, opportunities and issues related to the nanoscale world. Students will be exposed to the fundamental principles of various equipment used in observing the nanoworld. Next, knowledge related to manipulation, characterization and fabrication of micro and nano objects will be discussed. Then, students will be exposed to the analysis of microfluidic device using finite element analysis (FEA) tool. Finally, students will be exposed to the design and development of microfluidic device using photolithography technique. In the end of the course, students are expected to acquire good understanding and able to analyse the fundamental principles of various equipment used in nanoworld. Students must be able to differentiate between various fundamental working principles used by various nano equipment. Furthermore, students should be able to use FEA and microfabrication tools to design and develop microfluidic device.

## SKEI 4313: PLC AND SCADA SYSTEM DESIGN
**Pre-requisite: SKEE 3143 Control System Design**

This course is divided into parts: (1) Automation and (2) Scada system. This is an advance subject in control engineering for final year electrical engineering students. The main aim is to develop concepts in industrial control engineering to the students. Fundamental concepts in manufacturing and automation, building blocks of automation. Simple modeling and analysis process transducers and controllers, drivers and final control elements. Industrial logic control system, sequence control using electronic logic components and programmable logic controllers (PLC) in simple process, control system and automated control system. SCADA is the process of a plant and / or a method of gathering of data from devices in the field. This the process of collecting data into the actual business, and using it in real time. There are using standard communication protocols (eg IEC 60870, DNP3 and TCP/IP) and hardware and software. Many SCADA applications use PLCs as the RTU of choice,when communicating with field devices. This subject covers the essentials of SCADA and PLC systems, which are often used in close association with each other. A selection of case studies are used to illustrate the key concepts with examples of real world working SCADA and PLC systems in the water, electrical and processing industries.

**SKEI 4363 : INDUSTRIAL CONTROL NETWORKS**
**Pre-requisite: SKEE 3143 Control System Design**

The aim of this course is to present basic concepts in industrial control networks to students. It will highlight the basic system of interconnected equipment used to monitor and control the physical equipment in industrial environment. Fundamental concepts in conventional and industrial networks are initially described. Industrial control network components such as PLC, DCS and SCADA are also studied. The hierarchical and architecture of every level in industrial control networks are also discussed. The types of network protocols which are often used in industrial environment at every level are described.

**SKEL 3613: Semiconductor Material Engineering**
**Pre-requisite: SKEE 1073 Electronic Devices and Circuits**

The purpose of this course is to provide a basis for understanding the characteristics, operation, and limitations of semiconductor devices. In order to gain this understanding, it is essential to have a thorough knowledge of the basic physics and operation of the semiconductor material. The goal of this course is to bring together crystal structures, quantum mechanics, quantum theory for solids, semiconductor material physics, and fundamental of PN structures. All of these basic components are vital for students to understand the operation of present day and future electronic devices.

**SKEL 4223: Digital Signal Processing 1**
**Pre-requisite: SKEE 2073 Signal and System**

This course introduces concepts in digital signal processing. Continuous-time signals and systems will be reviewed. Consecutively, introduction to digital signal processing, basic idea, benefits and applications are presented. Discrete-time signals and systems are described based on signal definition, periodicity, stability, causality, convolution, difference equations, infinite impulse response (IIR), finite impulse response (FIR) and signal flow graphs. Spectrum representation of discrete-time signals will cover sampling theorem, the discrete-time Fourier transform (DTFT) and its properties, and Discrete Fourier Transform (DFT). Another domain presented is Z-transform which consists of topics on derivations, region of convergence, transformation properties, poles and zeros, and inverse z-transform. At the end of the course, analysis and design of digital filters covers filter basics, analog filter prototypes and design of IIR filter and FIR filter.

**SKEL 4273: CAD with HDL**
**Pre-requisite: SKEE 2263 Digital Systems**

This course introduces students to the use of computer-aided-design (CAD) tools and hardware description language (HDL) for the design of complex digital systems. Students will use CAD tools to model, design, analyze, synthesize, implement, and verify systems that are specified using the Register Transfer Level (RTL) methodology. Systems verification methods using scripts and testbenches will be introduced. Memory controller design and interfacing will be covered, including the use of RAMs, ROMs, Fifos, and external memory.

**SKEL 4283: Analog CMOS IC Design**
**Pre-requisite: SKEE 1073 Electronic Devices and Circuits**

In this course students will be taught the characteristics of MOSFET transistor as a prerequisite of CMOS analog design. It highlights the nonlinearity as an imperfection, which will limit the performance of analog circuits. The course will then proceed to analyse CMOS single ended as well as differential amplifiers. The trademark of analog design, which is the design challenge to fulfil design matrix, will be highlighted. Students will be guided on design principles to meet design specifications with acceptable accuracy. Op Amp design will be addressed towards the end of the course.

**SKEL 4373: IC Testing Techniques**
**Pre-requisite: SKEE 2263 Digital Systems; SKEL 4283 Analog CMOS IC Design**

This course introduces students to the techniques of testing a digital circuit and designing a testable digital circuit. Several fault models including single stuck-at fault model will be analyzed in details. Fault simulation methods are covered as well in this course. Test pattern generation and design-for-testability are also introduced to students. In order to facilitate learning process, computer-aided design (CAD) software is used throughout the course. Some practical or almost actual environment problems and solutions are provided.

**SKEL 4743: Basic Digital VLSI Design**
**Pre-requisite: SKEE 2263 Digital Systems**

The objective of this course is to introduce students to basic techniques to design and implement digital VLSI system. This course introduces students to VLSI technology. A historical perspective on the evolution of integrated circuit technology is covered. Important issues when designing a VLSI circuit are discussed. MOS transistors are studied in detail, including their characteristics, structure, switch-level behaviour, and current equation. SPICE model of a MOS transistor is also described. The simplest circuit, an inverter, is studied in detail. Its voltage-transfer characteristic, noise margin and how to control the inversion point is investigated. How an IC is fabricated is described. Fabrication processes are elaborated. Layout, design rules and stick diagram are explained. This course teaches how to design circuits. Several logic families will be introduced. Advantages and disadvantages of each logic design style are explained. Delay and power performance of each logic family is also compared. Latch and flip-flop circuits are also covered. Interconnect issues, when various components are connected, are elaborated.

**SKEM 4173: ARTIFICIAL INTELLIGENCE**

Artificial intelligence (AI) involves the development of algorithms derived from human and animal intelligence that have capabilities such as learning, reasoning, generalization, adaptation, reproduction, etc. Nowadays, these techniques are getting popular due to the large number of successful reports of implementations. AI techniques have also made their way into many domestic and industrial products and provided solutions to many difficult engineering problems. In this course, students are exposed to several AI techniques i.e. Artificial Neural Network (ANN), Fuzzy Logic, Genetic Algorithm (GA) and Particle Swarm Optimization (PSO), and how they are used as a stand-alone approach or in any combination of the methods in solving engineering and non-engineering problems.

**SKET 3573: Microwave Engineering**
**Pre-requisite: SKEE 3533 Communication Principles**

To introduce the basic theory of Microwave Engineering, such as transmission line theory, scattering parameters, Smith Chart, and impedance matching. Fundamental microwave devices, such as waveguides and resonators are explained. The students are also introduced to passive and active microwave components such as terminations, couplers, power dividers/combiners, circulators, amplifiers, oscillators,

travelling wave tubes, filters, and microwave solid-state devices. Fundamentals in microwave instruments and measurement techniques are introduced.

**SKET 3583: Digital Communication System**
**Pre-requisite: SKEE 3533 Communication Principles**

This course provides an introduction to fundamental concepts in digital communication system. Main topics to be covered are baseband pulse transmission, signal space analysis, digital modulation/demodulation, channel coding, source coding, detection methods and evaluation in AWGN channel. Fundamentals on error control coding is also included. Finally, the system trade-off in designing a digital communication system is explored.

**SKET 3623: Data Communication and Network**
**Pre-requisite: SKEE 3533 Communication Principles**

The objective of the subject is to enhance the students' knowledge on data communication and computer networks. It explains the basic process of data communication, protocol, interfacing and inter-working between computer networks and switching components in telecommunication system. At the end of the course, the students should be able to understand the system used in representation, distribution, transmission and reception of data in data communication network.

**SKET 4533: Wireless Communication Systems**
**Pre-requisite: SKET 3573 Microwave Engineering**

This course introduces students the concept and principle of mobile radio communication and satellite communication system. Topics covered include mobile radio propagation, multiple access, cellular concept, modern wireless communication systems and satellite communication systems.

**SKET 4543: RF Microwave Circuit Design**
**Pre-requisite: SKET 3573 Microwave Engineering**

This course introduces students to the concept of designing RF/Microwave circuit in wireless communication system such as filters, amplifiers, oscillators and mixers. The design of the RF/Microwave circuit is based on the discrete components and the S-parameter of the component. The

system block diagram is also discussed such as transmitter and receiver function and noise in communication system. The filter design is based on the lump component and the resposnse of the filter such as Butterworth and Chebyshev response. The matching concept is discussed further in the RF/Microwave amplifier and oscillator design using Smith chart. The analysis of the different mixer is also discussed in this subject.Simulation software CST will also introduced to facilitate learning process.

**SKET 4593: Acoustic Engineering**
**Pre-requisite: SKET 3533 Communication Principles**

This course embodies the basic principles of fundamentals of acoustics engineering. The aim is mainly to instil confidence and apply the basic concepts, theories and applications in acoustics, noise control, room acoustics and sound system design. The course provides an in depth understanding of the characteristics, propagations, transmission and attenuation of sound waves. Further, noise criteria and control of interfering noise, sound absorption and reflection shall follow. The last part of the course cover on good room acoustics and sound system design for an enclosed room. At the end of the course, the students shall be able to apply the acoustics engineering fundamentals and concept in designing enclosed room for optimum acoustics and sound system.

**SKET 4613: Antenna Theory and Design**
**Pre-requisite: SKET 3573 Microwave Engineering**

This course introduces students the concept of antenna, theory and design in telecommunication system. The basic antenna properties such as gain, polarization, directivity, efficiency, and radiation pattern for various types of antenna will be discussed. Several antennas with specific characteristic will be designed using simulation software and analysed. Finally, the antenna measurement setup is introduced and discussed.

**SKET 4623: Network Programming**
**Pre-requisite: SKET 3623 Data Communication and Networks**

The objective of this course is to introduce students to the basic of network programming, in the networking implementations. This course will provide the students with understanding of socket programming to interconnect computers in network. The module will cover topics such as treads, input-output streams, handling errors and exceptions in socket programming. By

the end of the module, students should have an understanding of interfacing between client and server.