

## BACHELOR OF COMPUTER SCIENCE (BIOINFORMATICS) WITH HONOURS

### PROGRAMME SPECIFICATIONS

The Bachelor of Computer Science (Bioinformatics) with Honours is offered on a full-time basis. The full-time programme is offered only at the UTM Main Campus in Johor Bahru. 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 fourteen (14) 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 Computer Science (Bioinformatics) with Honours      |           |                      |           |
| 4. Final Award  | Bachelor of Computer Science (Bioinformatics) with Honours      |           |                      |           |
| 5. Programme Code                                       | SECBH   |           |                      |           |
| 6. Professional or Statutory Body of Accreditation      | Ministry of Higher Education                                    |           |                      |           |
| 7. Language(s) of Instruction                           | English   |           |                      |           |
| 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 (8 semesters)<br>Maximum : 6 yrs (12 Semesters) |           |                      |           |
| Type of Semester  | No. of Semesters  |           | No of Weeks/Semester |           |
|   | Full Time   | Part Time | Full Time            | Part Time |
| Normal  | 8   | 20        | 8                    | 14        |
| Short   | -   | -         | -                    | -         |

## Course Classification

| No.  | Classification                                   | Credit Hours            | Percentage  |
|------|--|-------------------------|-------------|
| i.   | University Courses                               |                         |             |
|      | a. General                                       | 10                      |             |
|      | b. Language                                      | 8                       | 17.6%       |
|      | c. Co-Curriculum                                 | 3                       |             |
|      | d. IT Entrepreneurship                           | 2                       |             |
| ii.  | Core Courses                                     | 74                      | 56.4%       |
| iii. | Elective Courses                                 | 34                      | 26.0%       |
|      | <b>Total</b>                                     | <b>131</b>              | <b>100%</b> |
| A    | Engineering Courses                              |                         |             |
|      | (a) Lecture/Project/Laboratory                   |                         |             |
|      | (b) Workshop/Field/Design Studio                 | Nil                     | Nil         |
|      | (c) Industrial Training                          |                         |             |
|      | (d) Final Year Project                           |                         |             |
|      | <b>Total Credit Hours for Part A</b>             |                         |             |
| B    | Related Courses                                  |                         |             |
|      | (a) Applied Science/ Mathematic/<br>Computer     | Nil                     | Nil         |
|      | (b) Management/Law/Humanities/<br>Ethics/Economy |                         |             |
|      | (c) Language                                     |                         |             |
|      | (d) Co-Curriculum                                |                         |             |
|      | <b>Total Credit Hours for Part B</b>             |                         |             |
|      | <b>Total Credit Hours for Part A and B</b>       | <b>Nil</b>              |             |
|      | <b>Total Credit Hours to Graduate</b>            | <b>131 credit hours</b> |             |

## Award Requirements

### To graduate, students must:

- Achieve a total of 131 credit hours with minimum CPA of 2.0.
- Pass industrial training (equivalent to 12 credit hours), which 4 credits will be graded and 8 credits as HW status.
- Complete Bioinformatics Project I and II.
- Pass 5 Professional Skills Certificate (PSC).

## 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 | Obtain employment as computer scientist in local and global industries and organization, where they are competent in applying the fundamental knowledge, computational principles and skills in Bioinformatics to develop software of increasing size and complexity across different application areas.   |
| PEO2 | Demonstrate an ability to continue to learn throughout their career (i.e. professional, technical or postgraduate education) which can straighten their analytical and critical thinking skills to position them to advanced Computer Science and Bioinformatics and to contribute to the intellectual foundations of the Computer Science and Bioinformatics disciplines. |
| PEO3 | Involve in Bioinformatics and related a number software project that they are proficient in applying theoretical computing and knowledge in analysing, modelling, designing, developing and evaluation computing and bioinformatics solutions.   |
| PEO4 | Becoming leaders or technopreneurs in computer science and bioinformatics disciplines with combination skills  |
| PEO5 | Demonstrate an awareness of professional ethics and social responsibility as computer scientists specialising in bioinformatics.   |

## Programme Learning Outcomes (PLO)

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

| Code          | Intended Learning Outcomes   |
|---------------|--|
| PLO1<br>(KW)  | Attain advanced knowledge to solve critical issues of a field in Computing and Bioinformatics.         |
| PLO2<br>(CG)  | Critically solve and manage complex problems using systematic approaches.                              |
| PLO3<br>(PS)  | Adapt technical and scientific skills to solve problems in a field of Bioinformatics.                  |
| PLO4<br>(IPS) | Demonstrate effective collaboration with stakeholders professionally.                                  |
| PLO5<br>(CS)  | Use a broad range of information, media and technology to support study.                               |
| PLO6<br>(DS)  | Competently use digital technologies and software to support research works or studies.                |
| PLO7<br>(NS)  | Analyse numerical and graphical data using quantitative or qualitative tools in solving problems.      |
| PLO8<br>(LAR) | Demonstrate leadership, autonomy and responsibility in conducting and managing research and resources. |
| PLO9          | Self-advancement through continuous academic or professional development.                              |

| <b>Code</b>    | <b>Intended Learning Outcomes</b>   |
|----------------|---|
| (PRS)          |   |
| PLO10<br>(ENT) | Initiate entrepreneurial project with relevant knowledge and expertise.                             |
| PLO11<br>(ETS) | Demonstrate respectable ethical conducts and professionalism skills in an organization and society. |

## COURSE MENU

| YEAR 1: SEMESTER 1        |  |           |               |
|---------------------------|--|-----------|---------------|
| Code                      | Course                                   | Credit    | Pre-requisite |
| SECI1013                  | Discrete Structure                       | 3         |               |
| SECJ1013                  | Programming Technique I                  | 3         |               |
| SECP1513                  | Technology & Information System          | 3         |               |
| SECR1013                  | Digital Logic                            | 3         |               |
| UHMT1012                  | Graduate Success Attributes              | 2         |               |
| MALAYSIAN STUDENTS        |  |           |               |
| UHS1012                   | Philosophy and Current Issues            | 2         |               |
| UHMS1182                  | Appreciation of Ethics and Civilizations | 2         |               |
| INTERNATIONAL STUDENTS    |  |           |               |
| UHS1022                   | Philosophy and Current Issues            | 2         |               |
| UHMS1182                  | Appreciation of Ethics and Civilizations |           |               |
| UHLM1012                  | Malaysia Language for Communication 2    | 2         |               |
| <b>TOTAL CREDITS</b>      |  | <b>18</b> |               |
| <b>CUMULATIVE CREDITS</b> |  | <b>18</b> |               |

| YEAR 1: SEMESTER 2        |   |           |               |
|---------------------------|---|-----------|---------------|
| Code                      | Course  | Credit    | Pre-requisite |
| SECI1113                  | Computational Mathematics                         | 3         |               |
| SECI1143                  | Probability & Statistical Data Analysis           | 3         |               |
| SECJ1023                  | Programming Technique II                          | 3         | SECJ1013      |
| SECR1033                  | Computer Organization and Architecture            | 3         | SECR1013      |
| SEBB4173 <sup>#</sup>     | Cellular and Molecular Biology for Bioinformatics | 3         |               |
| UHLB1112 <sup>*</sup>     | English Communication Skills                      | 2         |               |
| <b>TOTAL CREDIT</b>       |   | <b>17</b> |               |
| <b>CUMULATIVE CREDITS</b> |   | <b>35</b> |               |

*<sup>#</sup>SEBB4173 is a core elective course for SECBH students*

*<sup>\*</sup> Students with minimum score of IELTS Band 5.5, TOEFL 525, TOEFL iBT 60, CEFR B2 and MUET Band 4 can apply for credit exemption for UHLB1112.*

| YEAR 2: SEMESTER 1        |   |           |                      |
|---------------------------|---|-----------|----------------------|
| Code                      | Course                                  | Credit    | Pre-requisite        |
| SECD2523                  | Database                                | 3         |                      |
| SECD2613                  | System Analysis and Design              | 3         |                      |
| SECJ2013                  | Data Structure and Algorithm            | 3         | SECJ1013<br>SECJ1023 |
| SECR2213                  | Network Communications                  | 3         |                      |
| SECV2113                  | Human Computer Interaction              | 3         |                      |
| UKQFxxx2                  | Service-Learning Co-curriculum Elective | 2         |                      |
| <b>TOTAL CREDIT</b>       |   | <b>17</b> |                      |
| <b>CUMULATIVE CREDITS</b> |   | <b>52</b> |                      |

| <b>YEAR 2: SEMESTER 2</b> |                               |               |                      |
|---------------------------|-------------------------------|---------------|----------------------|
| <b>Code</b>               | <b>Course</b>                 | <b>Credit</b> | <b>Pre-requisite</b> |
| SECJ2203                  | Software Engineering          | 3             |                      |
| SECV2223                  | Web Programming               | 3             |                      |
| SECR2043                  | Operating Systems             | 3             | SECR1033             |
| SECJ2154                  | Object Oriented Programming   | 4             | SECJ1023             |
| UHLB2122                  | Academic Communication Skills | 2             | UHLB1112             |
| SECB2103                  | Bioinformatics                | 3             |                      |
|                           | <b>TOTAL CREDIT</b>           | <b>18</b>     |                      |
|                           | <b>CUMULATIVE CREDITS</b>     | <b>70</b>     |                      |

| <b>YEAR 3: SEMESTER 1</b> |                                  |               |  |
|---------------------------|----------------------------------|---------------|--|
| <b>Code</b>               | <b>Course</b>                    | <b>Credit</b> | <b>Pre-requisite</b>                         |
| UHLB3132                  | Professional Communication Skill | 2             | UHLB2122                                     |
| UHLx1112                  | Foreign Language Elective        | 2             |  |
| SECB3104                  | Applications Development         | 4             | SECD2523<br>SECV1213<br>SECJ2203<br>SECR3413 |
| SECJ3553                  | Artificial Intelligence          | 3             | SECJ2013                                     |
| SECBxxx3                  | SECB elective 1                  | 3             |  |
| SECBxxx3                  | SECB elective 2                  | 3             |  |
|                           | <b>TOTAL CREDIT</b>              | <b>17</b>     |  |
|                           | <b>CUMULATIVE CREDITS</b>        | <b>87</b>     |  |

| <b>YEAR 3: SEMESTER 2</b> |   |               |                      |
|---------------------------|---|---------------|----------------------|
| <b>Code</b>               | <b>Course</b>                                 | <b>Credit</b> | <b>Pre-requisite</b> |
| SECB3032                  | Bioinformatics Project I                      | 2             | SECJ3104             |
| SECJ3203                  | Theory of Computer Science                    | 3             | SECI1013<br>SECJ2013 |
| UHIT2302                  | The Thought of Sciences and Technology        | 2             |                      |
| UKQT3001                  | Extracurricular Experiential Learning (ExCEL) | 1             |                      |
| SExBxxx3                  | SECB elective 3                               | 3             |                      |
| SExBxxx3                  | SECB elective 4                               | 3             |                      |
| SECx5xx3                  | PRISM elective 1                              | 3             |                      |
| SExBxxx3                  | SECB elective 5                               | 3             |                      |
| SECx5xx3                  | PRISM elective 2                              | 3             |                      |
|                           | <b>TOTAL CREDIT</b>                           | <b>17</b>     |                      |
|                           | <b>CUMULATIVE CREDITS</b>                     | <b>104</b>    |                      |

| <b>YEAR 4: SEMESTER 1</b> |                            |               |                      |
|---------------------------|----------------------------|---------------|----------------------|
| <b>Code</b>               | <b>Course</b>              | <b>Credit</b> | <b>Pre-requisite</b> |
| SECB4118                  | Industrial Training (HW)   | 8             | 92 credits           |
| SECB4114                  | Industrial Training Report | 4             | CGPA >= 2.0          |
|                           | <b>TOTAL CREDIT</b>        | <b>12</b>     |                      |
|                           | <b>CUMULATIVE CREDITS</b>  | <b>116</b>    |                      |

| <b>YEAR 4: SEMESTER 2</b> |                                    |               |                      |
|---------------------------|------------------------------------|---------------|----------------------|
| <b>Code</b>               | <b>Course</b>                      | <b>Credit</b> | <b>Pre-requisite</b> |
| SECB4134                  | Bioinformatics Project II          | 4             | SECB3032             |
| SECD3761                  | Technopreneurship Seminar          | 1             |                      |
| UHAK1032                  | Introduction to Entrepreneurship   | 2             |                      |
| Uxxx2xx2                  | General University Elective Course | 2             |                      |
| SExBxxx3                  | SECB elective 6                    | 3             |                      |
| SECx5xx3                  | PRISM elective 3                   |               |                      |
| SExBxxx3                  | SECB elective 7                    | 3             |                      |
| SECx5xx3                  | PRISM elective 4                   |               |                      |
|                           | <b>TOTAL CREDIT</b>                | <b>15</b>     |                      |
|                           | <b>CUMULATIVE CREDITS</b>          | <b>131</b>    |                      |

| <b>SECB ELECTIVES (choose 7)</b> |  |               |                      |
|----------------------------------|--|---------------|----------------------|
| <b>Code</b>                      | <b>Course</b>                          | <b>Credit</b> | <b>Pre-requisite</b> |
| SEBB4203                         | Protein Biomolecules                   | 3             |                      |
| SEBB4193                         | Gene and Protein Technology            | 3             |                      |
| SECB3032                         | Bioinformatics II                      | 3             |                      |
| SECB3203                         | Programming for Bioinformatics         | 3             |                      |
| SECB3213                         | Bioinformatics Database                | 3             |                      |
| SECB3133                         | Computational Biology I                | 3             |                      |
| SECB3223                         | Computational Biology II               | 3             |                      |
| SECB4243                         | Special Topics in Bioinformatics       | 3             |                      |
| SECB4213                         | Bioinformatics Visualization           | 3             |                      |
| SECB4313                         | Bioinformatics Modeling and Simulation | 3             |                      |

### **PRISMS ELECTIVE COURSES**

For students who intend to enroll in PRISMS, refer to the PRISMS Section for a list of related elective courses associated with the Postgraduate Programme. The PRISMS elective begins with code SECJ5xx3 / SECP5xx3 / SECR5xx3.

## 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.

| NO.   | CODE     | COURSE                                  | CREDIT EARNED (JKD) | CREDIT COUNT-ED (JKK) | TICK (✓) IF PASSED |
|---|----------|---|---------------------|-----------------------|--------------------|
| <b>COMPUTER SCIENCE COURSES</b>   |          |   |                     |                       |                    |
| <b>CORE COURSES (74 CREDITS)</b>  |          |   |                     |                       |                    |
| 1   | SECI1013 | Discrete Structure                      | 3                   | 3                     |                    |
| 2   | SECJ1013 | Programming Technique I                 | 3                   | 3                     |                    |
| 3   | SECR1013 | Digital Logic                           | 3                   | 3                     |                    |
| 4   | SCSP1513 | Technology & Information System         | 3                   | 3                     |                    |
| 5   | SECI1113 | Computational Mathematics               | 3                   | 3                     |                    |
| 6   | SCSI1143 | Probability & Statistical Data Analysis | 3                   | 3                     |                    |
| 7   | SECJ1023 | Programming Technique II                | 3                   | 3                     |                    |
| 8   | SECR1033 | Computer Organisation and Architecture  | 3                   | 3                     |                    |
| 9   | SECD2523 | Database                                | 3                   | 3                     |                    |
| 10  | SECD2613 | System Analysis and Design              | 3                   | 3                     |                    |
| 11  | SECJ2013 | Data Structure and Algorithm            | 3                   | 3                     |                    |
|   | SECR2213 | Network Communications                  | 3                   | 3                     |                    |
| 12  | SECV2113 | Human Computer Interaction              | 3                   | 3                     |                    |
| 13  | SECJ2203 | Software Engineering                    | 3                   | 3                     |                    |
| 14  | SECV2223 | Web Programming                         | 3                   | 3                     |                    |
| 15  | SECR2043 | Operating Systems                       | 3                   | 3                     |                    |
| 16  | SECJ2154 | Object Oriented Programming             | 4                   | 4                     |                    |
| 17  | SECB3032 | Bioinformatic Project I                 | 2                   | 2                     |                    |
| 18  | SECJ3203 | Theory of Computer Science              | 3                   | 3                     |                    |
| 19  | SECB4118 | Industrial Training                     | 8                   | HL                    |                    |
| 20  | SECB4114 | Industrial Training Report              | 4                   | 4                     |                    |
| 21  | SECB4134 | Bioinformatic Project II                | 4                   | 4                     |                    |
| 22  | SECD3761 | Technopreneurship Seminar               | 1                   | 1                     |                    |
| <b>ELECTIVES COURSES (34 CREDITS) – Choose SECJ3104 and 10 other elective courses from the following list (which can include up to maximum of 4 PRISMS courses, for qualified students)</b> |          |   |                     |                       |                    |
| <b>SECB ELECTIVES COURSES</b>   |          |   |                     |                       |                    |
| 23  | SECB3103 | Bioinformatics I                        | 3                   | 3                     |                    |
| 25  | SECB3032 | Bioinformatics II                       | 3                   | 3                     |                    |



|   |           |   |            |            |  |
|---|-----------|---|------------|------------|--|
| 27  | SECB3203  | Programming for Bioinformatics                      | 3          | 3          |  |
| 28  | SECB3213  | Bioinformatic Database                              | 3          | 3          |  |
| 29  | SECB3133  | Computational Biology I                             | 3          | 3          |  |
| 30  | SECB3223  | Computational Biology II                            | 3          | 3          |  |
| 31  | SECB4243  | Special Topic in Bioinformatics                     | 3          | 3          |  |
| 32  | SECB4213  | Bioinformatics Visualization                        | 3          | 3          |  |
| 33  | SECB4313  | Bioinformatics Modeling and Simulation              | 3          | 3          |  |
| 34  | SECD2623  | Database Programming                                | 3          | 3          |  |
| 35  | SECJ3104  | Applications Development                            | 4          | 4          |  |
| 36  | SECJ3553  | Artificial Intelligence                             | 3          | 3          |  |
| 37  | SECJ3303  | Internet Programming                                | 3          | 3          |  |
| 38  | SEBB4173  | Cellular and Molecular Biology for Bioinformatics   | 3          | 3          |  |
| 40  | SEBB4203  | Proteins Biomolecules                               | 3          | 3          |  |
| 41  | SEBB4193  | Gene and Protein Technology                         | 3          | 3          |  |
| <b>PRISMS ELECTIVES COURSES</b>                                 |           |   |            |            |  |
| 42  | SECR 5013 | Cryptographic Engineering                           | 3          | 3          |  |
| 43  | SECR 5023 | Digital Forensics                                   | 3          | 3          |  |
| 44  | SECR 5033 | Information Security Governance and Risk Management | 3          | 3          |  |
| 45  | SECR 5043 | Cloud Computing Security                            | 3          | 3          |  |
| 46  | SECJ 5013 | Secure Software Engineering                         | 3          | 3          |  |
| 47  | SECR 5053 | Penetration Testing                                 | 3          | 3          |  |
| 48  | SECJ 5023 | Advanced Theory of Computer Science                 | 3          | 3          |  |
| 49  | SECJ 5033 | Advanced Data Structure and Algorithms              | 3          | 3          |  |
| 50  | SECJ 5043 | Advanced Artificial Intelligence                    | 3          | 3          |  |
| 51  | SECP 5013 | Advanced Analytics for Data Science                 | 3          | 3          |  |
| 52  | SECP 5023 | Big Data Management                                 | 3          | 3          |  |
| 53  | SECP 5033 | Business Intelligence and Analytics                 | 3          | 3          |  |
| 54  | SECP 5043 | Data Science Governance                             | 3          | 3          |  |
| 55  | SECP 5053 | Massive Mining and Streaming                        | 3          | 3          |  |
| 56  | SECP 5063 | Statistics for Data Science                         | 3          | 3          |  |
| <b>TOTAL CREDIT OF COMPUTER SCIENCE COURSES</b>                 |           |   | <b>108</b> | <b>100</b> |  |
| <b>(a)</b>  |           |   |            |            |  |
| <b>UNIVERSITY GENERAL COURSES</b>                               |           |   |            |            |  |
| <b>Cluster 1: Appreciation of Philosophy, Value and History</b> |           |   |            |            |  |
| <b>(Faculty of Social Sciences and Humanities)</b>              |           |   |            |            |  |
| For Malaysian Students  |           |   |            |            |  |
| 1   | UHIS1022  | Falsafah dan Isu Semasa                             | 2          | 2          |  |
| 2   | UHMS1182  | Penghayatan Etika dan Peradaban                     | 2          | 2          |  |
| For International Students                                      |           |   |            |            |  |
| 1   | UHIS1022  | Falsafah dan Isu Semasa                             | 2          | 2          |  |

|   |          |  |     |     |  |
|---|----------|--|-----|-----|--|
|   | UHMS1182 | Penghayatan Etika dan Peradaban          |     |     |  |
| 2   | UHLM1012 | Malaysia Language for Communication      | 2   | 2   |  |
| <b>Cluster 2: Generic Skills</b>  |          |  |     |     |  |
| 1   | UBSS1032 | Introduction to Entrepreneurship         | 2   | 2   |  |
| 2   | UHMT1012 | Graduate Success Attributes              | 2   | 2   |  |
| <b>Cluster 3: Knowledge Enhancement</b>   |          |  |     |     |  |
| 1   | UHIT2302 | The Thought of Science and Technology    | 2   | 2   |  |
| <b>Cluster 4: Co-Curriculum and Service Learning</b>  |          |  |     |     |  |
| 1   | UKQF2xx2 | Service Learning Co-curriculum Elective  | 2   | 2   |  |
| 2   | UKQT3001 | Extracurricular Experiential Learning    | 1   | 1   |  |
| <b>Cluster 5: Language Skills<br/>(Language Academy, Faculty of Social Sciences and Humanities)</b> |          |  |     |     |  |
| 1   | UHLB1122 | English Communication Skills             | 2   | 2   |  |
| 2   | UHLB2122 | Academic Communication Skills            | 2   | 2   |  |
| 3   | UHLB3132 | Professional Communication Skills        | 2   | 2   |  |
| 4   | UHLx1112 | Foreign Language Elective                | 2   | 2   |  |
| <b>Other University Electives</b>   |          |  |     |     |  |
| 1   | Uxxx2xx2 | Any 1 course from Cluster 2 or Cluster 3 | 2   | 2   |  |
| <b>TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)</b>   |          |  | 23  | 23  |  |
| <b>TOTAL CREDIT TO GRADUATE (a + b + c)</b>   |          |  | 131 | 123 |  |

#### OTHER COMPULSORY COURSES

| No.                       | PSC COURSE  |  |
|---------------------------|---|--|
| <b>COMPULSORY COURSES</b> |   |  |
| 1                         | Design Thinking for Entrepreneur  |  |
| 2                         | Talent and Competency Management  |  |
| 3                         | English Communication Skills for Graduating Students (ECS)  |  |
| <b>ELECTIVE COURSES</b>   |   |  |
| 4                         | Occupational Safety, Health & Environment (OSHE) ( <i>Compulsory to all FE students</i> )   |  |
| 5.                        | Choose ONE elective course from the following list: <ul style="list-style-type: none"> <li>1. Data Analytics for Organization</li> <li>2. Construction Measurement (Mechanical &amp; Electrical Works)</li> <li>3. Professional Ethics and Integrity</li> <li>4. Other electives courses offered in future</li> </ul> |  |

## **COURSE SYNOPSIS**

### **CORE COURSES**

#### **SECI1013 Discrete Structure**

This course introduces students to the principles and applications of discrete structure in the field of computer science. The topics that are covered in this course are set theory, proof techniques, relations, functions, recurrence relations, counting methods, graph theory, trees and finite automata. At the end of the course, the students should be able to use set theory, relations and functions to solve computer science problems, analyze and solve problems using recurrence relations and counting methods, apply graph theory and trees in real world problems and use deterministic finite automata finite state machines to model electronic devices and problems.

#### **SECJ1013 Programming Technique I**

As a fundamental subject, this course equips the students with theory and practice on problem solving techniques by using the structured approach. Students are required to develop programs using C++ programming language, in order to solve simple to moderate problems. The course covers the following: pre-processor directives, constants and variables, data types, input and output statements, control structures: sequential, selection and loop, built-in and user-defined functions, single and two-dimensional arrays, file operations, pointers, and structured data types.

#### **SECR1013 Digital Logic**

Digital electronics is the foundation of all microprocessor-based systems found in computers, robots, automobiles, and industrial control systems. This course introduces the students to digital electronics and provides a broad overview of many important concepts, components, and tools. Students will get up-to-date coverage of digital fundamentals-from basic concepts to programmable logic devices. Laboratory experiments provide hands-on experience with the simulator software, actual devices and circuits studied in the classroom.

#### **SECP1513 Technology & Information System**

As a primer subject, this course will introduce students to information systems and technology (IS/IT), as well as its uses in daily life both at home and at work. Various aspects of IS/IT encompassing hardware, software, network, communications, internet, multimedia, graphics and systems applications will be introduced. Students will be equipped with basic skills in handling PC installation and productivity tools via practical work in the labs, which shall comprise a major part of the study. At the end of the course, student should be able to distinguish basic IS/IT component and applications.

### **SECI1113 Computational Mathematics**

This course is a combination of linear algebra and numerical methods as preparation for computer science student to apply mathematics knowledge in core knowledge of computer science. The first part of this course is an introduction to linear algebra. The topics that are covered in linear algebra are linear equations, linear combinations, linear independence, linear transformation, and vector spaces. The second part of this course covers numerical methods that can be used to solve non-linear equation, linear systems, eigenvalue problems, interpolation, differentiation and integration. At the end of the course, students should be able to apply mathematics knowledge to solve mathematical problems. Implementation of engineering tools such as MATLAB, would enhance student to use simple programming technique for solving mathematical problems.

### **SCSI1143 Probability & Statistical Data Analysis**

This course is designed to introduce some statistical techniques as tools to analyse the data. In the beginning the students will be exposed with various forms of data. The data represented by the different types of variables are derived from different sources; daily and industrial activities. The analysis begins with the data representation visually. The course will also explore some methods of parameter estimation from different distributions. Further data analysis is conducted by introducing the hypothesis testing. Some models are employed to fit groups of data. At the end of course the students should be able to apply some statistical models in analysing data using available software.

### **SECJ1023 Programming Technique II**

#### **Pre-requisite: SECJ1013 Programming Technique I**

This course presents the concept of object orientation and object-oriented programming (OOP) techniques using the C++ programming language. It equips the students with the theory and practice on problem solving techniques using the object-oriented approach. It emphasizes on the implementation of the OOP concepts including encapsulations, associations and inheritance. At the end of this course, students should be able to apply the OOP techniques to solve problems.

### **SECR1033 Computer Organisation and Architecture**

#### **Pre-requisite: SECR1013 Digital Logic**

This course was designed to give the understanding of basic concept of computer organization and architecture. Topics covered in this subject will be on computer performance, types of data and the representative, arithmetic manipulation, instruction execution, micro programmable control memory, pipelining, memory, input/output and instruction format. At the end of this course, the student should be able to understand the concept of overall computer component and realize the current technology in computer hardware.

### **SECD2523 Database**

This course introduces students to the concept of database system and how it is used in daily human life and profession. The focus of the course is to equip students with the knowledge and skills on important steps and techniques used in developing a database, especially in the conceptual and logical database design phase. Among topics covered are database environment, database design, entity relationship diagram, normalization, and structured query language (SQL). Students will be taught to use a database management system (DBMS). Students are required to design and develop the database component of an information system using the learned techniques, DBMS and a development tool. At the end of the course, students should be able to apply the knowledge of designing and developing a good database system.

### **SECD2613 System Analysis and Design**

The main focus of this course is to provide a practical approach of systems analysis and designing skills for the students using structured methodology. Hence the course enables students to study information system requirements for any system application within an organizational context. The contents are sequentially organized directly from planning, analysis, designing and implementation phases. From the resulting output of the planning and analysis phase shall enable students to form input, output and interface design. Hence a prototype design can be demonstrated.

### **SECJ2013 Data Structure and Algorithm**

**Pre-requisite: SECJ1013 Programming Technique I  
SECJ1023 Programming Technique II**

This course emphasis on data structure concepts theoretically and practically with detail algorithms for each of data structure. Students will learn abstract data type concepts using class and apply the concept in the implementation of data structures. Apart from it, student will learn recursive concept as a programming style and algorithm efficiency analysis with Big O notation. Various sorting and searching techniques will be discussed as data structure operations. Analysis of each algorithm will also be explained. Further, students will be exposed to linear data structures such as linked lists, stack and queue. Non-linear data structures such as tree and binary search tree will be discussed. Along the course, students should be able to implement and apply the theory and concepts of data structure in the assignments and mini project which are conducted in group.

### **SECR2213 Network Communications**

This course will discuss the basic topics of computer network and data communications. Based on TCP/IP Internet protocol stack, the course will apply top down approach. Starts with the important and usage of computer network in commonly applications, the approach will go further detail in the technical aspect in data communication. At the end of this course, students will have an understanding and appreciation of how the network works.

### **SECV2113 Human Computer Interaction**

This course will introduce students to human-computer interaction theories and design processes. The emphasis will be on applied user experience (UX) design. The course will present an iterative evaluation centered UX lifecycle and will introduce a broader notion of user experience, including usability, usefulness, and emotional impact. The lifecycle should be viewed as template intended to be instantiated in many different ways to match the constraints of a particular development project. The UX lifecycle activities we will cover include contextual inquiry and analysis, requirements extraction, design-informing models, design thinking, ideation, sketching, conceptual design, and formative evaluation.

### **SECJ2203 Software Engineering**

This course is designed to give students an introduction to an engineering approach in the development of high-quality software systems. It will discuss the important software engineering concepts in the various types of the common software process models. The students will also learn the concepts and techniques used in each software development phase including requirements engineering, software design and software testing. This course will also expose the students to utilizing object-oriented method (e.g. UML) and tools in analyzing and designing the software. At the end of this course, students are expected to be able to appreciate most of the common software engineering concepts and techniques as well as producing various software artifacts, documentations, and deliverables.

### **SECV2223 Web Programming**

This course is designed to introduce students the fundamental of knowledge, technologies and components for web application developments. The basic topics includes the standard HTML for content creation, CSS for content presentation, JavaScript for client-side logics, PHP for server-side logics and MySQL for database processing. At the end of the course, the students should be able to apply the web base technologies and then implement it all in the creating functional data-centric online system project.

### **SECR2043 Operating Systems**

#### **Pre-requisite: SECR1033 Computer Organization and Architecture**

This course covers introduction to operating systems, which serve as an interface between computer hardware and the user. The operating system is responsible for the management and coordination of processes, sharing of limited resources of the computer. Students will be exposed to the techniques and algorithms that may be applied in designing an operating system. Topics covered include process management, concurrency and synchronization, deadlock, memory management, file management, secondary storage management and I/O management. At the end of the course, the student shall have a clear understanding on the general concepts that underlie of an operating system.

### **SECJ2154 Object Oriented Programming**

#### **Pre-requisite: SECJ1023 Programming Technique II**

This course presents the concepts of object orientation and object-oriented programming techniques using Java programming language. It provides students with a thorough look at the basic constructs of the Java programming language such as its basic data types and operations. It also emphasizes on the use of standard Java APIs that allow students to develop text-based and GUI applications. It will also provide the programming techniques on exception handling and input/output files. At the end of this course, students should be able to use the basic constructs in object-oriented programming and utilize the selected Java APIs.

### **SECB3032 Bioinformatics Project I**

This is the initial part of a 2-part Final Year Project that every student must fulfil successfully. Students are introduced to the methodologies of research and application development through a series of lectures. Students are guided through a step-by-step practice to complete the initial stages of proposal, planning and design of a project. Students must also meet regularly with supervisor(s) who will monitor their continuous progress. Students are required to prepare a report and present their initial work.

### **SECJ3203 Theory of Computer Science**

#### **Pre-requisite: SECI1013 Discrete Structure**

#### **SECJ2013 Data Structure and Algorithm**

The goal of this course is to provide students with an understanding of basic concepts in the theory of computation. This course introduces students to formal languages and automata theory. It will emphasize on languages, grammars and abstract machines i.e. Regular Language, Context Free Language, Regular Grammar, Context Free Grammar, Finite Automata, Push Down Automata and Turing Machine. The course will also provide practice on the acceptability of input string by these machines. At the end of the course, students should be able to apply the theory in constructing these abstract machines and testing them with the right input strings.

### **SECB4118 Industrial Training (HW)**

#### **Pre-requisite: 92 credits AND CGPA $\geq$ 2.0**

Industrial Training refers to the placement of a student at an organization for a minimum of 20 weeks to elevate students' knowledge and skills in a specific database profession and at the same time produce graduates who are credible, creative and proficient. This course aims to provide a platform for the students apply their knowledge learned in the university and boost their skills which needed by a profession. It is also intended for the students to gain exposure in every aspect of real career life. The students will be evaluated based on two components; 1) student performance evaluation by organization supervisor and 2) student performance evaluation by faculty supervisor. The organization supervisor is expected to assess the student performance based on work performance and student's personality. The assessment by faculty supervisor more focusing on students' generic skills.

### **SECB4114 Industrial Training Report**

**Pre-requisite: 92 credits AND CGPA  $\geq$  2.0**

Industrial Training Report refers to the placement of a student at an organization for a minimum of 20 weeks to experience and apply their theoretical knowledge in the industrial training. The students will be evaluated based on four components; 1) technical report, 2) oral presentation, 3) logbook and 4) ethics. The aim of the technical report is to educate the students in producing related technical report and able to explain a specific detail on the tasks that have been done during the training. Students need to follow specified format in writing the technical report and submit it within the predetermined date. The students are required to present their training achievement to Industrial Training supervisors (organization and supervisor). Students need to fill in the online logbook daily for the purpose of close monitoring between the students and supervisors. Student also needs to practice the good ethical values and work conduct throughout the training. The passing mark is 60%.

### **SECB4134 Bioinformatics Project II**

**Pre-requisite: SECB3032 Bioinformatics Project I**

This is the second part of a 2-part Final Year Project that every student must fulfil successfully. In this installation, students are required to execute the next phases of their development plan from Part1. Students are now required to code and integrate the different modules that make up the proposed project. Students will test the developed modules and the final fully-integrated project following software development and research testing practices. Students must meet regularly with supervisor(s) who will monitor their continuous progress. Students are required to prepare a report and present their final work.

### **SECD3761 Technopreneurship Seminar**

This 1-credit course will provide module and training for students on how to generate digital income through crowdsourcing platforms and methods. Crowdsourcing is a method to generate online income which the work is offered and implemented digitally in global platforms.

## **ELECTIVE COURSES**

### **SECB3103 Bioinformatics I**

This course introduces the basic knowledge of Bioinformatics to students. It includes theories, applications, and tools. Introduction to Bioinformatics describes bioinformatics theories and tools that can help solve biological problems. It also shows how to efficiently apply bioinformatics applications to bioinformatics data and evaluate the resulting information.

### **SECB3023 Bioinformatics II**

This subject familiarizes students with resources essential in examining how raw sequence data from genome sequencing projects can be used to generate information about gene sequence, protein structures, molecular evolution, biochemical, and genomics. It introduces existing DNA sequence and protein structure concepts and theories. Students will be exposed to bioinformatics methods and practices using appropriate bioinformatics tools. The focus will be



on preparing the students with sufficient information, understanding and interpretation of biological data that may help them to learn of bioinformatics methodologies.

### **SECB3203 Programming for Bioinformatics**

This course provides students with the fundamental skills for programming in bioinformatics. It starts with introducing students to the command line environment in the Unix/Linux operating system. This will include a broad coverage of Unix/Linux utilities as well as shell scripting. This course will then use the Python programming language to illustrate the fundamentals of bioinformatics programming. Python-based data science tools will be used including NumPy, SciPy, Pandas and Jupyter Notebook. This course will focus on solving real world biological problems using bioinformatics algorithms and approaches.

### **SECB3213 Bioinformatics Database**

This subject introduces common types of biological data and major databases for bioinformatics applications. Students will learn how to search through the bioinformatics databases and the complete analytic process (data retrieval, pre-processing, data analysis and data visualization) for different types of biological data through different bioinformatics databases. Implementation of some of the process will be done in R programming.

### **SECB3133 Computational Biology I**

This course will discuss the basic topics of computational biology and the application in bioinformatics. Based on DNA Sequence Analyze Algorithm, the course will apply Python programming. Starts with the usage of basic Python in solving the DNA Sequence challenge, student will learn how to build computational tools that are used to analyze biological data. At the end of this course, students will have an understanding and appreciation of how the computational biology solve the biological data challenge.

### **SECB3223 Computational Biology II**

This course presents a comprehensive introduction to machine learning algorithms in bioinformatics. It provides a solid understanding of the entire machine learning algorithms and the needs for it in bioinformatics. Students apply knowledge learnt to solve some real-world problem.

### **SECB4243 Special Topics in Bioinformatics**

A case-study approach to current topics in computational genomics. Completion of a series of projects emphasizing actual challenges facing by biologists and exposure to data science approach in life science. The projects are aimed in applying and developing current approaches that involve recent programming language such as Python and NodeJS with existing software packages.

### **SECB4213 Bioinformatics Visualization**

This course presents a comprehensive introduction to data visualization and data mining in Bioinformatics. Students will be exposed to various techniques in visualizing / mining biological data using R programming language. R provides a vibrant of packages that able to produce interactive visualization of the data. This also provides a solid understanding of the importance of visualization in Bioinformatics and students will also able to apply these techniques in solving real-world case studies in Bioinformatics.

### **SECB4313 Bioinformatics Modeling and Simulation**

This course introduces the concepts and applications of mathematical and computational modelling in Bioinformatics. Students are exposed to how to apply computational models and statistical methods on biological data to study and infer the underlying biological mechanisms and identify the common patterns.

### **SECB3104 Applications Development**

Application Development is a comprehensive service-learning course which requires student to solve a real community problem by developing an application. Students will learn how to practice design thinking, adopting Agile development methodology. This involves an iterative process starting from community engagement, requirement elicitation and analysis, design solution, application construction and iterative verification process. Students are required to do reflection on the outcome of the project. In this course students should be able to develop their soft skills such as leadership, team collaboration, documentation process and communication skill.

### **SECJ3553 Artificial Intelligence**

#### **Pre-requisite: SECJ2013 Data Structure and Algorithm**

This course offers students a new perspective on the study of Artificial Intelligence (AI) concepts. The essential topics and theory of AI are presented, but it also includes practical information on data input and reduction as well as data output (i.e. algorithm usage). In particular, this course emphasizes on theoretical and practical aspects of various search algorithms, knowledge representations, and machine learning methods. The course features practical implementations through assignments undertaken both individually and in groups

### **SEBB4173 Cellular and Molecular Biology for Bioinformatics**

This subject will facilitate students to understand and visualize processes in cell biology and those responsible for DNA transmission and expression hence mechanisms by which bacteria inherit genetic information as the blueprint of life. The lectures will explain relationship between structure and function in molecular biology and how this relationship operates to control biochemical processes. Topics include macromolecules like DNA, RNA and proteins and how processes like replication, transcription and translation operate, eukaryotic genetics. Students will cover related aspects such as mutation and mutagenesis, effects of mutation and how cells overcome mutation. Students will also learn about basic techniques in molecular biology as the basis for genetic engineering. Microsoft PowerPoint presentation by each group will be done at the end of the semester on designated topics.

**SEBB4203 Proteins Biomolecules**

This course is a comprehensive introduction to the study of proteins and their importance to modern biochemistry. This course will start with a brief historical overview of the subject then move on to discuss the building blocks of proteins and their respective chemical and physical properties. This course will also explore experimental and computational methods of comparing proteins, methods of purification and protein folding and stability.

**SEBB4193 Gene and Protein Technology**

Students will learn the fundamental concepts of genomics and proteomics. Lectures will cover the structure, function and evolution of the human genome. Strategies for large-scale sequencing projects. Bioinformatics for the analysis of sequence data; approaches for determining gene expression patterns and functions. Protein/peptide separation techniques, protein mass spectrometry, bioinformatics tools, and biological applications which include quantitative proteomics, protein modification proteomics, interaction proteomics, structural genomics and structural proteomics.