

Master-list of CEG Technical Electives available in AY2019/20
(For CEG students of AY2017 intake and after)

Modules highlighted in green are NOT part of CEG core; students have to take as UEM to meet pre-requisite

In green fonts: amendments (from previous Academic Year)

In red fonts: pending approval/revision

Module(s) added to the list (from previous Academic Year) are tagged with <NEW>

| Technical Elective | | Hours per week | | | | CA | MCs | SEM | PRE/CO-REQ |
|--|---|----------------|-----|-----|--------|-----|-----|-----|--------------------------------------|
| | | LEC | TUT | LAB | PREP | | | | |
| COMMUNICATIONS & NETWORKING | | | | | | | | | |
| Breadth | CS2107 Introduction to Information Security <small>Co-list under 'embedded computing'</small> | 2 | 1 | 0 | 3 4 | | 4 | 1&2 | Pre: CS1010 or equiv |
| | CS3103 Computer Networks Practice | 2 | 0 | 2 | 4 2 | | 4 | 1 | Pre: EE4204 |
| | EE3131C Communication Systems | 2 | 1 | 0.5 | 6.5 | 40% | 4 | 1&2 | Pre: EE2023 or equiv Anti: EE3103 |
| Depth | CS4222 Wireless Networking <small>Module title change wef AY15/16 Co-list under 'embedded computing'</small> | 2 | 0 | 2 | 4 2 | | 4 | 2 | Pre: EE4204 and (ST2334/ST2131) |
| | CS4226 Internet Architecture | 2 | 1 | 0 | 4 3 | | 4 | 1 | Pre: EE4204 and (ST2334/ST2131) |
| | EE4210 Network Protocols and Applications <small>Module title change wef AY18/19 Co-list under 'large-scale computing'</small> | 2.5 | 0.5 | 0 | 7.5 | 40% | 4 | 2 | Pre: EE2012/ST2334 |
| | CS5223 Distributed Systems <RfP> | 3 | 0 | 0 | 3 4 | | 4 | 1 | Pre: CS3211 |
| | CS5321 Network Security <RfP> | 2 | 0 | 0 | 6 2 | | 4 | 2 | Pre: CS3235 |
| | EE5135 Digital Communications <RfP> | | | | | | 4 | 2 | Registration subject to approval |

| Technical Elective | | Hours per week | | | | CA | MCs | SEM | PRE/CO-REQ |
|---------------------------|---|----------------|-----|-----|--------|-----|-----|----------------|---|
| | | LEC | TUT | LAB | PREP | | | | |
| EMBEDDED COMPUTING | | | | | | | | | |
| Breadth | CG3207 Computer Architecture* Co-list under 'system-on-a-chip design' | 2 | 1 | 1 | 6 | 60 | 4 | 1 | Pre: CG2028/EE2028 |
| | CS2107 Introduction to Information Security Co-list under 'comms & networking' | 2 | 1 | 0 | 3 4 | | 4 | 1&2 | Pre: CS1010 or its equiv |
| | CS3211 Parallel and Concurrent Programming Co-list under 'large-scale computing' | 2 | 1 | 0 | 3 3 | | 4 | 2 | Pre: CS2106/CG2271 |
| | EE3731C Signal Processing Methods Co-list under 'interactive digital media' | 2 | 1 | 0 | 7 | 40% | 4 | 1 [Evening] | Pre: EE2012/ST2334 and (EE2023 or equiv) |
| Depth | CS4222 Wireless Networking Module title change wef AY15/16 Co-list under 'comms & networking' | 2 | 0 | 2 | 4 2 | | 4 | 2 | Pre: EE4204 and (ST2334/ST2131) |
| | CS4223 Multi-core Architectures Co-list under 'large-scale computing' & 'system-on-a-chip design' | 2 | 1 | 0 | 3 4 | | 4 | 1 | Pre: (CS2106/CG2271) and (CS3210/CS3220/CG3207) |
| | EE4218 Embedded Hardware System Design Co-list under 'large-scale computing' & 'system-on-a-chip design' | 2 | 0.5 | 1 | 6.5 | 60% | 4 | 1 [Evening] | Pre: EE2028/CG2028 |
| | EE4415 Integrated Digital Design Co-list under 'system-on-a-chip design' | 2 | 0.5 | 0.5 | 7 | 40% | 4 | 2 | Pre: EE2026 |
| | CS5272 Embedded Software Design <RfP> | 2 | 0 | 0 | 4 4 | | 4 | 2 | Pre: (CG2271 or CS2106) and (CS2103 or its equiv) |
| | EE5903 Real-time Systems <RfP> | | | | | | 4 | 2 | Registration subject to approval |

| Technical Elective | | Hours per week | | | | CA | MCs | SEM | PRE/CO-REQ |
|----------------------------------|---|----------------|-----|-----|--------------------|------|-----|----------------------------------|---|
| | | LEC | TUT | LAB | PREP | | | | |
| INTELLIGENT SYSTEMS | | | | | | | | | |
| Breadth | CS3243 Introduction to Artificial Intelligence | 2 | 1 | 0 | 3 4 | | 4 | 2 | Pre: (CS2040C or its equiv) and (CS1231/MA1100) |
| | CS3244 Machine Learning | 2 | 1 | 0 | 3 4 | | 4 | 1&2 | Pre: (CS2040C or its equiv), ST2334, MA1511, MA1512 and MA1508E |
| | EE3331C Feedback Control Systems | 3 | 1 | 0.5 | 5.5 | 40% | 4 | 1&2 | Pre: EE2023 or equiv Anti: EE2010 |
| Depth | CS4244 Knowledge-based systems | 3 | 0 | 0 | 3 4 | | 4 | 2 | Pre: CS3243 |
| | CS4246 AI Planning and Decision Making | 2 | 1 | 0 | 4 3 | | 4 | 1 [Evening] | Pre: (ST2334/ST2131/MA2216) and CS3243 |
| | CS4248 Natural Language Processing | 3 | 0 | 0 | 3 4 | | 4 | 1 | Pre: (CS3243/CS3245) and (ST1232/ST2131/ST2334) |
| | EE4305 Fuzzy/Neural Systems for intelligent robotics Introduction to Fuzzy/Neural Systems <small>Module title change wef AY19/20</small> | 2.5 | 0.5 | 0.5 | 6.5 | 30% | 4 | 2 | Pre: EE2023 or equiv |
| | EE4308 Autonomous Robot Systems Advances in Intelligent Systems and Robotics <small>Module title change wef AY19/20</small> | 2.5 | 0.5 | 0.5 | 2.5 proj 4 prep | 100% | 4 | 2 | Pre: EE3331C/ME2142 Ant: EE4306 |
| | CS5242 Neural Networks & Deep Learning <RfP> | | | | | | 4 | 1&2 | Pre: CS3244 |
| | CS5339 Theory and Algorithms for Machine Learning <RfP> | | | | | | 4 | 2 | Pre: CS3244 |
| | EE5904 Neural Networks <RfP> | | | | | | 4 | 2 | Registration subject to approval |
| EE5907 Pattern Recognition <RfP> | | | | | | 4 | 1&2 | Registration subject to approval | |

| Technical Elective | | Hours per week | | | | CA | MCs | SEM | PRE/CO-REQ |
|----------------------------------|--|----------------|-----|-----|--------|------|-----|---------------------|---|
| | | LEC | TUT | LAB | PREP | | | | |
| INTERACTIVE DIGITAL MEDIA | | | | | | | | | |
| Breadth | CS2108 Introduction to Media Computing | 2 | 1 | 0 | 3 4 | | 4 | 2 | Pre: CS2040C or CS2020 Anti: CS3246 |
| | CS3240 Interaction Design | 2 | 1 | 1 | 3 3 | | 4 | 1&2 | Pre: CS2113/T |
| | CS3241 Computer Graphics | 2 | 1 | 0 | 3 3 | | 4 | 1 | Pre: CS2020 or (CS2040C and CS2113/T) |
| | CS3242 3D Modeling and Animation | 2 | 1 | 1 | 3 3 | | 4 | 2 | Pre: CS3241 and (PC1221/H2 Physics or equiv) and MA1512 and MA1508E Anti: CS4342 |
| | CS3247 Game Development | 3 | 0 | 2 | 3 2 | | 4 | 2 | Pre: CS3241 and (PC1221/H2 Physics or equiv) Anti: CS4213 |
| | CS3249 User Interface Development | 2 | 1 | 1 | 3 3 | | 4 | Not offered in AY19 | Pre: CS2103 or equiv |
| | EE3731C Signal Processing Methods <i>Co-list under 'embedded computing'</i> | 2 | 1 | 0 | 7 | 40% | 4 | 1 [Evening] | Pre: EE2012/ST2334 and (EE2023 or equiv) |
| Depth | CS4240 Interaction Design for Virtual and Augmented Reality | 2 | 0 | 2 | 4 2 | | 4 | 2 | Pre: CS3240 and MA1301/H2 Math |
| | CS4243 Computer Vision and Pattern Recognition | 3 | 0 | 0 | 3 4 | | 4 | 1 [Evening] | Pre: CS2113/T, MA1511, MA1512, MA1508E and ST2334 Anti: EE4212 |
| | CS4247 Graphics Rendering Techniques | 3 | 0 | 0 | 3 4 | | 4 | 2 | Pre: CS3241 |
| | CS4249 Phenomena and Theories of Human-Computer Interaction | 2 | 0 | 0 | 4 4 | | 4 | 1 [Evening] | Pre: CS3240/NM2213/NM2216 |
| | CS4347 Sound and Music Computing | 2 | 0.5 | 0.5 | 4 3 | | 4 | 2 | Pre: MA1511, MA1512, MA1508E and CS2108 |
| | CS4351 Real-Time Graphics | 2 | 1 | 0 | 4 3 | | 4 | 1 | Pre: CS3241 |
| | EE4212 Computer Vision | 2.5 2 | 0.5 | 0 | 7 | 40% | 4 | 2 [Evening] | Pre: MA1508E and EE3731C/EE4704 Anti: CS4243 |
| | EE4604 Biological Perception in Digital Media | 2 | 1 | 0 | 7 | 100% | 4 | Not offered in AY19 | Pre: EE3206/EE3731C/EE4704 |
| | EE4704 Introduction to Computer Vision and Image Processing <i>Module code change wef AY18/19</i> | 2.5 | 1.0 | 0.5 | 6 | 25% | 4 | 1 | Pre: CG2023 or EE2023 Anti: CS4243, EE3206 |

| Technical Elective | | Hours per week | | | | CA | MCs | SEM | PRE/CO-REQ |
|------------------------------|--|----------------|-----|-----|--------|-----|-----|----------------|--|
| | | LEC | TUT | LAB | PREP | | | | |
| LARGE-SCALE COMPUTING | | | | | | | | | |
| Breadth | CS2102 Database Systems | 2 | 1.5 | 0.5 | 3 3 | | 4 | 1&2 | Pre: (CS2040C or its equiv) and (CS1231/MA1100) Anti: CS2102S, IT2002 |
| | CS3210 Parallel Computing | 2 | 1 | 0 | 3 4 | | 4 | 1 | Pre: CS2100/EE2024/CG2028 |
| | CS3211 Parallel and Concurrent Programming Co-list under 'embedded computing' | 2 | 1 | 0 | 3 3 | | 4 | 2 | Pre: CS2106/CG2271 |
| | CS3230 Design & Analysis of Algorithms* | 2 | 1 | 0 | 3 3 | | 4 | 1&2 | Pre: (CS2040C or its equiv) and (CS1231/MA1100) |
| | CS3235 Computer Security | 2 | 1 | 0 | 3 3 | | 4 | 1&2 | Pre: EE4204 and (CS2106/CG2271) and CS2107 |
| Depth | CS3223 Database Systems Implementation | 2 | 1 | 0 | 3 3 | | 4 | 2 | Pre: (CS2040C or its equiv) and CS2102 |
| | CS4211 Formal Methods for Software Engineering | 2 | 1 | 0 | 3 4 | | 4 | 1 | Pre: CS2103 or its equiv |
| | CS4221 Database Applications Design and Tuning Module title change wef AY15/16 | 2 | 1 | 0 | 3 4 | | 4 | 2 [Evening] | Pre: CS3223 Anti: CS5421 |
| | CS4223 Multi-core Architectures Co-list under 'embedded computing' & 'system-on-a-chip design' | 2 | 1 | 0 | 3 4 | | 4 | 1 | (CS2106/CG2271) and (CS3210/CS3220/CG3207) |
| | CS4224 Distributed Databases | 2 | 1 | 0 | 3 4 | | 4 | 1 [Evening] | Pre: CS3223 |
| | CS4231 Parallel & Distributed Algorithms | 3 | 0 | 0 | 3 4 | | 4 | 2 [Evening] | Pre: CS3230/CS3210 |
| | EE4210 Network Protocols and Applications Module title change wef AY18/19 Co-list under 'comms & networking' | 2.5 | 0.5 | 0 | 7.5 | 40% | 4 | 2 | Pre: EE2012/ST2334 |
| | EE4218 Embedded Hardware System Design Co-list under 'embedded computing' & 'systems-on-a-chip design' | 2 | 0.5 | 1 | 6.5 | 60% | 4 | 1 [Evening] | Pre: EE2024/EE2028/CG2028 |

| Technical Elective | | Hours per week | | | | CA | MCs | SEM | PRE/CO-REQ |
|--|---|----------------|-----|-----|--------|------|-----|---------------------|--|
| | | LEC | TUT | LAB | PREP | | | | |
| SYSTEM-ON-A-CHIP DESIGN | | | | | | | | | |
| Breadth | CG3207 Computer Architecture* Co-list under 'embedded computing' | 2 | 1 | 1 | 6 | 60 | 4 | 1 | Pre: CG2028/EE2028 |
| | EE3104C Introduction to RF and Microwave Systems & Circuits | 3 | 1 | 1 | 5 | 40% | 4 | 1 [Evening] | Pre: PC2020 |
| | EE3408C Integrated Analog Design | 3 | 1 | 0 | 6 | 40% | 4 | 1 | Pre: CG2027/EE2027 |
| Depth | CS4223 Multi-core Architectures Co-list under 'embedded computing' & 'large-scale computing' | 2 | 1 | 0 | 3 4 | | 4 | 1 | (CS2106/CG2271) and (CS3210/CS3220/CG3207) |
| | EE4104 Microwave Circuits & Devices | 2.5 | 0.5 | 0.5 | 6.5 | 45% | 4 | 2 | Pre: EE3104C |
| | EE4112 Radio Frequency Design and Systems | 3 | 1 | 1.5 | 4.5 | 40% | 4 | 1 | Pre: EE3104C |
| | EE4218 Embedded Hardware System Design Co-list under 'embedded computing' & 'large-scale computing' | 2 | 0.5 | 1 | 6.5 | 60% | 4 | 1 [Evening] | Pre: EE2028/CG2028 |
| | EE4415 Integrated Digital Design Co-list under 'embedded computing' | 2 | 0.5 | 0.5 | 7 | 40% | 4 | 2 | Pre: EE2026 |
| | EE4505 Power Semiconductor Devices & ICs Note: Scheduled to offer in alternative years i.e. AY18/19, AY20/21 | 2 | 0.5 | 0.5 | 7 | 100% | 4 | Not offered in AY19 | Pre: Stage 3 standing |
| EE5518 VLSI Digital Circuit Design <RfP> | | | | | | | 4 | 1 | Registration subject to approval |

Note:

- Other level 3000/4000 modules hosted by CS or ECE may be used as fulfilling CEG Technical Elective (TE) requirements (under no particular concentration). Generally, a level 3000 module will count as CEG TE Breadth, while a 4000 level module will count as CEG TE Depth.

- The following level 2000 modules may count as CEG TE Breadth (under no particular concentration):

CS2104 Programming Language Concepts

IE2110 Operation Research I

IE2130 Quality Engineering I

- With effect from AY18/19, some EE3xxx modules have been recoded to EE4xxx.

*CEG students (AY17 & after) are required to read either CG3207 or CS3230 as Programme requirements i.e. only students who passed both modules can count (the other/second) one as TE Breadth.

For CS-coded modules, please refer to LumiNUS/IVLE for the CA component.

Offer semester and pre-requisites may change; please refer to NUS Bulletin

<http://www.nus.edu.sg/nusbuletin/search-modules/>.

The host department reserves the right to make final changes to any module on offer.