Pending the update of new course information at NUSmods for the next academic year 2024/2024. This will serve as a temporary reference document for the course description.

Each course is equal to 4 Units unless otherwise stated.

Description of New Courses Hosted by ECE Department

- **EEK5101 Integrated Circuit Technology and Design Methodology**
  The course focuses on chip/system integration technologies rather than circuit design. The objective is to provide a comprehensive view of design methodologies employed to develop a complex system from concept to silicon. The journey from Register Transfer Level (RTL)/netlist logic description to large System on Chip (SoC)/ System in Package (SiP) design requires a set of knowledge and skills to understand how modern integrated electronics systems are made and the associated engineering challenges. The course provides a framework for the activities that are required to develop and produce a complex integrated electronic system covering all the important aspects.

- **EEK5102 Heterogeneous Integration, IC Packaging and Testing**
  Switching from “only front-end node scaling” to “combination with back-end scaling”, heterogeneous integration is to integrate multiple chiplets with different functionalities. Each fabricated with best fit node in terms of technology and economic aspects. It is the “low hanging fruit” for the new era of technological and scientific advances to continue and complement the progression of Moore’s-Law scaling into the future. Packaging, from device packaging to system packaging, will form the vanguard to this enormous advance. This course aims to provide an introductory coverage on heterogeneous integration, IC packaging and testing with case studies provided.

- **EEK5103 Photonic Integrated Circuits**
  In this course, students will learn the fundamentals of chip-based photonics on both silicon and lithium niobate substrates, including passive and active devices such as modulators, photodetectors, waveguides, edge couplers, and ancillary components such as optical fibers. Students will also learn relevant fabrication and design processes, such as how to prepare a layout for foundry fabrication. Students will also learn about relevant applications such as sensors and communications.

- **EEK5104 Bioelectronics**
  The development of novel electronic devices facilitates scientists and engineers to answer fundamental scientific questions in biological systems and to resolve the real-world issues, such as those in drug screening, disease detection and health monitoring. This course introduces basic biophysical concepts for biosensor, and various types of biosensors that are related with bioelectronics area. It also offers students the engineering principles how to design and prototype basic bioelectronic/biosensor devices to address health-related problems. Throughout this course, academic presentation and academic writing training sessions will also be provided to students.

- **EEK5105 Semiconductor Materials and Devices**
  This course aims to provide a comprehensive overview of different classes of advanced materials at the nanoscale for microelectronic applications. The course will familiarise students with existing and emerging electronic device applications through case studies.

- **EEK5106 Semiconductor Yield and Failure Analysis**
  High yield is one of the key performance criteria of all companies' operations as it affects the amount of product that can be sold relative to the amount that is started. Also, failure analysis capability is critical to isolate and identify the defects effectively and efficiently. This in turn allows problems to be identified and resolved quickly leading to faster time-to-market, yield and productivity improvements. This course provides an introductory coverage on semiconductor yield, yield management and failure analysis. Topics covered include the types of yield loss, defects, yield models, yield monitoring and management methods, including in-line process control, data mining, defect control, and failure analysis techniques. Industry standards and case studies, both in wafer fabrication and during device packaging will be provided.

- **EEK5301 Evolution and Transformation of Semiconductor Industry**
  In 1980, companies (like Intel) owned the manufacturing assets, made, marketed, researched and developed their own products. New concept of pure-play foundry started in the 1990s for companies that lacked the financial wherewithal to own expensive equipment. As fabs got more expensive, more IDMs (like TI and AMD) also chose the fabless model. Some switched to completely fabless (like Xilinx and Qualcomm), while others kept as fab-lite. This course covers the semiconductor industry perspectives and business models, lifecycle of fabless company, implementation approach, management of implementation program, Electronic Design Automation (EDA), intellectual property (IP), and future trends.

- **EEK5302 Semiconductor Supply Chain and Demand Management**
  This course aims to equip supply chain professionals, operations managers, and executives in the semiconductor industry with the skills and knowledge necessary to tackle the challenges faced in the supply chain. By using advanced analytics, digitalisation, and best practices in supply chain and risk management, participants will be able to improve supply chain resilience, reduce lead times, and enhance the overall efficiency of the supply chain. Ultimately, this course will help semiconductor companies to capitalise on the opportunities presented by the growing demand for semiconductors in the digital age.

- **EEK5001 or EEK5003 Semiconductor Technology and Operations Project I or II, respectively**
  These courses provide the master's students an opportunity to work on a cutting-edge project over one semester or two semesters. Students reinforce their knowledge and pick up new tools and skills in the process of solving problems that add value to themselves, the industry, and the society. Projects can involve a mix of research, design, and development aspects. Students work in close consultation with an internal supervisor (who is a faculty member) and/or an external (industry) supervisor. Students will need to submit a report, as well as a presentation to the supervisors.

- **EEK5888 Semiconductor Technology and Operations Internship**
  In this course, students will be placed in a Singapore-based organisation working on core and emerging topics related to Semiconductor Technology and Operations (e.g. new product development, technology intelligence and forecasting, product technology road mapping, technology strategy, intellectual property management and business models). Students will be jointly supervised by a team comprising of NUS academic staff and the Company's appointed manager. Assessments will be done periodically, leading to a project report and presentation at the end of the attachment.

end of this document