# EE9XXX Series (AY 2015-2016) – Course Syllabus

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**Remarks:**

A) EE9309 will be offered from 11 to 28 Jan 2016, it is only available for research students admitted before Jan 2016 admission.
EE9309    SPECIAL TOPICS IN INTEGRATED CIRCUITS AND SYSTEMS

Acad Unit: 3
Prerequisite: Nil
Effective: Acad Year 2006/07
Last update: January 2006

OBJECTIVE

1. This course is designed to provide graduate research students knowledge in the various emerging and advanced areas of integrated circuits and systems.
2. The course will provide graduate research students knowledge and insights in these areas for research direction and strategies.

DESIRED OUTCOME

1. The student will be able to gain the relevant research knowledge and insights in these advanced topics to enhance his/her research capabilities in the area of integrated circuits and systems.
2. The course will help to promote and foster interdisciplinary research, understanding, awareness, and appreciation among our graduate students.

OTHER RELEVANT INFORMATION

The course is designed for graduate research students who want to know more about the new developments in the field of integrated circuits and systems.
EE9902 SPECIAL TOPICS - QUANTUM PHYSICS IN MODERN TECHNOLOGY

Acad Unit: 3.0
Prerequisite: Nil
Effective: 6-22 August 2007
Last update: 12 July 2007

LEARNING OBJECTIVE
As modern technology evolves from the micrometer to the nanometer scale, the performance of new nano-devices cannot rely on just classical physics, for which the influence of quantum physics becomes significant. Thus engineers must learn to cope with the quirks and demands of the quantum physics for next generation application. In this course, the foundations of quantum physics will be briefly introduced, following by a grasp of the symmetries and properties of the Schrödinger wave function which will give students to understand the new engineering concepts in nanotechnology. Applications of these principles to selected areas in nanotechnology will also be discussed.

CONTENT
A Brief Review of Quantum Physics, Electron Spin and Spintronics, Fermi Gas of Electrons, Bose Gas and Bose-Einstein Condensation, Pairing Up Electrons: Superconductivity, Josephson Junctions and Superconducting Quantum Interference Device (SQUID), Quantum Hall Effect, Laser Cooling

COURSE OUTLINE
This course covers the essential principles of quantum physics and modern technology.

LEARNING OUTCOME
Students will acquire the knowledge of quantum physics which will facilitate students to understand the new engineering concepts in nanotechnology.

STUDENT ASSESSMENT
Continuous Assessment 100 %
Pass/Fail Course based on Attendance & Group Term Paper on selected topics.

Final Examination 0 %

REFERENCES
1. Lecture notes will be posted and selected readings from the Professor.
EE9911  SPECIAL TOPIC - FROM CONCEPTS IN OPTICS TO ADVANCED PHOTONICS

Acad Unit:  3
Pre-requisite:  Nil
Effective:  May-June 2014
Last update:  27 January 2014

LEARNING OBJECTIVE

1. Introduction of photonics and optics
2. Current topics in photonics
3. Applications to modern optics

CONTENT


LEARNING OUTCOME

The students will grasp the basic concepts to understand photonics and modern optics, which is a fast emerging field of research and technology with numerous potential applications in photovoltaics, telecommunication, storage, lighting, sensing, biophysics.

STUDENT ASSESSMENT

Continuous Assessment  Individual project presentation  60%
Participation during classes  10%
Quiz  30%
Grading: Pass/Fail
Total:  100%

TEXTBOOKS


REFERENCES

LEARNING OBJECTIVE

1. To understand the key principles of nanophotonics.
2. To develop the ability to design nanophotonic building blocks including filters, sensors and light-emitters among others.
3. To understand possible approach to interfacing optical-electronic biomolecular nanostructures via nanophotonic phenomena.

CONTENT


LEARNING OUTCOME

Nanophotonics is a contemporary field of new science and nanotechnology, which uses light propagation and light—matter interactions in nanostructures to improve existing systems and/or to develop new components and devices in optoelectronics, information technologies, display and lighting systems, photovoltaics, sensors and microchips for biomedicine.

The course will provide a consistent description of basic physical phenomena, principles, experimental advances and potential impact of light propagation, emission, and scattering in complex nanostructures: from analogies between electromagnetic waves and electrons to photonic circuitry and photonic metamaterials.

The proposed course aims to train research students and support the photonic design research at NTU, and the need for advanced photonics design experts in the Singapore micro-optoelectronics industry.

STUDENT ASSESSMENT

Continuous Assessment Based on 3 assignments in the form of studies, and problem solving. Students will be assessed individually. Grading: Pass / Fail
Total: 100%

TEXTBOOK

1. Introduction to Nanophotonics by Sergey V Gaponenko
REFERENCES

- Spacecraft Power Systems by Mukun R. Patel, CRC Press, 2005
EE9913 SPECIAL TOPIC - SPACE ENVIRONMENT AND SPACECRAFT SYSTEMS ENGINEERING

Acad Unit: 3
Pre-requisite: None
Effective: AY2015/16
Last update: August 2015

LEARNING OBJECTIVE

Students will learn
• systems engineering approach toward spacecraft development
• basics of the technological aspects of each spacecraft subsystem
• basics of space environment and environmental testing

CONTENT


COURSE OUTLINE [Lectures: 39 hours Tutorials: 0 hours]

Spacecraft Systems Engineering
Propulsion
Orbital Mechanics and mission analysis
Space Environment
Structural design and vibration testing
Shock Environment and Testing
Thermal design and analysis
Thermal testing
Satellite Power System
Radiation Effects and Testing
Spacecraft Charging
Telecommunications
Spacecraft Dynamics and Attitude Control

The course material (slides) will be distributed. The course will be carried out interactively. The number of students is limited to a maximum of 25.
This course will be offered in three weeks. A 3-hour lecture will be given each day from Monday to Friday. There will be quiz and assignment to assess and evaluate students.
LEARNING OUTCOME

Students will gain
• knowledge of systems engineering approach toward spacecraft development
• basic knowledge of technological aspects of each spacecraft subsystem
• basic knowledge of space environment and environmental testing.

STUDENT ASSESSMENT

Continuous Assessment
- Assignments: 60%
- Participation during classes: 20%
- Quiz: 20%

Total: 100%

Grading: Pass/Fail

Final Examination: 0%

TEXTBOOK

- Spacecraft Systems Engineering, edited by Peter Fortescue et al., Wiley

REFERENCES

- HARRIS' SHOCK AND VIBRATION HANDBOOK, sixth edition, Allan G. Piersol, Thomas L Paez, Macgrawhill, 2010
- SMC-S-016 “TEST REQUIREMENTS FOR LAUNCH, UPPER-STAGE AND SPACE VEHICLES”, 2008
- ISO-15864 “Space systems — General test methods for spacecraft, subsystems and units”, 2004
- ECSS-ST-10-03 “Space Engineering – Testing”, 2011
- Spacecraft Power Systems by Mukun R. Patel, CRC Press, 2005
Annex A

EE9914 Cryptography and Cybersecurity

Acad Unit: 3
Pre-requisite: Nil
Effective: Academic Year 2014-2015
Last update: 6 March 2014

LEARNING OBJECTIVE

The course aims to provide an opportunity for graduate students at School of EEE to obtain a fundamental but practical knowledge and background of cryptography and cybersecurity responding to the emerging threats to public information security and personal privacy. This course covers diverse topics on cryptography and cybersecurity including symmetric and asymmetric cryptography, privacy-enhanced techniques, security and privacy in vehicular communications, e-Healthcare systems, smart grid communications, cloud computing, big data, and other cybersecurity related issues.

CONTENT


LEARNING OUTCOME

On the successful completion of the course, students will be able to

- Understand the basic network attacks, security requirements, and cryptographic tools
- Understand the concepts of symmetric cryptography, block ciphers, stream ciphers, and hash functions
- Understand the fundamentals of finite fields, number theory and their applications to cryptography
- Understand the concepts of asymmetric cryptography, RSA cryptosystem and signatures
- Understand ElGamal cryptosystem and digital signature.
- Understand and apply key exchange technique in practice
- Understand privacy enhanced techniques
- Understand cyber security challenges in vehicular communications
- Understand cyber security challenges in e-Healthcare systems
- Understand cyber security challenges in smart grid communications
- Understand cyber security challenges in cloud computing
- Understand cyber security challenges in big data
- Explore new security topics with ease and confidence
STUDENT ASSESSMENT

Continuous Assessment  Assignments  30%

Quizzes  20%

Final project report  50%

Total  100%

Grading: Pass/Fail

TEXTBOOKS


REFERENCES
