**Course Syllabus**

**EE\_221: Electronics Engineering**

**Semester / Session: 4th /Spring 2020**

**Instructor:**  Ms. Nasim Zahra

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**Office Hours:** 0800hrs to 1600hrs

**Class Hours:** 10:00 AM – 12:00 PM Wednesday

**Course TA:** N.A.

**Course Description:** This subject is intended to provide students with the fundamentals of semiconductor physics and its application to common semiconductor devices. The course starts with an in-depth look at the theory of semiconductors including energy gap, mobility of electrons and holes, influence of temperature on conductivity, doping, photoconductivity, drift and diffusion of charge carriers and the ideal diode equation, diode models. Then, properties of the abrupt p-n junction are studied and applied to various practical devices including the signal diode, zener diode, varactor diode, photo-diode, light-emitting diode, bipolar junction transistor, and finally field effect transistors. Moreover application of diode as rectifier, clipper and clampers are studied in it. BJTs and FETs along with its biasing, types and configurations are studied in detail in the course. The course has a strong laboratory component. About half the experiments illustrate fundamental properties of semiconductor materials and half explore the characteristics and properties of a variety of semiconductor devices.

**CataLog Data:** Course Code: EE\_221/B.Sc. ME 04

Course Title: Electronics Engineering

Credit Hours: 2

Course Designation: Core/Elective

No of Sessions per week: 1 (Total 16 sessions)

Session Duration: 60 min

Compulsory/Elective Compulsory (Breadth)

**CataLog Description:** **EE\_221 Electronics Engineering, Credits (2)**

Semiconductor Basics, Semiconductor Diodes, Diodes applications, Diode types, Bipolar junction transistors (BJT), Field effect transistors (FET), BJT and FET types, biasing, working principle, construction, applications, small signal equivalent circuits

**Prerequisite:** Linear Circuit analysis

**Prerequisites by**

**Topics:** NIL

**Co-requisite:** NIL

**Recommended Textbook:**

1. Thomas ,Floyd, “Electronic Devices Conventional current version”, 9th edition.

**References:**

2- Robert Boylested and Louis Nashelsky, “Electronics Devices and circuits Theory,” Ninth edition, 2006, Parentice Hall.

1. “Electronics devices and circuits”, By Theodore and Bogart 3rd edition**.**
2. Robert Paynter, “ Introductory Electronic devices and circuits: Electron Flow Version,” seventh edition, 2006, Parentice Hall.

**Program Learning Outcome:** This course is designed in conjunction with the following PLOs.

**PLO 1. Engineering Knowledge:** An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

**Course Learning Outcome (CLO):**

Upon successful completion of this course, the student will be able to:

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| --- |
| **CLO 1.** Describe the basics of semiconductor devices, PN junction, diodes and its models |

[Congnitive-2]

|  |
| --- |
| **CLO 2.** Analyze the diode application based circuits |

[Cognitive-4]

**CLO 3.** Describe the basics of BJTs and its different configurations

[Cognitive-2]

**CLO 4.** Describe the basics of FETs and its different configurations

[Cognitive-2]

**Mapping of CLOs to PLOs and Learning Domains:**

|  |  |  |
| --- | --- | --- |
| **Course Learning Outcome** | **Program Learning Outcome** | **Learning Domain** |
| CLO-1 | PLO-1 | Cognitive 2 (Understand) |
| CLO-2 | PLO-1 | Cognitive 4 (analyze) |
| CLO-3 | PLO-1 | Cognitive 2 (Understand) |
| CLO-4 | PLO-1 | Cognitive 2 (Understand) |

**Course Professional Outcome/ Industrial Usage:**

Course provides details and introduction to many basic semiconductor based components that have vast applications and usage from industrial perspective.

**Course Outline and Sessions Breakdown:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Topics covered in the  course and level of  coverage | | Introduction to semiconductor theory, PN junction, Diode and its characteristics, breakdown voltage ,diode models , special purpose diode | 6 hours | | |
| Diode applications: Rectifiers, clippers,clampers | 8 hours | | |
| Introduction to BJT, characteristics and parameters, DC biasing, load line Q point | 6 hours | | |
| BJT as an amplifier and as switch  BJT configurations CC CB CE | 4 hours | | |
| Introduction to FETs, types, biasing techniques, confiigurations | 6 hours | | |
| Program learning outcomes and how they are covered by specific course outcomes | Detailed Contents | | | CLO | PLO |
| Semiconductor Devices, intrinsic and extrinsic materials, P-type and N-type materials | | | CLO-1 | PLO-1 |
| PN junction , diode, diode models, diode forward and reverse x-istics, breakdown voltage | | | CLO-1 | PLO-1 |
| Semiconductor Diodes: Photodiode, Schottky barrier diode, Zener diode | | | CLO-1 | PLO-1 |
| Diode applications: Rectification  Half wave rectifier  Full wave center tapped rectifier | | | CLO-2 | PLO-1 |
| Diode applications: Rectification  Full wave bridge rectifier | | | CLO-2 | PLO-1 |
| Diode applications: Clippers series | | | CLO-2 | PLO-1 |
| Clampers, parallel clippers | | | CLO\_2 | PLO-1 |
| Mid Exams | | |  |  |
| Basics of BJTs and working principle | | | CLO-3 | PLO-1 |
| BJT characteristics and basic parameters | | | CLO-3 | PLO-1 |
| DC biasing of BJT using voltage divider circuit , Load line and Q point | | | CLO-3 | PLO-1 |
| BJT as an amplifier and as switch | | | CLO-3 | PLO-1 |
| BJT configurations: CE, CB, CC configurations | | | CLO-3 | PLO-1 |
| Basic of FET and working principle  FET types: JFET(N TYPE, P TYPE) , MOSFET( E-MOS, D-MOS) | | | CLO-4 | PLO-1 |
| DC biasing of FET(JFET (self bias, voltage divider bias), MOSFET(drain feedback bias, voltage divider bias)) | | | CLO-4 | PLO-1 |
| FET configurations; CD,CG,CS configurations and their comparison | | | CLO-4 | PLO-1 |

**Computer Usage:** Not applicable unless otherwise stated.

**Projects Nil**

**Design Activities:** Students can be asked to solve an engineering problem from perspective of electronics theory

**Evaluation Criteria:** 1**.** Quizzes/assignments 20%

**2.** Mid-Term Exam 30%

**3.** Final Exam 50%

**Policies:**

1. No make up tests or quizzes, except in case of emergency, e.g. illness and accident. For make up tests, medical certificate is required and the instructor must be notified in advance of the test.
2. No late assignment will be accepted.

**Mapping of CLOs with Assessment Methods:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CLOs/Assessment** | **CLO-1** | **CLO-2** | **CLO-3** | **CLO-4** |
| **Quizzes** | √ |  | √\* |  |
| **Mid semester** |  | √ |  |  |
| **End semester** |  |  | √\* | √\* |
| **assignments** |  |  | √\* |  |

* **\* Tentative (yet has to be evaluated/conducted)**