

## Academic Course Description

BHARATH UNIVERSITY  
Faculty of Engineering and Technology  
Department of Electrical and Electronics Engineering

**BEE 303 ELECTRON DEVICES**  
**Third Semester (Odd Semester)**

### Course (catalog) description

Gain basic knowledge about low power semiconductor devices and its function.

**Compulsory Elective course** : Compulsory for EEE students

Credit hours & contact hours : 3 & 45 hours

Course Coordinator : Mr.S.P.Vijayaragavn

**Instructors** : Mr.S.P.Vijayaragavn

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@bharathuniv.ac.in)	Consultation
Mr.S.P.Vijayaragavn	Second year EEE	KS 101	04422290125	Vijayaragavn.eee @bharathuniv.ac.in	12.30-1.30 PM

### Relationship to other courses:

Pre –requisites : BEE101 Basic Electrical and Electronics Engineering

Assumed knowledge : The students will have a physics and mathematics background obtained at a high school level. In particular, working knowledge of basic mathematics including differentiation, integration and probability theories are assumed.

Following courses : Power Electronics

### Syllabus Contents

#### UNIT I ELECTRON DEVICES 9

Concept of electronic current in vacuum, gas and solid – Effect of electric and magnetic field on electron and other charged particles – Cathode ray tube – Electrostatic and magnetic deflection.

#### UNIT II SOLID STATE ELECTRONICS 9

Review of energy band structure of Ge, Si and GaAs –electron, hole generation and recombination – drift and diffusion currents – Continuity equation – Hall effect – PN junction – current equation – junction capacitance – breakdown characteristics – varactor, tunnel, fast recovery, scottkly and zener diodes.

#### UNIT III BIPOLAR JUNCTION TRANSISTOR 9

Ebers-Moll equation – Input / Output characteristics – Switching characteristics – ‘h’ parameters – low Frequency equivalent circuits – RF transistors – Power transistors.

#### UNIT IV FET, UJT AND SCR

9

Theory and characteristics of JFET and MOSFET – low frequency and high frequency equivalent circuits – theory and characteristics of UJT, SCR and TRIAC.

#### UNIT V CCD AND OPTOELECTRONIC DEVICES

9

Charge transfers and charge coupled devices – Theory and applications – semiconductor optoelectronic devices – LED, LASER diode, LCD, Photo diode, solar cell.

#### Text book(s) and/or required materials

- T1. Sethi, 'Applied Electronics', S.Chand, 2006.  
T2. Malvino, 'Electronic Principle', Tata McGraw-Hill. 2008.

#### Reference Books:

- R1. Sze, SM, "Physics of Semiconductor Devices", Wiley Eastem, 1981.  
R2. Boylestad and Nashelsky, "electronic Devices and Circuit Theory", PHI 6th Edition, 1999.  
R3. Mothershead, "Electronic Devices and Circuits", Prentice Hall of India 1999.  
R4. Streetman, B, "Solid State Electronics Devices", Prentice Hall of India, 4th Edition. 1995.  
R5. John D. Ryder, "Electronic Fundamentals And Applications, Integrated and Discrete System", 5th Edition Prentice Hall of India, 1999.  
R6. David Newman, "Semiconductor Physics and Devices – Basic Principles, Tata McGraw-Hill. 1999.

#### 1. Computer usage: Power point presentation

#### Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

**Broad area :** Electrical Machines/**Electronics**/Power system/Control & Instrumentation.

#### Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 1 <sup>st</sup> week	Session 1 to 18	2 Periods
2	Cycle Test-2	September 2 <sup>nd</sup> week	Session 19 to 36	2 Periods
3	Model Test	October 2 <sup>nd</sup> week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

## Mapping of Instructional Objectives with Program Outcome

Gain basic knowledge about low power semiconductor devices and its function.	Correlates to program outcome		
	H	M	L
1. To acquaint the students with construction, theory and characteristics of the p-n junction diode		a	j
2. Familiarize with the structure of basic electronic devices.	c,e,g,i	f,h	d,j
3. To acquaint the students with construction, theory and characteristics of the Field effect transistor	k		b
4. To acquaint the students with construction, theory and characteristics of the Power control / regulator devices	h,i	a,e	l
5. To acquaint the students with construction, theory and characteristics of the LED, LCD and other photo electronic devices		d	b

H: high correlation, M: medium correlation, L: low correlation

**Draft Lecture Schedule**

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I ELECTRON DEVICES			
1.	Concept of electronic current in vacuum, gas and solid	No	[T1],[R2]
2.	Concept of electronic current in vacuum, gas and solid	No	
3.	Effect of electric and magnetic field on electron and other charged particles –	No	
4.	Effect of electric and magnetic field on electron and other charged particles	No	
5.	Effect of electric and magnetic field on electron and other charged particles	No	
6.	Cathode ray tube	No	
7.	Cathode ray tube	No	
8.	Electrostatic and magnetic deflection.	No	
9.	Electrostatic and magnetic deflection.	No	
UNIT II SOLID STATE ELECTRONICS			
10.	Review of energy band structure of Ge, Si and GaAs	No	[T1],[R1],[R4]
11.	electron, hole generation and recombination – drift and diffusion currents	No	
12.	Continuity equation	No	
13.	Hall effect	No	
14.	PN junction	No	
15.	current equation	No	
16.	junction capacitance	No	
17.	breakdown characteristics	No	
18.	varactor, tunnel, fast recovery, scottkly and zener diodes.	No	
UNIT III BIPOLAR JUNCTION TRANSISTOR			
19.	Ebers-Moll equation	No	[T1],[R3]
20.	Input / Output characteristics	No	
21.	Switching characteristics	No	
22.	Switching characteristics	No	
23.	h' parameters	No	
24.	low Frequency equivalent circuits	No	
25.	RF transistors	No	
26.	Power transistors	No	
27.	Power transistors	No	
UNIT IV FET, UJT AND SCR			
28.	Theory and characteristics of JFET and MOSFET	No	
29.	Theory and characteristics of JFET and MOSFET	No	
30.	Theory and characteristics of JFET and MOSFET	No	
31.	low frequency and high frequency equivalent circuits	No	

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32.	low frequency and high frequency equivalent circuits	No	[T1],[R2],[R6]
33.	low frequency and high frequency equivalent circuits	No	
34.	theory and characteristics of UJT, SCR and TRIAC.	No	
35.	theory and characteristics of UJT, SCR and TRIAC.	No	
36.	theory and characteristics of UJT, SCR and TRIAC.	No	
<b>UNIT V      CCD AND OPTOELECTRONIC DEVICES</b>			
37.	Charge transfers and charge coupled devices –	No	[T1]
38.	Theory	No	
39.	Theory	No	
40.	Applications	No	
41.	Applications	No	
42.	semiconductor optoelectronic devices – LED	No	
43.	LASER diode	No	
44.	LCD, Photo diode	No	
45.	solar cell.	No	

### Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

### Evaluation Strategies

Cycle Test – I	-	05%
Cycle Test – II	-	05%
Model Test	-	10%
Attendance	-	05%
SEMINAR&ASSIGNMENT	-	05%
Final exam	-	70%

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**Prepared by:** Mr.S.P.Vijayaragavn

**Dated :**

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**Addendum****ABET Outcomes expected of graduates of B.Tech / EEE / program by the time that they graduate:**

- a) An ability to apply knowledge of mathematics, science, and engineering fundamentals.
- b) An ability to identify, formulate, and solve engineering problems.
- c) An ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- d) An ability to design and conduct experiments, as well as to analyze and interpret data.
- e) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- f) An ability to apply reasoning informed by the knowledge of contemporary issues.
- g) An ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- h) An ability to understand professional and ethical responsibility and apply them in engineering practices.
- i) An ability to function on multidisciplinary teams.
- j) An ability to communicate effectively with the engineering community and with society at large.
- k) An ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.
- l) An ability to recognize the need for, and an ability to engage in life-long learning.

**Program Educational Objectives****PEO1: PREPARATION**

Electrical Engineering Graduates are in position with the knowledge of Basic Sciences in general and Electrical Engineering in particular so as to impart the necessary skill to analyze and synthesize electrical circuits, algorithms and complex apparatus.

**PEO2: CORE COMPETENCE**

Electrical Engineering Graduates have competence to provide technical knowledge, skill and also to identify, comprehend and solve problems in industry, research and academics related to power, information and electronics hardware.

**PEO3: PROFESSIONALISM**

Electrical Engineering Graduates are successfully work in various Industrial and Government organizations, both at the National and International level, with professional competence and ethical administrative acumen so as to be able to handle critical situations and meet deadlines.

**PEO4: SKILL**

Electrical Engineering Graduates have better opportunity to become a future researchers/ scientists with good communication skills so that they may be both good team-members and leaders with innovative ideas for a sustainable development.

**PEO5: ETHICS**

Electrical Engineering Graduates are framed to improve their technical and intellectual capabilities through life-long learning process with ethical feeling so as to become good teachers, either in a class or to juniors in industry.

Course Teacher	Signature
Mr.S.P.Vijayaragavn	

**Course Coordinator**  
(Mr.S.P.Vijayaragavn)

**HOD/EEE**  
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