Ref No:

SRI KRISHNA INSTITUTE OF TECHNOLOGY

BENGALURU

COURSE PLAN

Academic Year 2019-20

Program:	B E – Electronics & Communication Engineering
Semester :	5
Course Code:	17EC53
Course Title:	Electronic devices
Credit / L-T-P:	4 / 4-0-0
Total Contact Hours:	50
Course Plan Author:	NARASIMHA MURTHY R

Academic Evaluation and Monitoring Cell

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Note : Remove "Table of Content" before including in CP Book

Each Course Plan shall be printed and made into a book with cover page

Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	EC
Semester:	3	Academic Year:	2018
Course Title:	ELECTRONIC DEVICES	Course Code:	18EC33
Credit / L-T-P:	4 / 4-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	50 Hours	SEE Marks:	60 Marks
CIA Marks:	40 Marks	Assignment	1 / Module
Course Plan Author:	Dr. DEVANANDA S N	Sign ..	Dt:
Checked By:		Sign ..	Dt:
CO Targets	CIA Target : ……. %	SEE Target:	……. %

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

Module	Content	Teaching Hours	Identified Module Concepts	Blooms Learning Levels
1	**Semiconductors:** Bonding forces in solids, Energy bands, Metals, Semiconductors and Insulators, Direct and	10	-Enenrgy bands - Intrinsic and	Understand L2

	Indirect semiconductors, Electrons and Holes, Intrinsic and Extrinsic materials, Conductivity and Mobility, Drift and Resistance, Effects of temperature and doping on mobility, Hall Effect.		Extrinsic semiconductors	
2	**P-N Junctions:** Forward and Reverse biased junctions- Qualitative description of Current flow at a junction, reverse bias, Reverse bias breakdown- Zener breakdown, avalanche breakdown, Rectifiers. Optoelectronic Devices Photodiodes: Current and Voltage in an Illuminated Junction, Solar Cells, Photodetectors. Light Emitting Diode: Light Emitting materials.	10	Diode biasing - Rectifiers - Diode Applications	Understand L2
3	**Bipolar Junction Transistor:** Fundamentals of BJT operation, Amplification with BJTS, BJT Fabrication, The coupled Diode model (Ebers-Moll Model), Switching operation of a transistor, Cutoff, saturation, switching cycle, specifications, Drift in the base region, Base narrowing, Avalanche breakdown.	10	-BJT operation - operating modes	Understand L2
4	**Field Effect Transistors:** Basic pn JFET Operation, Equivalent Circuit and Frequency Limitations, MOSFETTwo terminal MOS structure- Energy band diagram, Ideal Capacitance - Voltage Characteristics and Frequency Effects, Basic MOSFET Operation- MOSFET structure, Current-Voltage Characteristics.	10	-JFET operation VI characteristics	Understand L2
5	**Fabrication of p-n junctions:** Thermal Oxidation, Diffusion, Rapid Thermal Processing, Ion implantation, chemical vapour deposition, photolithography, Etching, metallization. **Integrated Circuits:** Background, Evolution of ICs, CMOS Process Integration, Integration of Other Circuit Elements.	10	-Fabrication techniques - IC fundamentals	Understand L2
-	**Total**	**54**	**-**	**-**

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 - 30 minutes
2. Design: Simulation and design tools used - software tools used ; Free / open source
3. Research: Recent developments on the concepts - publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1, 2, 3, 5	1. Ben. G. Streetman, Sanjay Kumar Banergee, "Solid State Electronic Devices", 7thEdition, Pearson Education, 2016, ISBN 978-93-325-	3,5,7,8, 9	In Lib

	5508-2.		
4	2. Donald A Neamen, Dhrubes Biswas, "Semiconductor Physics and Devices", 4th Edition, MCGraw Hill Education, 2012, ISBN 978-0-07-107010-2.	9	In Lib
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1, 2	1. S. M. Sze, Kwok K. Ng, "Physics of Semiconductor Devices", 3rd Edition, Wiley, 2018.		In Lib
1, 2	2. A. Bar-Lev, "Semiconductor and Electronic Devices", 3rd Edition, PHI, 1993.		In Lib
C	**Concept Videos or Simulation for Understanding**	**-**	**-**
C1	https://nptel.ac.in/courses/117101106/		
C2			
C3			
C4			
C5			
C6			
C7			
C8			
C9			
C10			
D	**Software Tools for Design**	**-**	**-**
E	**Recent Developments for Research**	**-**	**-**
F	**Others (Web, Video, Simulation, Notes etc.)**	**-**	**-**
1	https://nptel.ac.in/courses/117101106/		
?			

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level
1	-	-	Electronic Tubes / Knowledge of Tube Amplifier	-	Gap A seminar on Electron Tubes & amplifiers	Understand L2
3	15IT35	Electronics Instrumentation	Oscilloscopes / Knowledge of oscillators	3	-	Understand L2
3	15EC36	Engineering Electromagnetics	Steady Magnetic Fields/ Knowledge of fields	3	-	Understand L2
5	15MAT31	Mathematics-III	Vector Integration / Knowledge of vector analysis	3	-	Understand L2
-						
-						

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.

Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level
1	https://nptel.ac.in/courses/117101106/	nptel		Understand L2
3				
3				
5				
-				
-				

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs. Identify a max of 2 Concepts per Module. Write 1 CO per Concept.

Modules	Course Code.#	Course Outcome **At the end of the course,**	Teach. Hours	Concept	Instr Method	Assessment	Blooms' Level

		student should be able to . . .				Method	
1	18EC33.1	Understand the principles of semiconductor Physics	5	Energy bands	Lecture	Slip Test	Understand L2
1	18EC33.2	Understand the working principles of semiconductor devices.	5	Electrons and Holes,	Lecture/ Tutorial	Assignment	Understand L2
2	18EC33.3	Understand the principles and characteristics of semiconductor diodes.	5	Forward and Reverse biased junctions	Lecture	Assignment	Understand L2
2	18EC33.4	Understand the applications of semiconductor diodes.	5	applications of semiconductor diodes	Lecture	Slip Test	Understand L2
3	18EC33.5	Utilize the mathematical models of bipolar junction transistors for circuits and systems	5	BJT operation	Lecture	Slip test	Understand L2
3	18EC33.6	Understand the operating principle of BJT.	5	Amplification	Lecture/ Tutorial	Assignment	Understand L2
4	18EC33.7	Utilize the mathematical models of MOS transistors for circuits and systems.	5	JFET Operation	Lecture/ Tutorial	Assignment	Understand L2
4	18EC33.8	Understand the operating principle of MOS transistors.	5	MOSFET Operation	Lecture/ Tutorial	Assignment	Understand L2
5	18EC33.9	Understand the fabrication process of semiconductor devices .	5	Fabrication	Lecture	Assignment	Understand L2
5	18EC33.10	Understand the CMOS IC technology.	5	Integrated Circuits	Lecture	Assignment	Understand L2
-	-	**Total**	**50**	-	-	-	**L2-L2**

2. Course Applications

Write 1 or 2 applications per CO.

Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level
1	Analog circuit design is used for designing rectifiers, RPS.	CO1	L2
1	Analog circuit design is used for designing voltage regulators	CO2	L2
2	Analog circuit design is used for designing operational amplifiers.	CO3	L2
2	Analog circuit design is used for designing linear regulators.	CO4	L2
3	Analog circuit design is used for designing oscillators.	CO5	L2
3	Analog circuit design is used for designing active filters.	CO6	L2

4	Analog circuit design is used for designing phase locked loops.	CO7	L2
4	Analog circuit design is used for designing oscillators.	CO8	L2
5	Analog circuit design is used for designing active filters.	CO9	L2
5	Analog circuit design is used for designing phase locked loops.	CO10	L2

3. Mapping And Justification

CO – PO Mapping with mapping Level along with justification for each CO-PO pair.
To attain competency required (as defined in POs) in a specified area and the knowledge & ability required to accomplish it.

Modules	Mapping		Mapping Level	Justification for each CO-PO pair	Level
-	**CO**	**PO**	-	**'Area': 'Competency' and 'Knowledge' for specified 'Accomplishment'**	-
1	CO1	PO1	3	The basic engineering knowledge is applied for the basic analog circuit coding.	L2
1	CO1	PO2		Performing experiment allows the easy analysis of problems.	L2
1	CO1	PO3		Designing a analog system to meet the specific needs within the realistic constraints can be done.	L6
	CO2	PO1		The basic engineering knowledge is applied for the basic analog circuit coding.	
2	CO2	PO2		Performing experiment allows the easy analysis of problems.	
2	CO2	PO3		Designing a analog system to meet the specific needs within the realistic constraints can be done.	
2	CO3	PO1		The basic engineering knowledge is applied for the basic analog circuit coding.	
	CO3	PO2		Performing experiment allows the easy analysis of problems.	
	CO3	PO3		Designing a analog system to meet the specific needs within the realistic constraints can be done.	
	CO4	PO1		The basic engineering knowledge is applied for the basic analog circuit coding.	
	CO4	PO2		Performing experiment allows the easy analysis of problems.	
	CO4	PO3		Designing a analog system to meet the specific needs within the realistic constraints can be done.	
	CO5	PO1		The basic engineering knowledge is applied for the basic analog circuit coding.	
5	CO5	PO2		Performing experiment allows the easy analysis of problems.	
5	CO5	PO3		Designing a analog system to meet the specific needs within the realistic constraints can be done.	
5	CO6	PO1		The basic engineering knowledge is applied for the basic analog circuit coding.	
	CO6	PO2		Performing experiment allows the easy analysis of problems.	
	CO6	PO3		Designing a analog system to meet the specific needs within the realistic constraints can be done.	

	CO7	PO1		The basic engineering knowledge is applied for the basic analog circuit coding.	
	CO7	PO2		Performing experiment allows the easy analysis of problems.	
	CO7	PO3		Designing a analog system to meet the specific needs within the realistic constraints can be done.	
	CO8	PO1		The basic engineering knowledge is applied for the basic analog circuit coding.	
	CO8	PO2		Performing experiment allows the easy analysis of problems.	
	CO8	PO3		Designing a analog system to meet the specific needs within the realistic constraints can be done.	
	CO9	PO1		The basic engineering knowledge is applied for the basic analog circuit coding.	
	CO9	PO2		Performing experiment allows the easy analysis of problems.	
	CO9	PO3		Designing a analog system to meet the specific needs within the realistic constraints can be done.	
	CO10	PO1		The basic engineering knowledge is applied for the basic analog circuit coding.	
	CO10	PO2		Performing experiment allows the easy analysis of problems.	
	CO10	PO3		Designing a analog system to meet the specific needs within the realistic constraints can be done.	

4. Articulation Matrix

CO - PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes	Program Outcomes														-
Modules	CO.#	**At the end of the course student should be able to . . .**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	Level
1	18EC33.1	Understand the principles of semiconductor Physics	3	2	1													L2
1	18EC33.2	Understand the working principles of semiconductor devices.	3	2	1													L2
2	18EC33.3	Understand the principles and characteristics of semiconductor diodes.	3	2	1													L2
2	18EC33.4	Understand the applications of semiconductor diodes.	3	2	1													L2
3	18EC33.5	Utilize the mathematical models of bipolar junction transistors for circuits and systems	3	2	1													L2
3	18EC33.6	Understand the operating principle of BJT.	3	2	1													L2
4	18EC33.7	Utilize the mathematical	3	2	1													L2

		models of MOS transistors for circuits and systems.																	
4	18EC33.8	Understand the operating principle of MOS transistors.	3	2	1														L2
5	18EC33.9	Understand the fabrication process of semiconductor devices .	3	2	1														L2
5	18EC33.10	Understand the CMOS IC technology.	3	2	1														L2
-	**CS501PC**	**Average attainment (1, 2, or 3)**	3	2	1														**-**
–	*PO, PSO*	*1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design*																	

5. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					
3					
4					
5					

6. Content Beyond Syllabus

Topics & contents required (from A.5) not addressed, but help students for Placement, GATE, Higher Education, Entrepreneurship, etc.

Modules	Gap Topic	Area	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1						
1						
2						
2						
3						
3						
4						
4						
5						
5						

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Semiconductors	10	2	-	-	1	1	2	CO1, CO2	L2
2	P-N Junctions	10	2	-	-	1	1	2	CO3, CO4	L2
3	Bipolar Junction Transistor	10	-	2	-	1	1	2	CO5, CO6	L2
4	Field Effect Transistors	10	-	2	-	1	1	2	CO7, C08	L2
5	Fabrication of p-n junctions	10	-	-	4	1	1	2	CO9, CO10	L2
-	**Total**	**50**				**5**	**5**	**10**	**-**	**-**

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam - 1	30	CO1, CO2, CO3,Co4	L2,L2,L2,L2
3, 4	CIA Exam - 2	30	CO5, CO6, CO7, C08	L2,L2,L2,L2
5	CIA Exam - 3	30	CO9, CO10	L2,L2
1, 2	Assignment - 1	10	CO1, CO2, CO3,Co4	L2,L2,L2,L2
3, 4	Assignment - 2	10	CO5, CO6, CO7, C08	L2,L2,L2,L2
5	Assignment - 3	10	CO9, CO10	L2,L2
1, 2	Seminar - 1		-	-
3, 4	Seminar - 2		-	-
5	Seminar - 3		-	-
1, 2	Quiz - 1		-	-
3, 4	Quiz - 2		-	-
5	Quiz - 3		-	-
1 - 5	Other Activities - Mini Project	-	CO9, CO10	L2,L2
	Final CIA Marks	**40**	**-**	**-**

D1. TEACHING PLAN - 1

Module - 1

Title:	Semiconductors	Appr Time:	10 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Understand the principles of semiconductor Physics	CO1	L2
2	Understand the working principles of semiconductor devices.	CO2	L2
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
1	Bonding forces in solids	CO1	L2
2	Energy bands,	CO1	L2
3	Metals, Semiconductors and Insulators,	CO1	L2
4	Direct and Indirect semiconductors,	CO1	L2
5	Electrons and Holes,	CO1	L2
6	Intrinsic and Extrinsic materials,	CO2	L2
7	Conductivity and Mobility,	CO2	L2
8	Drift and Resistance,	CO2	L2
9	Effects of temperature and doping on mobility,	CO2	L2
10	Hall Effect.	CO2	L2
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Analog circuit design is used for designing rectifiers, RPS.	CO1	L2
2	Analog circuit design is used for designing voltage regulators	CO2	L2
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Explain the Bonding forces in solids	CO1	L2
2	Explain the Energy bands,	CO1	L2
3	Explain the Metals, Semiconductors and Insulators,	CO1	L2
4	Explain the Direct and Indirect semiconductors,	CO2	L2
5	Explain theElectrons and Holes,	CO2	L2
6	Explain the Intrinsic and Extrinsic materials,	CO2	L2
7	Explain the Conductivity and Mobility,	CO2	L2
8	Explain the Drift and Resistance,	CO2	L2
9	Explain the Effects of temperature and doping on mobility,	CO2	L2
10	Explain the Hall Effect.	CO2	L2

e	**Experiences**	–	–
1		CO1	L2
2			
3			
4		CO2	L2
5			

Module - 2

Title:	P-N Junctions	Appr Time:	7 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
–	At the end of the topic the student should be able to . . .	–	**Level**
1	Understand the principles and characteristics of semiconductor diodes.	CO3	L2
2	Understand the applications of semiconductor diodes.	CO4	L2
b	***Course Schedule***	–	–
Class No	**Portion covered per hour**	**-**	**-**
11	Forward and Reverse biased junctions- Qualitative description of Current flow at a junction,	CO3	L2
12	Forward and Reverse biased junctions- Qualitative description of Current flow at a junction,	CO3	L2
13	reverse bias,	CO3	L2
14	Reverse bias breakdown- Zener breakdown,	CO3	L2
15	avalanche breakdown,	CO3	L2
16	Rectifiers.	CO4	L2
17	Optoelectronic Devices Photodiodes: Current and Voltage in an Illuminated Junction,	CO4	L2
18	Solar Cells, Photodetectors.	CO4	L2
19	Light Emitting Diode: Light Emitting materials.	CO4	L2
20	Light Emitting Diode: Light Emitting materials.	CO4	L2
c	**Application Areas**	**-**	**-**
–	Students should be able employ / apply the Module learnings to . . .	–	–
1	Analog circuit design is used for designing voltage regulators	CO3	L2
2	Analog circuit design is used for designing operational amplifiers.	CO4	L2
d	**Review Questions**	–	–
–	The attainment of the module learning assessed through following questions	–	–
14	Explain the Forward biased junctions- Qualitative description of Current flow at a junction.	CO3	L2
15	Explain the Reverse biased junctions- Qualitative description of Current	CO3	L2

	flow at a junction.		
16	Explain the reverse biasing in semiconductor diode.	CO3	L2
17	Explain the Reverse bias breakdown and Zener breakdown,	CO4	L2
18	Explain the avalanche breakdown.	CO4	L2
19	Explain the Rectifiers. List the types of rectifiers.	CO4	L2
20	Explain the Optoelectronic Devices(Photodiodes).	CO4	L2
21	Explain the working and construction Solar Cells, Photodetectors.	CO4	L2
22	Explain the working and constructionLight Emitting Diode.	CO4	L2
e	**Experiences**	-	-
1		CO3	L2
2			
3			
4		CO4	L2
5			

E1. CIA EXAM - 1

a. Model Question Paper - 1

Crs Code:	18EC33	Sem:	III	Marks:	30	Time:	90 minutes
Course:	ELECTRONIC DEVICES						

-	-	**Note: Answer all questions, each carry equal marks. Module : 1, 2**	**Marks**	**CO**	**Level**
1	a	Explain the Bonding forces in solids	8	CO1	L2
	b	Explain the Energy bands,	8	CO1	L2
	c	Explain the Metals, Semiconductors and Insulators,	9	CO1	L2
		OR			
2	a	Explain the Intrinsic and Extrinsic materials,	8	CO1	L2
	b	Explain the Conductivity and Mobility,	8	CO1	L2
	c	Explain the Drift and Resistance,	9	CO1	L2
3	a	Explain the Reverse biased junctions- Qualitative description of Current flow at a junction.	8	CO3	L2
	b	Explain the reverse biasing in semiconductor diode.	8	CO3	L2
	c	Explain the Reverse bias breakdown and Zener breakdown,	9	CO4	L2
		OR			
4	a	Explain the avalanche breakdown.	8	CO4	L2
	b	Explain the Rectifiers. List the types of rectifiers.	8	CO4	L2
	c	Explain the working and constructionLight Emitting Diode.	9		

b. Assignment -1

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	18EC33	Sem:	III	Marks:	5	Time:	90 - 120 minutes
Course:	Electronic devices				Module : 1, 2		
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1	1KT18EC001	Explain the Bonding forces in solids	5	CO1	L2
2	1KT18EC003	Explain the Energy bands,	5	CO1	L2
3	1KT18EC005	Explain the Metals, Semiconductors and Insulators,	5	CO1	L2
4	1KT18EC008	Explain the Direct and Indirect semiconductors,	5	CO1	L2
5	1KT18EC009	Explain theElectrons and Holes,	5	CO1	L2
6	1KT18EC010	Explain the Intrinsic and Extrinsic materials,	5	CO1	L2
7	1KT18EC011	Explain the Conductivity and Mobility,	5	CO1	L2
8	1KT18EC012	Explain the Drift and Resistance,	5	CO1	L2
9	1KT18EC013	Explain the Effects of temperature and doping on mobility,	5	CO1	L2
10	1KT18EC014	Explain the Hall Effect.	5	CO1	L2
11	1KT18EC015	Explain the Forward biased junctions- Qualitative description of Current flow at a junction.	5	CO2	L2
12	1KT18EC016	Explain the Reverse biased junctions- Qualitative description of Current flow at a junction.	5	CO2	L2
13	1KT18EC017	Explain the reverse biasing in semiconductor diode.	5	CO2	L2
14	1KT18EC018	Explain the Reverse bias breakdown and Zener breakdown,	5	CO2	L2
15	1KT18EC019	Explain the avalanche breakdown.	5	CO2	L2
16	1KT18EC020	Explain the Rectifiers. List the types of rectifiers.	5	CO2	L2
17	1KT18EC021	Explain the Opto-electronic Devices(Photodiodes).	5	CO2	L2
18	1KT17EC001	Explain the working and construction Solar Cells, Photodetectors.	5	CO2	L2
19	1KT16EC030	Explain the working and construction Light Emitting Diode.	5	CO2	L2
20	DIP	Explain the Rectifiers. List the types of rectifiers.	5	CO2	L2
21	DIP	Explain the Optoelectronic Devices(Photodiodes).	5	CO2	L2
22	DIP	Explain the working and construction Solar Cells, Photodetectors.	5	CO2	L2
23	DIP	Explain the working and construction Light Emitting Diode.	5	CO2	L2

D2. TEACHING PLAN - 2

Module - 3

Title:	Bipolar Junction Transistor	Appr	10 Hrs

		Time:	
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Utilize the mathematical models of bipolar junction transistors for circuits and systems	CO5	L2
2	Understand the operating principle of BJT.	CO6	L2
b	***Course Schedule***		
Class No	**Portion covered per hour**	**-**	**-**
21	Fundamentals of BJT operation,	CO5	L2
22	Amplification with BJTS,	CO5	L2
23	BJT Fabrication,	CO5	L2
24	The coupled Diode model (Ebers-Moll Model),	CO5	L2
25	The coupled Diode model (Ebers-Moll Model),	CO5	L2
26	Switching operation of a transistor,	CO6	L2
27	Cutoff, saturation, switching cycle,	CO6	L2
28	Cutoff, saturation, switching cycle,	CO6	L2
29	specifications, Drift in the base region,	CO6	L2
30	Base narrowing, Avalanche breakdown.	CO6	L2
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Analog circuit design is used for designing operational amplifiers.	CO5	L2
2	Analog circuit design is used for designing linear regulators.	CO6	L2
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
18	Explain the working of BJT operation,	CO5	L2
19	Explain the working of bjt as an Amplifier.	CO5	L2
20	Explain the BJT Fabrication,	CO5	L2
21	Explain the The coupled Diode model (Ebers-Moll Model),	CO6	L2
22	Explain the Switching operation of a transistor,	CO6	L2
23	Explain the fallowing in terms of bjt - Cutoff, saturation, switching cycle,	CO6	L2
24	Explain the Base narrowing, Avalanche breakdown.	CO6	L2
e	**Experiences**		
1			
2			
3			
4		CO6	L2

5			

Module - 4

Title:	Field Effect Transistors	Appr Time:	13 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Utilize the mathematical models of MOS transistors for circuits and systems.	CO7	L2
2	Understand the operating principle of MOS transistors.	CO8	L2
b	***Course Schedule***		
Class No	**Portion covered per hour**	**-**	**-**
31	Basic pn JFET Operation,	CO7	L2
32	Equivalent Circuit	CO7	L2
33	Frequency Limitations,	CO7	L2
34	MOSFET Two terminal MOS structure- Energy band diagram,	CO7	L2
35	MOSFET Two terminal MOS structure- Energy band diagram,	CO7	L2
36	Ideal Capacitance - Voltage Characteristics and Frequency Effects,	CO8	L2
37	Ideal Capacitance - Voltage Characteristics and Frequency Effects,	CO8	L2
38	Basic MOSFET Operation- MOSFET structure,	CO8	L2
39	Basic MOSFET Operation- MOSFET structure,	CO8	L2
40	Current-Voltage Characteristics.	CO8	L2
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learning to . . .	-	-
1	Analog circuit design is used for designing active filters.	CO7	L2
2	Analog circuit design is used for designing oscillators.	CO8	L2
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
32	Explain theBasic pn JFET Operation,	CO7	L2
33	Explain the the jfet Equivalent Circuit	CO7	L2
34	Explain the Frequency Limitations of jfet	CO7	L2
35	Explain the JFET Two terminal MOS structure with neat Energy band diagram,	CO7	L2
36	Explain the Ideal Capacitance and Voltage Characteristics of JFET.	CO7	L2
37	Explain the Basic MOSFET Operation- MOSFET structure,	CO8	L2
38	Explain the Current-Voltage Characteristics of MOSFET.	CO8	L2
39	Explain the Current-Voltage Characteristics of MOSFET.	CO8	L2
40	Explain the Frequency Effects of JFET.	CO8	L2

e	**Experiences**	–	–
1			
2			
3			
4			
5			

E2. CIA EXAM – 2

a. Model Question Paper – 2

Crs Code:	18EC33	Sem:	III	Marks:	30	Time:	90 minutes
Course:	Electronic devices						

-	-	**Note: Answer all questions, each carry equal marks. Module : 3, 4**	**Marks**	**CO**	**Level**
1	a	Explain the qualitative description of current flow at a junction.	8	CO5	L2
	b	Explain the Reverse bias breakdown in a PN junction.	8	CO6	L2
	c	Explain the difference between Zener breakdown and Avalanche breakdown.	9	CO6	L2
		OR			
2	a	Explain the Piece –Wise linear approximation of junction Diode characteristics.	8	CO6	L2
	b	Explain the Optical generation of carrier in a PN junction.	8	CO6	L2
	C	Explain the configuration of a Solar cell.	9	CO5	L2
3	a	With schematic explain P-I-N Photo diode.	8	CO7	L2
	b	Explain the effect of Injection Electroluminiscence.	8	CO7	L2
	c	Explain different types of light emitting materials.	9	CO8	L2
		OR			
4	a	Explain the external contral of current in reverse biased PN junction.	8	CO8	L2
	b	With schematic explain P-N-P transistorwith biased condition.	8	CO7	L2
	c	Explain the Amplification in a common emitter transistor circuit.	9	CO8	L2

b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	18EC33	Sem:	III	Marks:	5	Time:	90 – 120 minutes
Course:	ELECTRONIC DEVICES				Module : 3, 4		
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	**USN**	**Assignment Description**	**Marks**	**CO**	**Level**
1	1KT18EC001	Explain the working of BJT operation,	CO5	L2	L2
2	1KT18EC003	Explain the working of bjt as an Amplifier.	CO5	L2	L2

3	1KT18EC005	Explain the BJT Fabrication,	CO5	L2	L2
4	1KT18EC008	Explain the The coupled Diode model (Ebers-Moll Model),	CO6	L2	L2
5	1KT18EC009	Explain the Switching operation of a transistor,	CO6	L2	L2
6	1KT18EC010	Explain the fallowing in terms of bjt - Cutoff, saturation, switching cycle,	CO6	L2	L2
7	1KT18EC011	Explain the Base narrowing, Avalanche breakdown.	CO6	L2	L2
8	1KT18EC012	Explain theBasic pn JFET Operation,	CO7	L2	L2
9	1KT18EC013	Explain the the jfet Equivalent Circuit	CO7	L2	L2
10	1KT18EC014	Explain the Frequency Limitations of jfet	CO7	L2	L2
11	1KT18EC015	Explain the JFET Two terminal MOS structure with neat Energy band diagram,	CO7	L2	L2
12	1KT18EC016	Explain the Ideal Capacitance and Voltage Characteristics of JFET.	CO7	L2	L2
13	1KT18EC017	Explain the Basic MOSFET Operation- MOSFET structure,	CO8	L2	L2
14	1KT18EC018	Explain the Current-Voltage Characteristics of MOSFET.	CO8	L2	L2
15	1KT18EC019	Explain the Current-Voltage Characteristics of MOSFET.	CO8	L2	L2
16	1KT18EC020	Explain the Frequency Effects of JFET.	CO8	L2	L2
17	1KT18EC021	Explain the working of BJT operation,	CO5	L2	L2
18	1KT17EC001	Explain the working of bjt as an Amplifier.	CO5	L2	L2
19	1KT16EC030	Explain the BJT Fabrication,	CO5	L2	L2
20	DIP	Explain the The coupled Diode model (Ebers-Moll Model),	CO6	L2	L2
21	DIP	Explain the Switching operation of a transistor,	CO6	L2	L2
22	DIP	Explain the fallowing in terms of bjt - Cutoff, saturation, switching cycle,	CO6	L2	L2
23	DIP	Explain the working of BJT operation,	CO5	L2	L2

D3. TEACHING PLAN - 3

Module - 5

Title:	Fabrication of p-n junctions and Integrated Circuits	Appr Time:	10 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Understand the fabrication process of semiconductor devices .	CO9	L2
2	Understand the CMOS IC technology.	CO10	L2
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
41	Thermal Oxidation,	CO9	L2

42	Diffusion,	CO9	L2
43	Ion implantation,	CO9	L2
44	Rapid Thermal Processing,	CO9	L2
45	chemical vapour deposition,	CO9	L2
46	Background, Evolution of ICs,	CO10	L2
47	CMOS Process Integration,	CO10	L2
48	Integration of Other Circuit Elements.	CO10	L2
49	photolithography,	CO10	L2
50	Etching, metallization.	CO10	L2
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Analog circuit design is used for designing oscillators.	CO9	L2
2	Analog circuit design is used for designing active filters.	CO10	L2
	Analog circuit design is used for designing phase locked loops.		
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
42	Explain the Thermal Oxidation method of fabrication.	CO9	L2
43	Explain the Diffusion fabrication.	CO9	L2
44	Explain the Ion implantation fabrication,	CO9	L2
45	Explain the Rapid Thermal Processing fabrication,	CO9	L2
46	Explain the chemical vapour deposition fabrication,	CO9	L2
47	Explain the Background and Evolution of ICs,	CO10	L2
48	Explain the CMOS Process Integration,	CO10	L2
49	Explain the Integration of Other Circuit Elements.	CO10	L2
50	Explain the photolithography,	CO10	L2
51	Explain the Etching, metallization.	CO10	L2
e	**Experiences**	-	-
1		CO10	L2
2		CO9	
3			
4		CO9	L2
5			

E3. CIA EXAM - 3

a. Model Question Paper - 3

Crs Code:	18EC33	Sem:	III	Marks:	30	Time:	90 minutes
Course:	Electronic devices						

-	**-**	**Note: Answer all questions, each carry equal marks. Module : 5**	**Marks**	**CO**	**Level**

1	a	Explain the Thermal Oxidation method of fabrication.	8	CO9	L2
	b	Explain the Diffusion fabrication.	8	CO9	L2
	c	Explain the Ion implantation fabrication,	9	CO9	L2
		OR			
1	a	Explain the Rapid Thermal Processing fabrication,	8	CO9	L2
	b	Explain the chemical vapour deposition fabrication,	8	CO9	L2
	c	Explain the Background and Evolution of ICs,	9	CO9	L2
2	a	Explain the CMOS Process Integration,	8	CO10	L2
	b	Explain the Integration of Other Circuit Elements.	8	CO10	L2
	c	Explain the photolithography,	9	CO10	L2
		OR			
2	a	Explain the Integration of Circuit Elements.	8	CO10	L2
	b	Explain the photolithography,	8	CO10	L2
	c	Explain the Etching, metallization.	9	CO10	L2

b. Assignment - 3

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	18EC33	Sem:	III	Marks:	5	Time:	90 - 120 minutes
Course:	Electronic devices				Module : 5		
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1	1KT18EC001	Explain the Thermal Oxidation method of fabrication.	5	CO10	L2
2	1KT18EC003	Explain the Diffusion fabrication.	5	CO10	L2
3	1KT18EC005	Explain the Ion implantation fabrication,	5	CO9	L2
4	1KT18EC008	Explain the Rapid Thermal Processing fabrication,	5	CO9	L2
5	1KT18EC009	Explain the chemical vapour deposition fabrication,	5	CO9	L2
6	1KT18EC010	Explain the Background and Evolution of ICs,	5	CO9	L2
7	1KT18EC011	Explain the CMOS Process Integration,	5	CO9	L2
8	1KT18EC012	Explain the Integration of Other Circuit Elements.	5	CO9	L2
9	1KT18EC013	Explain the photolithography,	5	CO9	L2
10	1KT18EC014	Explain the Etching, metallization.	5	CO9	L2
11	1KT18EC015	Explain the Thermal Oxidation method of fabrication.	5	CO9	L2
12	1KT18EC016	Explain the Diffusion fabrication.	5	CO9	L2
13	1KT18EC017	Explain the Ion implantation fabrication,	5	CO10	L2
14	1KT18EC018	Explain the Rapid Thermal Processing fabrication,	5	CO10	L2
15	1KT18EC019	Explain the chemical vapour deposition fabrication,	5	CO10	L2

16	1KT18EC020	Explain the Background and Evolution of ICs,	5	CO10	L2
17	1KT18EC021	Explain the CMOS Process Integration,	5	CO10	L2
18	1KT17EC001	Explain the Integration of Other Circuit Elements.	5	CO10	L2
19	1KT16EC030	Explain the photolithography,	5	CO10	L2
20	DIP	Explain the Etching, metallization.	5	CO10	L2
21	DIP	Explain the Background and Evolution of ICs,	5	CO10	L2
22	DIP	Explain the CMOS Process Integration,	5	CO10	L2
23	DIP	Explain the Integration of Other Circuit Elements.	5	CO10	L2

F. EXAM PREPARATION

1. University Model Question Paper

Course:	Electronic devices					Month / Year	May /2018	
Crs Code:	18EC33	Sem:	III	Marks:	80	Time:	180 minutes	
Module	**Note**	Answer all FIVE full questions. All questions carry equal marks.				**Marks**	**CO**	**Level**

2. SEE Important Questions

Course:		Electronic devices					Month / Year	May /2018	
Crs Code:		18EC33	Sem:	7	Marks:	80	Time:	180 minutes	
	Note	Answer all FIVE full questions. All questions carry equal marks.					-	-	
Module	Qno.	Important Question					**Marks**	**CO**	**Year**

G. Content to Course Outcomes

1. TLPA Parameters

Table 1: TLPA – Example Course

Module-#	Course Content or Syllabus (Split module content into 2 parts which have similar concepts)	Content Teaching Hours	Blooms' Learning Levels for Content	Final Blooms' Level	Identified Action Verbs for Learning	Instruction Methods for Learning	Assessment Methods to Measure Learning
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
1		3	- L1 - L2	L2	- -	- Lecture - -	- Slip Test - -
1		9	- L2 - L2	L2	- -	- Lecture - Tutorial -	- Assignment - -
2		4	- L2 - L2	L2	- -	- Lecture -	- Assignment -
2		3	- L2 - L2	L2	- -	- Lecture -	- Slip Test -

3		5	- L1 - L2	L2	- -	- Lecture -	- Slip Test -
3		12	- L2 - L2	L2	- -	- Lecture - Tutorial -	- Assignmen t - -
4		8	- L2 - L1	L2	- -	- Lecture - Tutorial -	- Assignmen t - -
4		8	- L2 - L2	L2	- -	- Lecture - Tutorial -	- Assignmen t - -
5		5	- L2 - L2	L2	- -	- Lecture - -	- Assignmen t - -
5		5	- L2 - L2	L2	- -	- Lecture - -	- Assignmen t - -

2. Concepts and Outcomes:

Table 2: Concept to Outcome – Example Course

Module-#	Learning or Outcome from study of the Content or Syllabus	Identified Concepts from Content	Final Concept	Concept Justification (What all Learning Happened from the study of Content / Syllabus. A short word for learning or outcome)	CO Components (1.Action Verb, 2.Knowledge, 3.Condition / Methodology, 4.Benchmark)	Course Outcome **Student Should be able to ...**
A	*I*	*J*	*K*	*L*	*M*	*N*
1	- -	- -	Klystron oscillator	Comprehend the working of Klystron oscillator	- Understand - Klystron Oscillator	Understand the working of Klystron Oscillator.

					– –	
1	– –	– –	Microwave transmission lines	Examine the transmission lines using graphical methods	- Analyze - Transmission Lines - Graphical Methods –	Analyze the transmission lines using Graphical methods.
2	– –	– –	Multiport networks	Implement the Z, Y and S parameters to Multiport networks	- Analyze - Multiport Networks – –	Analyze the Z, Y and S parameters for a Multiport network.
2	– –	– –	Microwave passive devices	Understand the working of microwave passive devices	- Understand - Microwave Passive Devices – –	Understand the working of different microwave passive devices.
3	– –	– –	Striplines	Have knowledge of micro, parallel and shielded striplines	- Understand - Types of Stripline – –	Understand micro, parallel and shielded striplines.
3	– –	– –	Antenna parameters	Compute the antenna design characteristics using the parameters	- Apply - Design Characteristics – –	Describe antenna working using the given parameters.
4	– –	– –	Array of point sources	Extend the antenna parameters to the array of point sources	- Apply - Array of Point Sources – –	Describe the working of point sources.
4	– –	– –	Electric dipole antennas	Examine the field parameters of electric dipole antennas	- Analyze - Electric Dipole Antenna	Analyze the working of electric dipole antenna.
5	– –	– –	Loop and horn antennas	Explain the working of horn and loop antennas	- Understand - Horn and Loop Antenna	Explain the working of horn and loop antennas.
5			Helical, Parabola, Yagi-Uda and Log-periodic antennas	Compare the working of helical, parabola, Yagi-Uda and log-periodic antennas	- Understand - Helical, Parabola, Yagi-Uda and Log-periodic Antennas	Compare the working of helical, and Yagi-Uda antennas