

COURSE CODE	COURSE TITLE	L	T	P	C
1152EC239	ELECTRONICS CIRCUIT SIMULATION AND PCB DESIGN	1	0	4	3

**a. Course Category:**

Program Elective

**b. Preamble:**

The course is aimed at making the students to understand electronic circuit simulation process for better understanding and designing of cost effective Printed Circuit Boards. Emphasizing the students to understand how to design a PCB layout of given circuit using available circuit simulation and PCB layout design CAD tools (free or licensed) .This course helps the student to simulate the circuit, develop the complete hardware circuit on PCB and assemble the components using SMD soldering technique

**c. Prerequisite Courses:**

Nil

**d. Related Courses:**

Analog Electronics, Linear Integrated Circuits

**e. Course Outcomes :**

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

CO Nos.	Course Outcomes	Skill Level (Based on Dave's Taxonomy)
CO1	Simulate and perform various analysis for the given Electronic Circuit.	S3
CO2	Design a PCB Layout for the given circuit	S4
CO3	Fabricate the PCB and assemble the components.	S2

**f. Correlation of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	M	H	-	H	-	-	-	M	-	-	M	H	H
CO2	L	M	H	-	H	-	-	-	M	-	-	M	H	H
CO3	L	M	H	-	H	-	-	-	M	-	-	M	H	H

**g. Examination scheme**

Examination Scheme for practical dominated course										
Internal evaluation (40M)							Semester end evaluation (60M)			
Laboratory experiment (15M)				Model laboratory test (25M)			Part-A (20M)	Part-B (40M)		
Performance in conducting experiment (5)	Result and analysis (3)	Viva Voce (3)	Record (4)	Performance in conducting experiment (15)	Result and analysis (5)	Viva Voce (5)	Theory questions to evaluate the knowledge and understanding (20)	Performance in conducting experiment (25)	Result and analysis (10)	Viva Voce (5)

**h. Course Content :**

**Theory**

**15 Hours**

**Electronics Circuit Simulation**

State the features of different circuit simulation tools (Open source or licensed) used for electronic circuit simulation. Different PCB layout design tools (Open source or License) used for PCB layout design. General terms and elements used in circuit simulation software. Assemble electronics circuit using circuit simulation software. Types of Circuit Analysis- Transient Analysis, Bias Point Analysis, Frequency Response.

**PCB Layout Design**

Terms used: net list file, back annotation, bill of material, foot print, PTH, track width, mil, etc. used in PCB layout design software. Place, route and generate the layout of given circuit using manual or auto routing using PCB layout design software. Raw Materials - Types of PCBs: Single layer - Double layer - Multi layer – Rigid – Flexible - Flex Rigid -High frequency - Aluminium\_Backed - Track Width Calculation - Layout Design - Back Annotation -Gerber File - NC Drill File - Fab and Assembly Drawings – Legend - Bill of Material. Packaging Trends - Package Classifications - Package Type and Characteristics: Through-Hole Mounting - Surface Mounting - Special Packages- Package Symbols and Codes. Symbols-Reference Designators- Values and Attributes-Schematic Design Guidelines-Routing - Nodes – Joints - Design Error Check.

## PCB Manufacturing and Assembly

Design to Manufacturing - CAM Editor - Reverse Engineering of PCBs - From File to Film - Printing the Inner layers - Removing the Unwanted Copper - Layer Alignment and Optical Inspection - Layer-up and Bond – Drill Plating- Copper Deposition - Outer Layer Imaging\_ Plating- Final Etching - Solder Mask Application - Surface Finish – Silkscreen - Electrical Test - Profiling and V-Scoring - Soldering: Soldering Tools- Assembly and Support Equipment.

### i. List of experiments

S.No.	CO's	Practical exercises 60
1.	CO1	Getting acquainted with simulation tool
2.	CO1	Design a Variable Power Supply Circuit using LM338/LM317
3.	CO1	Design a Hartley Oscillators Circuit and simulate its response.
4.	CO1	Design an AstableMultivibrator Circuit and simulate its response.
5.	CO1	Design and simulate response of Active and Passive Filter Circuits.
6.	CO2	Getting acquainted with PCB layout tool
7.	CO2	Design a PCB layout for the given circuit (Basic Level)
8.	CO2	Design a PCB layout for the given circuit (Advanced Level)
9.	CO2	Board to Layout Design (Reverse Engineering)-FM Board.
10.	CO3	Hands on Experience-Soldering and types of Soldering
11.	CO3	THT components- Drilling and Soldering.
12.	CO3	Complete Board Assembly-FM Board

Total 75 hrs

### j. Suggested Learning Resources

#### i) List of textbooks

1. Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards,SimonMonk;McGraw Hill Education (1 July 2014)
2. Complete PCB Design Using OrCAD Capture and PCB Editor,KraigMitznerNewnes; Pap/Cdr edition (28 May 2009), 2011, ISBN: 978-1-4493- 9357-1

#### ii) List of Major Equipment/ Instrument/Software with Broad Specifications

1. Altium Designer (Licensed version)
2. Express PCB (Free version)
3. Eagle (Free version)
4. MultiSim(Student Version)
5. UtilBoard(Student Version)

#### iii) Online resources

1. [www.techdocs.altium.com/](http://www.techdocs.altium.com/)
2. [www.ni.com](http://www.ni.com) (Multisim and Ultiboard - Academic version)
3. [www.cadence.com](http://www.cadence.com) (Orcade - Student version)
4. [www.youtube.com](http://www.youtube.com) (PCB Manufacturing Videos)