SEMESTER S7

FLEXIBLE ELECTRONICS

Course Code	**PEEVT 747**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3-0-0-0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Solid State Devices	**Course Type**	Theory

Course Objectives:

1. Identify the advantages, drawbacks, performances, complementarity, and uniqueness of large area manufacturing vs. silicon technology
2. Integrate the operation principles, architectures, and processing of main devices and systems fabricated for flexible electronics.
3. Predict systems integration issues and propose methods for integration and encapsulation of printed devices and systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Flexible and Printed Electronics: Evolution of Flexible Electronics, review of cutting edge research on electronics that can be flexible, plastic, stretchable, conformable or printed. Electronic materials, components, and systems, applications for IoT.	**9**

2	Materials, Processing, and Manufacturing: Various semiconductors, dielectric, and conducting materials, Organic semiconductors, from chemical bonds to bands, Charge injection and transport, Examples of printable functional materials, Thin-film Deposition and Processing Methods for Flexible Devices, Solution-based Patterning Processes; Ink-jet printing, gravure, and other processes, surface energy effects, multilayer patterning	**9**
3	Flexible Thin-Film Transistors and Circuits: Thin-Film Transistor; Device structure and performance, Electrical characteristics, parameter extraction, characterization methods for rigid and flexible devices, electrical stability, printed transistors; organic/polymer, metal-oxide, electrolyte gated	**9**
4	Other Flexible Devices and System Integration: Organic Light Emitting Diodes, Organic Solar Cells, thin flexible OLED displays, OLED lighting, smart wallpaper, sensors, logic, and memory, RFID tags, Latest applications of printed electronics, Encapsulation, Roll to roll printing processes, Integration Issues, and Designs for the Future.	**9**

Course Assessment Method
(CIE: 40 marks,ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	**Assignment/ Microproject**	**Internal Examination-1 (Written)**	**Internal Examination-2 (Written)**	**Total**
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Familiarize the flexible and printed electronics technology	**K2**
CO2	Understand the materials, processing and manufacturing methods for flexible devices	**K2**
CO3	Analyse the flexible thin film transistor's device structure and characterization	**K4**
CO4	To understand the latest applications of fexible printable devices	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2									
CO2	3	3	2									
CO3	3	3	2									
CO4	3	3	2									

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Organic and Printed Electronics: Fundamentals and Applications	G. Nisato, D. Lupo, S. Ganz	CRC Press	2016
2	Handbook of Flexible and Stretchable Electronics	M. M. Hussain and N. El-Atab	CRC Press	2020
3	3D Bioprinting Revolution	Sabrie Soloman	Khanna Publishing house	2020

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Large Area and Flexible Electronics	Mario Caironi & Yong-Young Noh	WILEY-VCH	2015
2	Flexible electronics: materials and applications	Wong, William S., and Alberto Salleo	Springer	2009

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://youtu.be/YoslM2Sxihs?si=02yozFsifxWfsYQH
2	https://youtu.be/YoslM2Sxihs?si=HD8mG5nR9XuUMUgB
3	https://youtu.be/KtKG_rIPbVs?si=xuOHyOLjNQCfzNm5
4	https://youtu.be/MC1zGEmrELA?si=erqi_zobzrhiMf3D