SEMESTER: S8

CONDUCTING POLYMERS

Course Code	PEPOT863	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)	Polymer Materials & Polymer Physics	Course Type	Theory

Course Objectives:

1. Students will be able to demonstrate knowledge of mechanism of electrical conduction in electro active polymers
2. Analyse the properties of conducting polymers with respect to the structure and choose conducting polymers for specific applications.

SYLLABUS

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Module No.	Syllabus Description	Contact Hours
1	Electronic states, structural disorder, tight-binding theory, band structure of c-c bonds, band gap, pendant groups and electronic states, electron-hole interaction, molecular- ion model, photoemission, intrinsic bulk states, extrinsic bulk state, energy level diagram.	9
2	Charge carriers in semiconductors, dopant atoms and energy levels, donors and acceptors, probability function, charge neutrality, position of fermi energy level, fermi-dirac integral. Charging techniques, charge measuring techniques, interpretation of real charge and dipole polarization, concepts of electronic energy transfer, interpretation and measurement of electronic energy transfer.	9
3	Piezoelectricity of polypeptides, formation of electrets, structure of PVDF electrets, piezo and pyroelectric properties of polar crystals, properties of ceramic composites, piezoelectric relaxation. Applications of conducting polymers as batteries, light emitting diodes, sensors, electro optic devices,	9

	microwave and electrochromic devices, membranes, corrosion protection, imaging and lithography	
4	Solubility of conducting polymers, solvents, soluble and sulfonated conducting polymers, processing and coating by insitu polymerisation, melt and heat processability, colloidal solution and precursor methods, L-B films, direct vapour deposition, other deposition methods	**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**

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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	Summarize the principles of electrical conduction in polymer materials.	**K2**
CO2	Explain the significance of electrical charge storage and energy transfer.	**K2**
CO3	Identify the applications of conducting polymers	**K3**
CO4	Determine the properties and synthesis of electroactive polymers	**K5**
CO5	Illustrate different techniques to impart conductivity in polymers	**K2**

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

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**											
CO2	**3**											
CO3	**3**											
CO4	**3**											
CO5	**3**											

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Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Springer Handbook Of Electronic And Photonicmaterials.	Kasap, Safa, and Peter Capper	Springer	2017.
2	Handbook of polymers in electronics.	Malhotra, Bansi D	ISmithers Rapra Publishing	2001
3	Handbook of Advanced Electronic and Photonic Materials and Devices, Ten-Volume Set.	Nalwa, Hari Singh, ed	Vol. 1. Academic Press,	2000.

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Conducting polymers	Yilmaz, Faris.		2016
2	Electrical Conductivity in Polymer-Based Composites: Experiments, Modelling, and Applications	Taherian, Reza, and Ayesha Kausar	William Andrew	2018.
3	Conjugated conducting polymers.	Kiess, Helmut G., and Dionys Baeriswyl	Vol. 102. Berlin: Springer-Verlag	1992
4	Conductive polymers and plastics.	Margolis, James	Springer Science & Business Media	2012

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1-4	https://www.youtube.com/watch?v=nSAvyQajVzE&t=23s https://www.youtube.com/watch?v=ygtbo5KDXeI https://www.youtube.com/watch?v=9J9OViSUol4 Prof.Abhijit P Deshpande, IIT Madras

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