SEMESTER 7

EXPERIMENTAL STRESS ANALYSIS

Course Code	PEAOT745	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3/5	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Strength of Materials	Course Type	Theory

Course Objectives:

1. To study the various experimental techniques involved for measuring displacements, stresses and strains in structural components.

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SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Principles of measurements, Strain Gauges – Mechanical strain gauges, Optical strain gauges, Acoustical strain gauge and Pneumatic strain gauge.	9
2	Electrical Strain Gauges – Inductance strain gauge, Capacitance strain gauge and Electrical resistance strain gauge – Types, Selection of gauges, Gauge factor, Gauge materials, Carrier materials, Transverse sensitivity, Application techniques and Temperature compensation techniques.	9
3	Strain Rosettes – Two-gauge rosette, rectangular rosette, Delta rosette and T-Delta rosette. Strain Gauge Circuits – Wheatstone bridge circuit and Potentiometer circuit (constant voltage type and constant current type), Strain Indicators.	9
4	Two-dimensional photoelasticity – Concept of light, Double refraction, Stress optic law, Plane polariscope, Circular polariscope, Interpretation of	9

	fringe pattern, Fringe sharpening, Fringe multiplication, Fringe order determination, Calibration techniques, Photoelastic materials and their properties.	

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)**	2 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. Each question carries 9 marks. **(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	Understand the working principle and procedure of strain gauges	**K2**

CO2	Understand the working principle and procedure of electrical strain gauges	**K2**
CO3	Understand the working principle of strain rosettes and strain gauge circuits	**K2**
CO4	Understand the working principle and procedure of photoelasticity	**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	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO3	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO4	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

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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	Experimental Stress Analysis	Sadhu Singh	Khanna Publishers, New Delhi.	2017
2	Experimental Stress Analysis	Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G.RaMachandra, K.	Tata McGraw Hill, New Delhi	2009
3	Experimental Stress Analysis	Dally, J.W., and Riley, W.F.	McGraw Hill Inc., New York.	2005

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Hand book of Experimental Stress Analysis	Hetenyi, M.	John Wiley and Sons Inc	1972
2	Applied Stress Analysis	Durelli. A.J.	Prentice Hall of India Pvt Ltd.New Delhi	1982
3	Photo Elasticity	Max Mark Frocht	John Wiley and Sons Inc., New York.	1959
4	Digital Photoelasticity	Ramesh, K.	Springer, New York.	2000
5	Hand book of Experimental Stress Analysis	Hetenyi, M.	John Wiley and Sons Inc., New York.	1972

Video Links (NPTEL, SWAYAM)	
Module No.	**Link ID**
1-4	**https://archive.nptel.ac.in/courses/112/106/112106068/**

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SEMESTER 7

NANOTECHNOLOGY

Course Code	**PEAOT746**	**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)	Nil	**Course Type**	Theory

Course Objectives:

To give an introduction to nanotechnology and nanostructures

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction and scope-Classification of nanostructures: Quantum dots, quantum wires, quantum wells, nano clusters, nanotubes, super lattices, nano crystalline materials-Effects of nano meter length scale – Changes to the system total energy, changes to the system structures. Effect of Nanoscale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical, and electronic properties.	**9**
2	Fabrication methods: Top down and bottom up approaches-Top down processes: Milling, Lithographic, machining process, pulsed laser methods- Bottom up processes: Vapour phase deposition methods, PVD, CVD, electro deposition, plasma assisted deposition process, MBE, chemical methods, colloidal and solgel methods	**9**
3	Characterization methods: General classification of characterization methods, Microscopy techniques: Scanning Electron Microscopy, Transmission Electron Microscopy, Scanning Tunnelling Microscopy, Atomic Force Microscopy, Diffraction Techniques-Spectroscopy Techniques – Raman Spectroscopy, Surface analysis and depth profiling-Mechanical Properties- Magnetic and Thermal properties.	**9**
4	Applications of Nanotechnology (nano materials and devices)-Applications of nanocomposites, nanocrystalline materials, nano layered structures, nanomagnetic materials-magneto resistance- Carbon nanotubes: SW, MW, nanostructured coatings- nano sensors: order from chaos,	**9**

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	characterization, perception, nano sensor based on quantum size effect, Electrochemical sensors, Sensors based on physical properties, Nano biosensors, smart dust	

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

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Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks (8x3 =24 marks)	• 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 subdivisions. (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	Understanding classification and effects of nanostructures	***K2***
CO2	Understanding fabrication methods of nanostructures	***K2***
CO3	Understanding microscopy techniques (SEM, TEM, STM, AFM),	***K2***
CO4	Understanding the applications of nanotechnology.	***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	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO3	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO4	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

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

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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	Nanomaterials,,	A.K.Bandyopadhyy	New age international publishers,	2008
2	Handbook of Nanotechnology	Bharat Bhushan	Springer	2010
3	" Introduction to Nanotechnology "	Charles P Poole, Frank J Owens,	John Wiley and Sons ,	2003
4	Jeremy Ramsden	Jeremy Ramsden,	William Andrew,Elsevier,	2011
5	Nano: The essentials	T Pradeep	McGraw–Hill education	2007
6	Nanoscience and	V.S.Muralidharan A	Anebooks Pvt	

	Technology	Subramnya,	Ltd	

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Nanotechnology,	Gregory Timp	Springer-Verlag	2009
2	NanoTechnology	E John Mongillo	Greenwood Press	2007
3	Nanoscale Science and Technology	Kelsall Robert.W,IanHamley, MarkGeoghegan	Wiley Eastern	2005

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/118102003

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SEMESTER 7

SPACE EXPLORATION TECHNOLOGY