APPLIED ELECTRONICS AND INSTRUMENTATION DEPARTMENT B.TECH CURRICULUM STRUCTURE UNDER AUTONOMY

HALDIA INSTITUTE OF TECHNOLOGY

HALDIA
EAST MEDINIPUR

AFFILIATED TO

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Economics for Engineers

Course Name: Economics for Engineers	Category:Humanities & Social Sciences
Course Code: HM HU 501	Semester: 5th
L-T-P: 3-0-0	Credit: 3
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Continuous Assessment: 25Marks
Tutorial: Nil	Attendance: 5 Marks
Total Lectures: 45	End Semester Exam.: 70 Marks
Pre-Requisites:Mathematics	

Objectives:

1. To provide students the basic concepts of Economic theories related to Engineering so that they can analyze the economic viability of any engineering course ofaction.

2. To provide students the basic concepts of Finance and the methods of Accounting so that they can use such methods and concepts in order to analyze the economic viability of the engineering or any other courses of action related to anyproject.

Course Outcome:

HM HU 501.1: Remembering the basic concepts, definitions, process know how of Economics for Engineers and recalling the terms already taught with the new list of terms.

HM HU 501.2: Understanding and interpreting the models of Economics for Engineers by stating the main ideas of the models and illustrating the related graphs and tables.

HM HU 501.3: Identifying the problems on the facts, techniques and rules and solving the same applying knowledge already acquired and utilizing the related formula.

HM HU 501.4: Analyzing the information and classifying them into different groups along with examining relationships, making inferences among the parameters of distinguished models.

HM HU 501.5: Evaluating different projects by comparing the benefits and costs related to the same, assessing the best option and recommending the same.

HM HU 501.6: Creating alternative solutions by adopting new ideas, compiling the existing information, designing new process with the objective of maximizing benefits or outcomes.

Syllabus details

Module No.	Description of Topic	Contact Hrs.	CO
Module 1	1. Economic Decisions Making – Overview, Problems, Role, Decision makingprocess. 2. Engineering Costs & Estimation – Fixed, Variable, Marginal &Average Costs,Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.	5	1, 2
Module 2	3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debtrepayment, Nominal& EffectiveInterest. 4. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods;Internal Rate Of Return, Calculating Rate ofReturn,	5	2, 3
Module 3	5. Incremental Analysis; Best Alternative Choosing AnAnalysis Method, Future Worth Analysis, Benefit-Cost RatioAnalysis, 6. Sensitivity and Breakeven Analysis. Economic Analysis In the Public Sector -Quantifying And Valuing Benefits &drawbacks.	5	2, 4
Module 4	7.Inflation And Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at differentRates. 8. Uncertainty In Future Events - Estimates and Their Use inEconomic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Riskvs Return, Simulation, Real Options.	6	1, 2, 3
Module 5	9. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, MultipleAlternatives 10.Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation,Common Elements of Tax Regulations For Depreciation And Capital Allowances	8	3, 4
Module 6	11. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems. 12. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and IndirectCosts, Indirect CostAllocation.	7	4, 5, 6

Total	36	

Learning Resources:

Text books:

1. R. PaneerSeelvan: Engineering Economics,PHI
2. PremvirKapoor, Sociology & Economics for Engineers, Khanna PublishingHouse
3. BhabatoshBanerjee : Cost Accounting ,The World Press PrivateLtd.
4. BhabatoshBanerjee : Cost & Management Accounting ,The World Press PrivateLtd.
5. Amit Kumar De &SamironMkherjee: Economics for Engineers, Matrix EducarePvt. Ltd.
6. Financial Accounting I : Soumya Mukherjee &Abhik Kr. Mukherjee,Oxford UniversityPress

Reference books:

1. Sullivan and Wicks: Engineering Economy,Pearson
2. James L.Riggs,David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e ,TataMcGraw-Hill
3. Cost & Management Accounting I :J.K.Mitra , Oxford UniversityPress.

Object Oriented Programming Language

Course Name: Object Oriented Programming Language	**Category:** Open Elective Course-I
Course Code: OE-EI501	**Semester: 5th**
L-T-P: 3-0-0	**Credit: 3**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Continuous Assessment: 25Marks
Tutorial: Nil	Attendance: 5 Marks
Total Lectures: 36	End Semester Exam.: 70 Marks
Pre-Requisites:	

Course Objective:

1. To understand Object Oriented Programming concepts and basic characteristics of Java.
2. To know the principles of packages, inheritance and interfaces.
3. To define exceptions and use I/O streams.
4. To develop a java application with threads and generics classes.
5. To design and build simple Graphical User Interfaces

Course Outcome:

OE-EI501.1. Develop Java programs using OOP principles.
OE-EI501.2. Develop Java programs with the concepts inheritance and interfaces.
OE-EI501.3. Build Java applications using exceptions and I/O streams.
OE-EI501.4. Develop Java applications with threads and generics classes.
OE-EI501.5. Develop interactive Java programs using swings

Course Details

Module No.	Description of Topics	Contact Hrs	COs
Module 1	**Introduction to oop and java fundamentals** Object Oriented Programming – Abstraction – objects and classes – Encapsulation- Inheritance – Polymorphism- OOP in Java	5	1,2
Module 2	**Characteristics of Java** – The Java Environment – Java Source File Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers – static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays, Packages – Java Doc Comments.	5	1-3

Module 3	**Inheritance And Interfaces** Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces – Object cloning –inner classes, Array Lists – Strings	9	2
Module 4	**Exception Handling And I/O** Exceptions – exception hierarchy – throwing and catching exceptions– built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files	8	3
Module 5	**Multithreading And Generic Programming Differences:** Between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, and thread groups. Generic Programming–Generic classes– generic methods – Bounded Types – Restrictions and Limitations.	9	4
Module 6	**Event Driven Programming** Graphics programming – Frame – Components – working with 2D shapes – Using color, fonts, and images – Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – Introduction to Swing – layout management – Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows– Menus – Dialog Boxes.	9	5

Text/Reference Books:

1. Herbert Schildt, ―Java The complete reference‖, 8th Edition, McGraw Hill Education, 2011.
2. Steven Holzner, ―Java 2 Black book‖, Dreamtech press,2011.
3. Timothy Budd, ―Understanding Object-oriented programming with Java‖, Updated Edition, Pearson Education,2000.
4. R.S. Salaria – Mastering Object-Oriented Programming using C++, Khanna Publishing House, 2018.

Database ManagementSystems

Course Name:Database Management Systems	Category: Open Elective Course-I
Course Code: OE-EI 502	Semester: 5th
L-T-P: 3-0-0	Credit: 3
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Continuous Assessment: 25Marks
Tutorial: Nil	Attendance: 5 Marks
Total Lectures: 36	End Semester Exam.: 70 Marks
Pre-Requisites:	

Course Objective:

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3. To understand and use data manipulation language to query, update, and manage a database
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Outcomes:

At the end of the course, students will demonstrate following abilities

OE-EI 502.1. The design and implementation of a database system. For a given query write relational algebra expressions for that query and optimize the developed expressions

OE-EI 502.2. For a given specification of the requirement design the databases using ER method and normalization.

OE-EI 502.3. For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.

OE-EI 502.4. For a given query optimize its execution using Query optimization algorithms

OE-EI 502.5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability. And implement the isolation property, including locking, time stamping based on concurrency control and serializability of scheduling.

OE-EI 502.6. Concept of the file organization along with different index structurings.

Syllabus Details

Module No.	Description of Topics	Contact Hrs	COs
Module 1.	**Introduction:** Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.	3	1
Module 2.	**Entity-Relationship Model :** Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.	5	2
Module 3.	**Relational Model:** Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.	5	1
Module 4.	**SQL and Integrity Constraints:** Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Sub-queries, Database security application development using SQL, Stored procedures and triggers.	7	3
Module 5.	**Relational Database Design:** Functional Dependency, Different anamolies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF	7	2
Module 6.	**Internals of RDBMS** Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols, two phase locking.	5	4,5
Module 7.	**File Organization & Index Structures:** File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.	4	6
	Total	36	

Text/References:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer SciencePress.
3. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe,

Pearson Education
4. "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

Digital Signal Processing

Course Name: Digital Signal Processing	Category: Open Elective Course-II
Course Code: OE-EI 503	Semester: 5th
L-T-P: 3-0-0	Credit: 3
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Continuous Assessment: 25Marks
Tutorial: Nil	Attendance: 5 Marks
Total Lectures: 36	End Semester Exam.: 70 Marks
Pre-Requisites: Knowledge of matrix, KCL, KVL and LaplaceTransformation, Fourier Transform.	

Objectives:

This course aims to make students familiar with the most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processorsand also to make students aware about the meaning and implications of the properties of systems and signals.

Course Outcomes (COs):

At the endofthecourse,astudent willbe ableto:

OE-EI 503.1. **Describe** the distinctions between analog, continuous-time, discrete-time and digital signals, and describe the basic operations involved in analog-digital (A/D) and digital-analog (D/A) conversion, and **Understand** the concept ofSampling and reconstruction.

OE-EI 503.2. **Evaluate** different type of mathematical operation on signals.

OE-EI 503.3. **Compute the**
   a. z-transform of a sequence, identify its region of convergence,
   b. Inverse z-transform by partial fractions.
   c. Fourier series and Fourier transform
   d. Fast Fourier transform of discrete signal.

OE-EI 503.4. **Implement** the DFT in terms of the FFT, as well as some of its applications (computation of convolution sums, spectral analysis).

OE-EI 503.5. **Apply** tests (or examples and counter examples) to demonstrate linearity, time-invariance, causality and stability, and hence show whether or not a given system belongs to the important class of causal, LTI (linear time-invariant) systems.

OE-EI 503.6. **Design** FIR and IIR filters with desired frequency responses.

Syllabus Details

Module No.	Description of Topics	Contact Hrs.	CO
Module: 1	**Module Name:** *Discrete-time signals & Systems:* Concept of discrete-time signals, unit-sample, unit-step, unit-ramp, real & complex exponentials, periodic, energy, power signal, arithmetic operations on sequences. Concept of discrete-time system, linear, causal, stable, time invariance, recursive, FIR, IIR, invertible systems.	3	CO1, 2, 5
Module: 2	**Module Name:** *Sampling and Reconstruction of Signals* Introduction, Periodic Sampling, Frequency-Domain Representation of Sampling, Reconstruction of a Band limited Signal from its samples, Aliasing, Sampling Theorem, Nyquist Rate, Prefiltering to avoid Sampling, A/D Conversion, Analysis of Quantization Error, D/A Conversion.	5	CO1, 2, 3
Module: 3	**Module Name:** *LTI Systems & its Implementation* Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and tabular methods to compute convolution supported with examples and exercises, properties of convolution, interconnections of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems. Structures for FIR Systems: Direct-Form, Cascade Form, Lattice and frequency sampling Structures. Structures for IIR Systems: Signal flow graphs, transposed, Direct Form, Cascade Form, Lattice, Lattice Ladder and Parallel from structure.	7	CO2, 5
Module: 4	**Module Name:** *Z-Transform and its applications* Definition, mapping between s-plane and z-plane, unit circle, convergence and ROC, properties of Z-transform, Z-transform on sequences with examples and exercises, characteristic families of signals along with ROCs, convolution, correlation and multiplication using Z transform, initial value theorem, Perseval's relation, inverse	6	CO 2, 3, 5

	Z-transform by contour integration, power series & partial-fraction expansions with examples and exercises.		
Module: 5	**Module Name:***Discrete Fourier Transform-Properties & Applications* Concept and relations for DFT/IDFT, Twiddle factors and their properties, computational burden on direct DFT, DFT/IDFT as linear transformations, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circular convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences – Overlap-Save and Overlap-Add methods with examples and exercises. ***Efficient computation of DFT-Fast Fourier Transform:*** Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithms, signal flow graphs, Butterflies, computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises.	8	CO 2, 3, 4
Module: 6	**Module Name:***Digital Filter Design* Characteristics of Practical Frequency Selective Filters, Design of Butterworth Discrete-Time IIR filters from Analog filters using impulse invariant and bilinear transforms, FIR filters-Symmetric and ant symmetric, design of linear phase FIR filters using windowing and frequency sampling method. Kaiser Window Filter Design Method, optimum approximations of FIR Filters- Optimal type I & II Low Pass Filters, Park-McClellan Algorithm. Least Squares Design method, Wiener Filters.	7	CO 3, 5,6
	Total	36	

Text Books:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis& D.G. Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
3. Discrete-Time Signal Processing, Alan V. Oppenheim, Ronald W.Schafer, John R. Buck.
4. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.

Reference Books:

1. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj& C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing, A. NagoorKani, TMH Education
4. Digital Signal Processing S. Poornachandra& B. Sasikala, MH Education

Soft Computing

Course Name: Soft Computing	Category: Open Elective Course-II
Course Code: OE-EI-504	Semester: 5th
L-T-P: 3-0-0	Credit: 3
Teaching Scheme	Examination Scheme
Theory: 3hrs./week	Continuous Assessment: 25Marks
Tutorial: Nil	Attendance: 5 Marks
Total Lectures:44	End Semester Exam.: 70 Marks
Pre-Requisites: Familiarity with linear algebra, multivariate calculus, and probability theory Knowledge of a programming language	

Objectives:
- *Introduce a relatively new computing paradigm for creating intelligent machines usefulfor solving complex real world problems.*
- *Insight into the tools that make up the soft computing technique: fuzzy logic, artificialneural networks and hybrid systemsTechniques.*
- *To create awareness of the application areas of soft computing technique*
- *Provide alternative solutions to the conventional problem solving techniques inimage/signal processing, pattern recognition/classification, control system*

Course Outcomes (COs):

OE-EI-504.1: **Identify and describe** soft computing techniques and their roles in building intelligent machines

OE-EI-504.2: **Recognize** the feasibility of applying a soft computing methodology for a particular problem

OE-EI-504.3: **Apply** fuzzy logic and reasoning to handle uncertainty and solve engineering problems

OE-EI-504.4: **Apply** genetic algorithms to combinatorial optimization problems

OE-EI-504.5: **Apply** neural networks to pattern classification and regression problems

OE-EI-504.6: **Evaluate and compare** solutions by various soft computing approaches for a given problem.

Syllabus Details

Module No.	Description of Topics	Contact Hrs.	CO
Module: 1	**Introduction:** Introduction to Soft-computing, Its Constituent components, Fuzzy Sets, General Idea and importance in practical life, definition,	5	CO 1
Module: 2	**Basic Operators:** T- Norms, S- Norms, other aggregation operators, Fuzzy relations, implications, extensions, projections and compositions	5	CO 1, 2, 3
Module: 3	**Fuzzy Logic:** Approximate reasoning, compositional rule of inference, rule based systems, term set, Fuzzification, reasoning, defuzzification	5	CO 2, 3
Module: 4	**Fuzzy Models:** Different Fuzzy models (MA/TS), Applications of Fuzzy rule based systems	5	CO 2, 3
Module: 5	**Genetic Algorithm:** Basics of Genetic Algorithm, its adaptation for computing, Application	8	CO 2, 4, 6
Module: 6	**GA and Fuzzy based Back propagation Network:** Studies of some Fuzzy-neural, Neuro-fuzzy and Fuzzy-GA systems	8	CO 4, 5, 6
	Total	36	

Text Books:

1. Dirankov and Hellendrom Fuzzy logic control, Narosa
2. Rajsekhar and Pai, Neural Networks, Fuzzy logic and Genetic Algorithm: Synthetic and Applications, Pearson Education
3. Goldberg - Genetic algorithm, Pearson 2003

Reference Books:

1. Freeman - Neural Networks, Pearson 2003
2. Jang - Neuro-fuzzy and soft Computing, Pearson 2003

Control System

Course Name: Control System	Category: Professional Core Courses
Course Code: PC EI 501	Semester: 5TH
L-T-P: 3-0-0	Credit: 3
Teaching Scheme	Examination Scheme
Theory:3hrs./week	Continuous Assessment: 25Marks
Total Lectures: 36	Attendance: 5 Marks
	End Semester Exam.: 70 Marks
Pre-Requisites: Engineering mathematics that teaches complex variables and Laplace transform	

Objectives:

1. *To understand the use of transfer function models for analysis of physical systems and introduce the control system components.*
2. *To provide adequate knowledge in the time response of systems and steady state error analysis.*
3. *To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.*
4. *To introduce the concept of stability of physical systems.*
5. *To introduce design of compensators and non-linear systems.*

Course Outcomes (COs):

On completion of this course, the student will be able to

PC EI 501.1: The modeling of different linear-time-invariant systems using transfer.
PC EI 501.2: The concept of time response and steady state error for linear-time invariant systems.
PC EI 501.3: Characterization of plants and control loops.
PC EI 501.4: The concept of stability analysis in time and frequency domain for linear-time invariant systems
PC EI 501.5: The design of compensators.
PC EI 501.6: The concept of non-linear system**.**

Syllabus Details

Module No.	Description of Topics	Contact Hrs.	CO
Module: 1	Mathematical modelling of linear time-invariant systems (LTI): System components and Differential equations of physical Systems – mechanical, electrical systems, thermal systems, electromechanical system, biological system; Concept of analogous systems. Laplace transforms, Transfer function, Solution of set of differential equations using Laplace transformation. Concept of poles and zeros. System order and type number. A brief introduction to non-LTI systems, distributed systems, discrete systems, time-delay system	8	1
Module: 2	Block diagram and signal flow graph analysis: Block diagram reduction techniques, Mason's gain formula. Examples.	4	1
Module: 3	System analysis (time-domain): Time response of first-order and second-order systems. Steady-state errors and error constants.	3	2
Module: 4	Characteristics of feedback control: Feedback Principles, Effect of feedback in stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity, and robustness.	3	3
Module: 5	Stability analysis: Concepts of stability. Necessary conditions for Stability. Routh stability criterion. Relative stability analysis. Introduction to root- locus techniques.	5	4
Module: 6	System analysis (frequency-domain): Bode plots-phase and gain margins, Experimental determination of transfer function. Introduction to Polar Plots. Nyquist plots. Nyquist Stability criterion (including time delay systems).	6	4
Module: 7	Compensator Design: Design of lead, lag and lead-lag compensators, Design (and development) of the simple control system.	4	5
Module: 8	Disadvantages of Transfer function modelling, Introduction to state-space representation.	3	6
	Total	36	

Text/References:

1. Automatic Control System: Basic analysis and design by William A. Wolovich, The Oxford Series in Electrical and Computer Engineering.
2. B. C. Kuo, "Automatic Control System", 10th Mc Graw Hill.
3. K. Ogata, "Modern Control Engineering", Prentice Hall, 5th edition.

4. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009
5. Control Systems Engineering, 6th edition, ISV (WSE), by Norman Nise, Wiley
6. Control Systems, Ambikapathy, Khanna Publishing House, 2018.
7. Control Systems, N K Sinha, New Age International Pvt, 2013.

Industrial Instrumentation

Course Name: Industrial Instrumentation	Category: Professional Core
Course Code: PC-EI 502	Semester: V
L-T-P: 3-0-0	Credit: 3
Teaching Scheme	Examination Scheme
Theory: hrs./week	Continuous Assessment: 25Marks
Tutorial: Nil	Attendance: 5 Marks
Total Lectures:36	End Semester Exam.: 70 Marks
Pre-Requisites:To understand this course, the learner must have idea of elementary physics, Sensor & Transducers and Basic Measurement.	

Objectives:

1. Tofamiliar the students with industrial instruments used in various industries.
2. To acquire knowledge about various techniques used for measurement of process variables such as temperature, pressure, flow and level.
3. To equip the students with the basic knowledge of industrial processes.
4. To learn the construction and working of different types of temperature, pressure, flow and level transducers.
5. To provide the concept of possible sources of error and possible remedies when performing measurements.
6. To realize the basic concepts of hazardous area classification.

Course Outcomes (COs):

PC-EI 502.1. Name different methods for pressure, temperature, flow and level measurement in industry andlaboratory.

PC-EI 502.2. Explain the working principle of different method of pressure, temperature, flow and levelmeasurement.

PC-EI 502.3. Apply the basic knowledge of physics to explain the working principle of the measurement of pressure, temperature, flow and level.

PC-EI 502.4. Differentiate characteristics of each technique of measurement for pressure, temperature, flow and level.

PC-EI 502.5. Select the suitable method of pressure, temperature, flow and level measurement technique depending on industrial application.

PC-EI 502.6. Comprehend the installation, calibration and application of process transmitter.

Syllabus details

Module No.	Description of Topics	Contact Hrs.	CO
Module: 1	**Temperature Measurement** Temperature scale, ITS 90, fixed points and interpolation equations Filled in systems: liquid, gas and vapour, ranges, media, errors, construction details and comparison, classification Bimetal elements, Thermostats Thermocouples including MI thermocouples: types, thermoelectric power, circuits, ranges, errors, cold junction compensation, compensating cables; Radiation Thermometer sensors used, spectral and other characteristics, Optical Pyrometers; Semiconductor type Temperature Transducers, operation, circuit, range. Accessories instruments required for installation in industrial application like thermo well.	6	1-5
Module: 2	**Measurement of Pressure and Vacuum** **Pressure:** Manometers – U tube, Inclined Tube, Well type and Ring Manometers Elastic Pressure Sensor Instruments – Bourdon Tube Pressure Gauge, Capsule Gauge, Differential Pressure Gauge, Pressure Switch Electronic Pr / DP transmitters: capacitive, piezo - resistive and resonating wire type Pressure gauge calibration: Deadweight tester. **Vacuum:** Mcleod Gauge, Knudsen gauge, thermal conductivity gauge, ionization gauge. Accessories instruments required for installation in industrial application like snubber.	7	1-5
Module: 3	**Flow meter I** General concepts - Laminar and turbulent flow, Reynolds's number, Effect of temperature and pressure on flow rate measurement, Calibration of flow meters. Head type flow measurement – analysis and calculation, and head producing devices - orifice, nozzle, venturi, pitot tube, multiport averaging pitot Variable Area Flowmeters – Glass and metal tube rotameters,	6	1-5
Module: 4	**Flow meter II** Electromagnetic type, Ultrasonic type, Vortex type, Positive displacement type Mass flow meters : Coriolis, Thermal, Impeller type Weirs, Flumes and open channel flow measurement, measurement of flow of bulk solids. Accessories instruments required for installation in industrial application like manifolds.	6	1-5
Module: 5	**Level Measurement** Gauge glass, Bi-Colour, Magnetic and Reflex Level Gauge Float and displacers type instruments – Gauge and Switch D/P type sensors and their installation arrangements Capacitive type level instrument, Ultrasonic and Microwave type, Radar Level Transmitters, level switches – fork type, paddle type. Accessories	6	1,2,6

	instruments required for installation in industrial application like siphon.		
Module: 6	**Introduction to process Transmitters** Need of transmitter (concept of field area & control room area), Need for standardization of signals, Current, voltage, and pneumatic signal standards, Concept of live & dead zero. Types of transmitters: Two and four wire transmitters, Electronic and Pneumatic transmitters, Electronic Capacitive Differential Pressure Transmitter: Types, Mounting (Installation), Calibration setup, Application of DPT for Level measurement, Zero elevation, suppression, and Square root extractor. Difference between converter & Transmitter, Pneumatic to current converter, Current to pneumatic converter.	5	1,6

Text Books:

1. D. Patranabis, Principles of industrial Instrumentation, TMH, New Delhi, 2nd Ed.
2. K. Krishnaswamy, S. Vijayachitra, Industrial Instrumentation, New Age International Publishers.
3. S.K. Singh, Industrial Instrumentation and Control, McGraw Hill Education.

Reference Books:

1. B. G. Liptak, Instrument Engineers Handbook, vol-I and vol-II, Chilton Book Co. Philadelphia
2. D. M. Considine and G. D. Considine (Eds.) Process Instruments and controls Handbook, McGraw Hill, New York
3. C. R. Alavala, Principles of Industrial Instrumentation and Control Systems, Cengage Learning

Optical Instrumentation

Course Name: Optical Instrumentation	Category: Professional Elective Courses-I
Course Code: PE-EI 501	Semester: V
L-T-P: 3-0-0	Credit: 3
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Continuous Assessment: 25 Marks
Tutorial: Nil	Attendance: 5 Marks
Total Lectures: 36	End Semester Exam.: 70 Marks
Pre-Requisites: Knowledge of basic optics, Fundamentals of Electromagnetic theory	

Objectives

Course Outcome:

PE-EI 501.1:   To remember the structures of Optical fiber and theirproperties.
PE-EI 501.2:   To understand operation of lasers, LEDs, and Photo-detectors
PE-EI 501.3:   To apply the advantages of Optical - modulators, Switch, and Amplifiers.
PE-EI 501.4:   To analyze the application of Optical Fiber Sensors and Laser.
PE-EI 501.5:   To evaluate the principle of Holography and applications.
PE-EI 501.6:   To design case studies about Industrial Application of optical fiber and lasers.

Course Details

Module No.	Description of Topics	Contact Hrs	COs
Module 1.	**Optical Fibers and Their Properties:** Introduction to optical fiber – fiber characteristics – principles of light propagation through a fiber – Different types of fibers and their properties – Losses in the optical fiber – Dispersion – advantages and disadvantages of optical fibers, Connector and splices. Optical Fibers and Their Properties: Introduction to optical fiber – fiber characteristics – principles of light propagation through a fiber – Different types of fibers and their properties – Losses in the optical fiber – Dispersion – advantages and disadvantages of optical fibers, Connector and splices.	8	1, 6
Module 2.	**Optoelectronic Components: LED, PD, Optical Modulators** Optical sources: LED, DH LED, Edge & Surface emitting LED; Optical detectors: Photodiode, Photoconductive Photodetector, PIN, APD – Electro-optic, Magneto optic and Acousto-optic Modulators. Description of LED, LCD and Plasma Codes and	8	2, 3

	Standards of Instruments.		
Module 3.	**Optical Switches and Amplifiers –** Coupled mode analysis of directional couplers, electro-optic switches. Optical amplifiers - EDFA, Raman amplifier	3	3
Module 4.	**Laser Fundamentals:** Two/Three levels and four level lasers – Properties of Semiconductor laser –Laser modes – Resonator configuration – Q-switching and mode locking; Types of Gas lasers, Solid State lasers, etc.	7	2, 4
Module 5.	**Industrial Application of Optical Fiber and Lasers:** Optical fiber based sensors - for measurement of distance, length, pressure, velocity/ acceleration, current, etc. Laser applications for material processing – Laser heating, welding, melting, etc. Medical applications of lasers - Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynecologyand oncology, etc.	8	6
Module 6.	**Holography–** Basic principle-Methods– Holographic interferometry and application.	2	5
	Total	36	

Text/Reference Books:

1. Introduction to Optoelectronics, J. Wilson and J.F.B. Hawkes, Prentice Hall of India, 2001.
2. Optoelectronics and Optical Fiber Sensors, A. B. Maity, PHI, 2013
3. Fiber Optics and Optoelectronics, R. P. Khare, Oxford Univ. Press, 2004.
4. Laser Fundamentals – W. T. Silfvast, Cambridge Univ. Press, 2004
5. Optical Fiber Communication – Principles and Practice, J.M. Senior, PHI, 1985.
6. Lasers Systems and Applications – S. K. Srivastava, New Age, 2019

Advanced Sensors

Course Name: Advanced Sensors	Category: Professional Elective Course-I
Course Code: PE-EI 502	Semester: 5th
L-T-P: 3-0-0	Credit: 3
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Continuous Assessment: 25Marks
Tutorial: Nil	Attendance: 5 Marks
Total Lectures:36	End Semester Exam.: 70 Marks
Pre-Requisites:Basic knowledge of electronics, sensor and transduces.	

Objectives:

This course aims to educate students with different advanced sensing technology and also make them familiar with manufacturing and fabrication technique of different silicon and micro sensors. Also it is expected that the knowledge of this course will encourage the students in designing different sensor based projects for application in the field of robotic and industrial automation.

Course Outcomes (COs):

After completing the course the student should be able to

PE-EI 502.1: Explain the various principles employed in transducers.
PE-EI 502.2: Examine the methods of fabricating a sensor.
PE-EI 502.3: Apply knowledge in designing smart sensors.
PE-EI 502.4: Discuss the techniques of fabrication and application of MEMS.
PE-EI 502.5: Design environmental measurement systems using different chemical sensors.
PE-EI 502.6: Develop bio-sensors for agricultural and food processing industry.

Course details

Module No.	Description of Topics	Contact Hrs.	CO
Module: 1	**Fundamentals of sensors** Transducers for various parameters like temperature, pressure, flow, level, acceleration, vibration, orientation etc.	8	1
Module: 2	**Sensor Fabrication:** Design considerations and selection criterion as per standards, Sensor fabrication techniques, process details and latest trends in sensor fabrication. Thick film sensing and system design.	7	2
Module: 3	**Smart Sensors:** Smart sensor basics, signal conditioning and A/D conversion for sensors, examples of available ICs and their applications.	5	3
Module: 4	**Micro Electromechanical Sensors:** Construction, Features, Applications	7	4
Module: 5	**Advanced Sensing Technology:** Sensors, instruments and measurement techniques for emerging application areas such as environmental measurement like DO(dissolves oxygen),BOD (biological oxygen demand),COD(chemical oxygen demand)TOC(total organic carbon)Cox(carbon dioxides)NOx(nitrogen oxide),SOx (Sulpher Oxides)	5	5
Module: 6	**Bio Sensors:** Sensors agricultural measurements such as soil moisture, wind speed, leaf wetness duration, sensors for food processing like smell or odour, taste.	4	6
	Total	36	

Text Books:

1. Chang Liu, Foundations of MEMS, Pearson Education Inc., 2012.
2. Stephen D Senturia, Microsystem Design, Springer Publication, 2000.
3. Tai Ran Hsu, MEMS & Micro systems Design and Manufacture Tata McGraw Hill, New Delhi, 2002.
4. Jacob Fraden /Handbook of Modern Sensors, 2nd Ed.
5. S. M. Sze, Semiconductor Sensors.
6. M J Usher, Sensors and Transducers, MacMillan, 1985.

Reference Books:

1. NadimMaluf, An Introduction to Micro Electro Mechanical System Design, Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, The MEMS Handbook, CRC press Baco Raton, 2001.
3. Julian W. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M. Adams and Richard A.Layton, Introduction to MEMS, Fabrication and Application, Springer, 2010.

Object Oriented Programminglanguage Lab

Name of the Course:Object Oriented Programming language Lab	Category:Open Elective Courses-I
Course Code: OE-EI 591	Semester: 5th
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination scheme:
Tutorial: Nil	External Assessment:60
Practical: 3 hrs./week	Internal Assessment:40
Credit Points: 1.5	

Course Outcome:

OE-EI 5911. Gain the basic knowledge on Object Orientedconcepts.
OE-EI 5912. Ability to develop applications using Object Oriented ProgrammingConcepts.
OE-EI 5913. Ability to implement features of object oriented programming to solve
real world problems.
OE-EI 5914. Understand advanced features of C++ specifically stream I/O, templates and
operator overloading
OE-EI 5915. Understand how to apply the major object-oriented concepts to implement object
oriented programs in C++, encapsulation, inheritance andpolymorphism

Laboratory Experiments:

Exp. No.	Title of the Experiment	COs
1	Assignments on class, constructor, overloading, inheritance, overriding	
2	Assignments on wrapper class, arrays	
3	Assignments on developing interfaces- multiple inheritance, extending interfaces	
4	Assignments on creating and accessing packages	
5	Assignments on multithreaded programming	
6	Assignments on applet programming	

Data Base Management SystemLab

Name of the Course: Data Base Management SystemLab	**Category:**Open Elective Courses-I
Course Code: OE-EI 592	**Semester: 5th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination scheme:**
Tutorial: Nil	External Assessment:60
Practical: 3 hrs./week	Internal Assessment:40
Credit Points: 1.5	

Course Outcome:

OE–EI 592.1. Understand, appreciate and effectively explain the underlying concepts of database technologies.

OE–EI 592.2. Design and implement a database schema for a givenproblem-domain.

OE–EI 592.3. Normalize adatabase.

OE–EI 592.4. Populate and query a database using SQL DML/DDLcommands.

OE–EI 592.5. Programming PL/SQL including stored procedures, stored functions, cursors,packages.

OE–EI 592.6. Design and build a GUI application using a4GL

Laboratory Experiments:		COs
1.	**Creating Database** • Creating aDatabase • Creating aTable • Specifying Relational DataTypes • SpecifyingConstraints • CreatingIndexes	
2.	**Table and Record Handling** • INSERT statement • Using SELECT and INSERTtogether • DELETE, UPDATE, TRUNCATE statements • DROP, ALTERstatements	
3.	**Retrieving Data from a Database** • The SELECTstatement • Using the WHEREclause • Using Logical Operators in the WHEREclause • Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY andHAVING Clause • Using AggregateFunctions • Combining Tables UsingJOIN • Sub queries	
4.	**Database Management** • CreatingViews • Creating ColumnAliases • Creating DatabaseUsers • Using GRANT andREVOKE	

Control System Lab

Name of the Course:Control System Lab	Category: Professional Core Courses
Course Code:PC-EI 591	Semester:5th
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	**Examination scheme:**
Tutorial: Nil	External Assessment:60
Practical: 3 hrs./week	Internal Assessment:40
Credit Points: 1.5	

Course Outcomes:	
CO. 1	To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response.
CO. 2	To assess the system performance using time domain analysis and methods for improving it.
CO. 3	To assess the system performance using frequency domain analysis and techniques for improving the performance
CO. 4	To design various controllers and compensators to improve system performance.
CO. 5	To develop the ability to communicate effectively with fellow group members for dividing and sharing the assignments among themselves.
Pre-Requisite:	
1	MATLAB programming, Engineering Mathematics

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Experiment No.	Laboratory Experiments	COs
1	Familiarization with MATLAB control system toolbox, MATLAB-SIMULINK toolbox and PSPICE	1 - 5
2	Study of step response for first and second order system with unity feedback with display on CRT screen and calculation of parameters for different system designs.	1 - 5
3	Simulation of impulse response for types 0, 1 and 2 with unity feedback using MATLAB and PSPICE.	1 - 5
4	Determination of root-locus, Bode plot, Nyquist plot using MATLAB toolbox for a given second order transfer function and listing of the specifications.	1 - 5
5	Determine the effect of P, I, D actions on first order simulated process and obtaining the system transfer functions from Bode plot	1 - 5
6	Lag and lead compensation – Magnitude and phase plot	1 – 5
7	Create the state space model of a linear continuous system.	1 – 5

Industrial Instrumentation Lab

Name of the Course: Industrial Instrumentation Lab	Category:Professional Core Courses
Course Code: PC EI 592	Semester: 5th
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination scheme:
Tutorial: Nil	External Assessment:60
Practical: 3 hrs./week	Internal Assessment:40
Credit Points: 1.5	

Course Outcomes:	
CO. 1	Illustrate the different methods for the measurement of temperature, pressure, flow and level.
CO. 2	Elucidate the construction and working of various industrial devices used to measure temperature, pressure, flow and level.
CO. 3	Explicate the construction and working of various industrial devices used to measure temperature, pressure, flow, level, viscosity and moisture.
CO. 4	Ability to analyze, formulate and select suitable sensor for the given industrial applications.
CO. 5	Demonstrate the knowledge of calibrations used in the measurement and control processes.
CO. 6	Demonstrate skills in trouble shooting problems with the measurement and control of industrial processes.
Pre-Requisite:	
1	Knowledge of sensor & Transducers

Experiment No.	Laboratory Experiments	COs
1	Study of Thermocouple characteristics and Measurement of Temperature with it.	1, 2, 3, 4 & 6
2	Measurement of Temperature using AD 590 IC Sensor.	1, 2, 3, 4 & 6
3	Calibration of Pressure Gauge using Dead Weight Tester.	5
4	Measurement of low pressure using Pirani gauge.	1, 2, 3, 4 & 6
5	Measurements of Volumetric flow rate by head type flow meter.	1, 2, 3, 4 & 6
6	Measurements of flow rate and velocity of fluid flow by Variable Area type flow meter.	1, 2, 3, 4 & 6
7	Measurements of Mass flow rate by Mass flow meter.	1, 2, 3, 4 & 6
8	Measurement of level using capacitive type level instrument.	1, 2, 3, 4 & 6