ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

SCHOOL OF ELECTRONIC SCIENCES

B. Tech in Electronics and Instrumentation Engineering

Curriculum and Syllabus

(**2023-24 admitted students**)

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

School/ Department: SCHOOL OF ELECTRONIC SCIENCES

Course: B. Tech **Programme: Electronics and Instrumentation Engineering**

Abbreviation used:

AC	Audit course	LC	Laboratory Course	PA	Practical Assessment
PC	Professional Core	PR	Project/ Practical/ Internship	L	Lecture
PE	Professional Elective	SE	Seminar/ Expert Lecture/ Etc.	T	Tutorial
OE	Open Elective	IA*	Internal Assessment	P	Practical
MC/BS/HS	Mandatory/ Common Course	EA	End-Semester Assessment		
ACC	Advanced Competency Course				
*Internal Assessment Mark (40 marks) consists of (i) Mid Semester (20 marks) (ii) Quiz/ Assignment/Attendance (20 marks)					

5th Semester

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PC	EI3101	Instrumentation Devices and Systems-II	3	0	0	3	40	60	-	100
2	PC	EI3103	Microprocessor & Microcontroller	3	0	0	3	40	60	-	100
3	PC	EI3105	Control System Engineering	3	0	0	3	40	60	-	100
4	PE-I	EI3201	1. Optoelectronic Instrumentation	3	0	0	3	40	60	-	100
		EI3203	2. Electromagnetic Field Theory								
		EI3205	3. VLSI Design								
		EI3207	4. Digital Communication								
5	HS	BH3401	Business Management	3	0	0	2	40	60	-	100
		BH3403	Entrepreneurship Development								
6	MC	IP3401	Environmental Engineering	3	0	0	2	40	60	-	100
		IP3403	Industrial Safety Engineering								
7	LC	EI3501	Instrumentation Devices and Systems-II Lab	0	0	3	1.5	-	-	100	100
8	LC	EI3503	Microprocessor & Microcontroller Lab	0	0	3	1.5	-	-	100	100
9	LC	EI3505	Control System Engineering Lab	0	0	3	1.5	-	-	100	100
10	PSI	EI3701	Seminar on SIRE-I	0	0	3	1.5	-	-	100	100
			Total	**18**	**0**	**12**	**22**	**240**	**360**	**400**	**1000**

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Syllabus (Admission Batch: 2023-24)

6th Semester

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PC	EI3102	Process Control	3	0	0	3	40	60	-	100
2	PC	EI3125	Digital Signal Processing	3	0	0	3	40	60	-	100
3	PE-II	EI3202	1. Biomedical Instrumentation	3	0	0	3	40	60	-	100
		EI3204	2. Computer Networks								
		EI3206	3. MEMS and NEMS								
		EI3208	4. Power Electronics								
4	PE-III	EI3212	1. Industrial Internet of Things	3	0	0	3	40	60	-	100
		EI3214	2. Pulse and Digital Circuits								
		EI3216	3. Embedded Systems								
		EI3225	4. Machine Learning								
5	HS	BH3401	Business Management	3	0	0	2	40	60	-	100
		BH3403	Entrepreneurship Development								
6	MC	IP3401	Environmental Engineering	3	0	0	2	40	60	-	100
		IP3403	Industrial Safety Engineering								
7	PSI	EI3602	Project for Product Development-I	0	0	6	3	-	-	100	100
8	LC	EI3502	Process Control Lab	0	0	3	1.5	-	-	100	100
9	LC	EI3525	Digital Signal Processing Lab	0	0	3	1.5	-	-	100	100
10	Summer Internship and Research Experience (SIRE - II) *										
			Total	**18**	**0**	**12**	**22**	**240**	**360**	**400**	**1000**

***Minimum 4 weeks of Summer Course / Training / Internship / Skill Course / etc. after 6th Semester**

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Syllabus (Admission Batch: 2023-24)

7th Semester

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PE-IV	EI4201	1. Industrial Instrumentation	3	0	0	3	40	60	-	100
		EI4203	2. Advanced Control System								
		EI4205	3. Introduction to Microfabrication								
		EI4207	4. Natural Language Processing								
2	PE-V	EI4211	1. Advanced Process Control	3	0	0	3	40	60	-	100
		EI4213	2. Smart & Wireless Instrumentation								
		EI4215	3. Electronics for Sensor Design								
		EI4217	4. Digital Image Processing								
3	OE		Open Elective—I	3	0	0	3	40	60	-	100
4	ACC	EI4101	**Advanced Artificial Intelligence**	3	0	0	3	40	60	-	100
5	PSI	EI4701	Seminar on SIRE – II	0	0	6	1	-	-	100	100
6	PSI	EI4601	Project for Product Development—II	0	0	4	2	-	-	100	100
		EI4603	Internship Project—I								
Total				**12**	**0**	**10**	**15**	**160**	**240**	**200**	**600**

8th Semester

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	OE		Open Elective – II	3	0	0	3	40	60	-	100
2	OE		Open Elective – III	3	0	0	3	40	60	-	100
3	OE		Open Elective – IV	3	0	0	3	40	60	-	100
4	PSI	EI4702	Seminar on Project	0	0	6	1	-	-	100	100
5	PSI	EI4602	Project for Product Development – III	0	0	4	2	-	-	100	100
		EI4604	Internship Project – II								
Total				**9**	**0**	**10**	**12**	**12**	**180**	**200**	**500**

FIFTH
SEMESTER

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
INSTRUMENTATION DEVICES AND SYSTEMS-II	EI3101	3-0-0	3

Prerequisite: Knowledge of Physics and Chemistry.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Describe the working principles of various transducers/sensors.

CO2: Identification of transducers/sensors for measurement of various physical variables.

CO3: Interpret the characteristics of the transducers/sensors.

CO4: Design a measurement system for the measurement of various physical variables.

Module I: **9 Hours**

Pressure measurement: Comparison with known dead-weights, Manometer for use of pressure measurement, Low pressure (vacuum) measurements (Mechanical, Thermal, Ionization based).

Flow Measurement: Basics of Flow Measurement: Pitot-Static Tube, Flow-Obstruction Elements, Rotameter, Turbine-type flow meter, Electromagnetic flow meter, Ultrasonic flow meter.

Module II: **7 Hours**

Level measurement: Using floats, Diaphragm type, Differential pressure gage, Air bubbler, Capacitive level indicator, Ultrasonic level indicator, Gamma-ray level indicator.

Humidity measurement: Capacitive type Hygrometer.

Module III: **7 Hours**

Liquid conductivity measurement: Two pole, Four pole type, Sources of error in conductivity measurement

pH measurement: Electrode method.

Viscosity Measurement: Capillary flow method, Falling ball viscometer, Rotational viscometer.

Acceleration Measurement: Piezoelectric transducers: basic principle, equivalent circuit, frequency response, charge amplifier; acceleration measurement: basic principle and frequency response; piezoelectric accelerometer.

Module IV: **7 Hours**

Optical sensing: Optical sources (LED, LASER), Photo detectors (photo conductive cells, photo voltaic, photo emissive, and photodiodes); Radiation pyrometer: Planck's law, Stefan Boltzmann's law, broadband and narrow band pyrometer; Optical measurement systems (Modulation of intensity and phase).

Total lecture hours: **30 Hours**

Text Book:

1. Introduction to Measurement and Instrumentation- A.K. Ghosh, 3rd edition, PHI Learning.
2. Process Control Instrumentation Technology- C.D. Johnson,8th edition, PHI Learning.
3. Principles of Measurement Systems- J.P. Bentley, 3rd edition, Pearson Education, New Delhi
4. Measurement Systems Application and Design- E.O. Doeblin, 4th edition McGraw-Hill, International, NY

Reference Book:

1. Transducers and Instrumentation- D.V.S. Murthy, 2nd edition, PHI Learning, New Delhi,2009
2. Industrial instrumentation, D Patronabis, 2nd edition, TMH

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Syllabus (Admission Batch: 2023-24)

CO-PO-PSO MAPPING

INSTRUMENTATION DEVICES AND SYSTEMS-II															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	1	2	2	-	-	-	-	-	-	1	3	2	1
CO2	3	3	2	2	2	-	-	-	-	-	-	1	3	2	1
CO3	3	3	2	3	2	-	-	-	-	-	-	2	3	2	1
CO4	3	2	3	3	3	-	-	-	1	1	1	2	3	2	1
Average	3	2.5	2	2.5	2.25	-	-	-	0.25	0.25	0.25	1.5	3	2	1
Level of Correlation:					3 - High				2 - Medium				1 - Low		

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Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
MICROPROCESSOR & MICROCONTROLLERS	**EI3103**	**3-0-0**	**3**

Prerequisite: Digital Electronic Circuits, Hexadecimal Arithmetic, Basic Programming Skills.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Apply knowledge of internal architecture of microprocessors and microcontrollers to analyze its operation.

CO2: Analyze the various addressing modes, instruction sets and timing diagrams of microprocessor and microcontrollers.

CO3: Evaluate appropriate assembly language programs, and concept of interrupts and stacks to provide solutions real-world control problems.

CO4: Apply the concept of Address maps for Memory and I/O interfacing for different applications using 8255 PPI.

Module I: **8 Hours**

Introduction to Microprocessors (8085/8086) - Architecture, Register Organization, Signal descriptions, timing diagrams, Stacks and Subroutines, Interrupts.

Module II: **9 Hours**

Interfacing with microprocessors (8085/ 8086)- Addressing modes, Instruction sets, Assembly language programing, Address maps, Memory and I/O interfacing, Interfacing using 8255 PPI.

Module III: **8 Hours**

Introduction to microcontrollers 8051- Basic features, register organization, Addressing Modes, Instructions, Assembly language programing, Interfacing.

Module IV: **5 Hours**

Introduction to RISC- Features of ARM Processor, Instruction set, assembly language programming.

Total lecture hours: **30 Hours**

Text Book:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/ 8080A, Penram International Publishing, 1996
2. K M Burchandi and A K Ray, "Advanced Microprocessors and Peripherals," 3rd edition, Tata McGraw-Hill Education, 2012, ISBN: 9781259006135.
3. The 8051Microcontroller and Embedded Systems: Using Assembly and C. Front Cover. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Pearson/Prentice Hall, 2006.
4. Steve Furber, Arm System-On-Chip Architecture, 2/E, Pearson Education, 2009.

Reference Book:

1. Douglas V. Hall, Microprocessor and Interfacing: Programming and Hardware, 2nd Edition, McGraw Hill, 1991.
2. Barry B. Brey, The Intel Microprocessors, 8th Edition, Pearson, 2013.
3. John Uffenbeck, The 8086/8088 Family: Design, Programming, and Interfacing, Prentice Hall, 2002.
4. Jonathan W. Valvano, Embedded Microcomputer Systems: Real Time Interfacing, 3rd Edition, Cengage Learning, 2011

CO-PO-PSO MAPPING

MICROPROCESSORS AND MICROCONTROLLERS															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PS O3
CO1	3	2	3	3	1	1	1	1	1	1	-	1	3	3	3
CO2	3	3	3	3	1	1	1	1	1	1	-	1	3	3	3
CO3	3	3	3	3	3	1	1	1	1	1	-	1	3	3	3
CO4	3	3	3	3	1	1	1	1	1	1	-	1	3	3	3
Average	3.0	2.8	3.0	3.0	1.5	1.0	1.0	1.0	1.0	1.0	0.0	1.0	3.0	3.0	3.0
Level of Correlation:					3 - High				2 - Medium				1 - Low		

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Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
CONTROL SYSTEM ENGINEERING	EI3105	3-0-0	3

Prerequisite: Basic Electrical Engineering, Circuit Theory, Laplace Transform, and Second-Order Differential Equations

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Explain fundamental control system concepts and develop mathematical models of mechanical, electrical, and electromechanical systems.

CO2: Analyze and represent control systems using block diagrams and signal flow graphs, and assess the impact of feedback on system behavior.

CO3: Evaluate time-domain responses of control systems and determine stability using classical methods such as Routh-Hurwitz and root locus.

CO4: Analyze frequency response characteristics and assess system performance and stability using Bode plots, Nyquist criterion.

Module I: Introduction to Control Systems and System Modeling **10 Hours**

An Example of Control Action, Open-Loop Control System, Closed-Loop Control System, Mathematical Modelling of different system: rotational systems and their electrical analogy, mechanical coupling, servo motors, stepper motor, Application of Laplace Transform in Control Systems, Laplace Transform, Derivation, Basic Theorems. Poles and Zeros of Transfer Function, Transfer Function and Impulse Response Relationship, Procedure for Determining Transfer Function of physical systems. Rules for Drawing Signal Flow Graphs, Mason's Gain Formula, Converting Block Diagrams to Signal Flow Graphs.

Module II: Feedback characteristics of Control Systems **6 Hours**

Feedback and non-feedback systems, Reduction of parameter variations, Control over system dynamics, Effect of feedback on disturbance rejection, System sensitivity to parameter variations and external disturbances.

Module III: Time Domain Analysis **10 Hours**

Different response functions (impulse, step, ramp, etc.), First order systems, second order systems, higher order systems, typical test signals, transient analysis of second order systems, overshoot, damping, settling time and rise time, Analysis of multi-order control system with dominant poles, steady state error analysis, error coefficients, generalised error series, transient analysis with derivative control, integral control and proportional control, rate feedback control, Routh Hurwitz stability criteria, static and dynamic error coefficients, Introduction to system optimization.

Module IV: Stability & Frequency Domain Analysis **6 Hours**

Root locus plots, Bode plots (logarithmic, magnitude-phase), Polar plot, Nyquist criterion, Gain and phase margins, Closed-loop frequency response

Total lecture hours: **32 Hours**

Text Book:

1. K. Ogata, Modern Control Engineering, PHI.
2. Gene Franklin, J. D. Powell, and Abbas Emami-Naeini, Feedback Control of Dynamic Systems, Prentice Hall.
3. Norman S. Nise, *Control Systems Engineering*, 7th Edition, Wiley.

Reference Book:

1. B. Kuo, Control System Engineering, PHI.
2. Eronini I. Umez-Eronini, System Dynamics and Control, Thomson Engineering.
3. Richard C. Dorf, *Modern Control Systems*, Pearson.

CO-PO-PSO MAPPING

CONTROL SYSTEM ENGINEERING														
Course outcome	**Program Outcomes**												**Program Specific Outcomes**	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	2	1	1	0	0	0	0	0	0	0	2	2	0
CO2	2	3	3	2	1	0	0	0	0	0	0	0	3	2	0
CO3	3	3	3	2	2	0	0	0	0	0	0	0	3	3	0
CO4	2	3	3	3	2	0	0	0	0	0	0	0	2	3	0
Average	2.5	2.75	2.75	2.0	1.5	0	0	0	0	0	0	0	2.5	2.5	0
Level of Correlation: 3 - High 2 - Medium 1 - Low															

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Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
OPTOELECTRONIC DEVICES AND INSTRUMENTATION	**EI3201**	**3-0-0**	**3**

Prerequisite: Basic Mathematics (Calculus), Various coordinate systems, Wave Theory, modes taught in Electromagnetic Field Theory.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Analyze modes in a fiber.

CO2: Evaluate performance indices of Optical sources like LED (Light Emitting Diode), Lasers, and photodetectors like PiN and APD (Avalanche Photodiode).

CO3: Create a Fiber Optic Sensor for a specific application.

CO4: Design an optical fiber link for long-distance communication.

Module I: **8 Hours**

Introduction: The general communication system versus the optical fiber communication system, Advantages of optical fiber communication.

Optical fiber waveguides: Introduction, Ray theory transmission, Electromagnetic mode theory for optical propagation, cylindrical fiber, Single-mode, and Multimode fibers. Modes in step and graded index fibers, single mode, and multimode fibers

Module II: **8 Hours**

Losses in Optical Fiber: Introduction, Attenuation, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion.

Optical Sources: Emission and Recombination Processes in LED and LASER, Spectrum of Recombination Radiation, LED materials with direct and indirect bandgap semiconductors, LED structures, Lasers-fundamentals, LED Parameters, LASER Diodes, concept of lasing action and principle of operation of surface emitters and edge emitters.

Module III: **8 Hours**

Optical Detectors: Introduction, Device types, Quantum efficiency, Responsivity, Long-wavelength cutoff, photodiodes- PiN and APD (Avalanche Photodiode)

Optical fiber connection: joints, and couplers: Introduction, Fiber alignment and joint loss, Fiber splices, Fiber couplers.

Module IV: **6 Hours**

Optoelectronic Instrumentation Modulation techniques: intensity, polarization, interference, electro-optic, electromagnetic; Fiber optic gyroscope, Distributed fiber optic sensors: OTDR and OFDR principles.

Total lecture hours: **30 Hours**

Text Book:

1. John M. Senior, Optical Fibre Communications, Principles and Practice, 3rd Edition, Pearson, 2010.
2. A. Tripathy, Opto Electronics and Systems: Studium Press, New Delhi,2016.

Reference Book:

1. R.P. Khare: Fiber Optics and Optoelectronics, Oxford University Press, New Delhi, 2010.
2. A. Ghatak and K. Tyagrajan: Introduction to Fiber Optics: Cambridge University Press, New Delhi, 2004.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

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Syllabus (Admission Batch: 2023-24)

CO-PO-PSO MAPPING

OPTOELECTRONIC DEVICES AND INSTRUMENTATION															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	2	2	1	-	-	-	-	-	-	-	3	2	-
CO2	3	3	2	2	1	-	-	-	-	-	-	-	3	2	-
CO3	2	3	2	3	1	-	-	-	-	-	-	-	2	3	1
CO4	3	2	2	2	1	-	-	-	-	-	-	-	3	1	1
Average	2.75	2.5	2	2.25	1	-	-	-	-	-	-	-	2.75	2	1
Level of Correlation:			3 - High			2 - Medium				1 - Low					

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Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
ELECTROMAGNETIC FIELD THEORY	**EI3203**	**3-0-0**	**3**

Prerequisite: Physics, Vector Algebra, Calculus, Integration and Differentiation

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Convert vectors and Scalars from one coordinate system to other two coordinate systems and also obtain gradient, divergence and curl in all the three-coordinate systems.

CO2: Obtain the electric field and magnetic field and Derive Maxwell's equation under static conditions.

CO3: Derive Maxwell's equations for Time Varying Field and Time Harmonic Field.

CO4: Analyze the propagation of EM waves under Lossy and Lossless dielectric, free space and Good Conductor.

CO5: Design the wave equations for Perpendicular and Parallel Polarization in Oblique Incidence.

Module I: Vectors, Fields and Electrostatics **8 Hours**

Vectors and Fields: Cartesian Coordinate System, Cylindrical coordinate system and Spherical coordinate system, Vector Algebra, Scalar and Vector Fields, gradient, divergence, curl operations, The Laplacian, Divergence Theorem, Stoke's Theorem, Useful vector identities and their derivations.

Electrostatics: Coulomb's Law and Field Intensity, Field due to a line/sheet/volume charge, Electric Flux Density, Gauss's law, Electric Potential, Electric Dipole.

Module II: Magnetostatics **6 Hours**

Biot Savart Law, Ampere's Circuital Law, Magnetic Flux Density, Maxwell's equation for static field, Magnetic Scalar and Vector potential. Boundary Conditions for Electrostatic field and magneto static field.

Module III: **10 Hours**

Maxwell's equations: Faraday's Law, Transformer and Motional EMF, Displacement Current, Time varying potential, Maxwell's Equation for Time varying field, Time Harmonic field.

Wave Propagation in Free Space: The electromagnetic wave equation and its solution, Uniform Plane Waves, Wave Equation and Solution, Uniform Plane Waves in Dielectrics and Conductors, Concept on TEM mode, Poynting Vector and Power density.

Module IV: Wave Propagation **7 Hours**

Wave Polarization, Reflection of Plane Waves at normal incidence, Reflection of Plane Wave at oblique incidence, Perpendicular Polarization, Parallel Polarization, Derivation of Brewster's angle and reflection and transmission coefficients.

Total lecture hours: **30 Hours**

Text Book:

1. Elements of Electromagnetic, Mathew N.O. Sadiku, Oxford University Press.
2. Electromagnetic Waves and Radiating Systems, 2nd Edition, E.C. Jordan and K.G. Balmain, Pearson Education.
3. Engineering Electromagnetic, 2nd Edition, Nathan Ida, Springer.

Reference Book:

1. Fundamentals of Electromagnetic for Engineering, First Impression – 2009, N. Rao, Pearson Education.
2. Engineering Electromagnetic, 7th Edition, William H. Hyat, Tata McGraw-Hill Publishing

Company Ltd.

3. Electromagnetic Field Theory Fundamentals, B.S. Guru and H.R. Hiziroglu, PWS Publishing Company, a division of Thomson Learning Inc.

CO-PO-PSO MAPPING

ELECTROMAGNETIC FIELD THEORY															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	3	2	1	-	-	-	-	2	-	1	1	3	2	1
CO2	3	3	2	1	-	-	-	-	2	-	1	1	3	2	1
CO3	3	3	2	1	-	-	-	-	2	-	1	1	3	2	1
CO4	3	3	2	1	-	-	-	-	2	-	1	1	3	2	1
CO5	3	3	2	1	-	-	-	-	2	-	1	1	3	2	1
Average	3	3	2	1	-	-	-	-	2	-	1	1	3	2	1
Level of Correlation: 3 - High 2 - Medium 1 - Low															

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Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
VLSI DESIGN	EI3205	3-0-0	3

Prerequisite: Basics of electronic circuits and devices.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Apply the knowledge of design methodology, design flow, design styles, scaling and submicron issues in VLSI Design.

CO2: Evaluate different electrical parameters of a MOS transistor.

CO3: Design different CMOS circuits and memory components using various logic families along with their layout and stick diagrams.

CO4: Analyse critical voltages, switching delays, power dissipation, and timing parameters in VLSI designs.

Module I: **08 Hours**

Overview of VLSI Design: Historical perspective, overview of VLSI design methodologies, VLSI design flow, design hierarchy, concepts of regularity, modularity, and locality, VLSI design styles, design quality, packaging technology, CAD technology.

MOS Transistor Theory: Introduction to metal oxide semiconductor (MOS) structure, long channel I-V characteristics, Electrical parameters, DC transfer characteristics. Scaling and submicron issues.

Module II: **08 Hours**

MOS Inverter (Static Characteristics): Resistive-load inverter, inverter with n-type MOSFET load, CMOS inverter. Layout and stick diagrams.

MOS Inverters (Switching Characteristics and Interconnects effects): Delay-time definitions, calculation of delay times, estimation of interconnect parasitics, calculation of interconnect delay, switching power dissipation of CMOS inverters.

Module III: **08 Hours**

Combination CMOS Logic Circuits: Implementation using CMOS, CMOS transmission gates (pass gates), dynamic and domino logic circuits.

Sequential MOS logic circuits: Behaviour of bi-stable elements, SR latch circuits, clocked latch and flip-flop circuits, CMOS D-latch, and edge-triggered flip-flop.

Module IV: **06 Hours**

Timing Parameters: Timing path, Setup time and hold time static, example of setup and hold time static, setup and hold slack, clock skew and jitter, Clock, reset and power distributions.

S**emiconductor Memories:** Memory Design, SRAM, DRAM structure and implementations.

Total lecture hours: **30 Hours**

Text Book:

1. Sung Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits- Analysis and Design, Mc Graw Hill, 2nd Edition.
2. Anantha P. Chandrakasan, Borivoje Nikolic, and Jan M. Rabaey, Digital Integrated Circuits: A Design Perspective, Pearson Education, 2nd Edition.

Reference Book:

1. N. H. E. Weste and C. Harris, “Principles of CMOS VLSI Design: A System Perspective, 3rd Edition, Pearson Education 2007.

CO-PO-PSO MAPPING

VLSI DESIGN															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	3	3	3	1	1	1	1	1	1	-	1	3	3	3
CO2	3	3	3	3	1	1	1	1	1	1	-	1	3	3	3
CO3	3	3	3	3	2	1	1	1	1	1	-	1	3	3	3
CO4	3	3	3	3	1	1	1	1	1	1	-	1	3	3	3
Average	3.0	3.0	3.0	3.0	1.3	1.0	1.0	1.0	1.0	1.0	0.0	1.0	3.0	3.0	3.0
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
DIGITAL COMMUNICATION	EI3207	3-0-0	3

Prerequisite: Probability and statistics, Fourier transform, convolution, digital systems, signals and systems.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Evaluate the power spectral density of line codes and the modulation formats.

CO2: Perform orthogonalization of signal space.

CO3: Evaluate the statistical moments of certain probability density functions.

CO4: Design and analyze the performance of baseband and passband receivers using probability of error, threshold detection, and optimum filter design..

Module I: INTRODUCTION **07 Hours**

Sampling Theorem, Flat top sampling, natural sampling, Signal reconstruction from uniform samples, Digital representation of analog signals- Quantization of Signals, Quantization error, Electrical representation of binary digits, PCM systems, Companding, Line Coding, scrambling, Differential PCM.

Module II: DIGITAL MODULATION TECHNIQUES **09 Hours**

Signal space, Orthogonal signals, Generation, Transmission, Reception, Spectrum and Geometrical Representation in the Signal Space of BPSK, DPSK, QPSK, M-ary PSK, BFSK, M-ary BFSK, minimum shift keying (MSK).

Module III: RANDOM VARIABLES **08 Hours**

Random variables, cumulative distribution function, probability distribution function, relation between probability and probability density function, joint cumulative distribution and probability density, a communications example, average value of a random variable, variance of a random variable, Tchebycheff's inequality, the Gaussian probability density, its mean and variance calculation, the Error function, the Rayleigh probability density function.

Module IV: BASEBAND RECEIVERS **06 Hours**

A base band signal receiver, peak signal to RMS noise output voltage ratio, probability of error, optimum threshold, optimum receiver for both base band and pass band: calculation of optimum filter transfer function, optimum filter realization using Matched filter, Probability of error for matched filter, optimum filter realization using correlator, equivalence of matched filtering and correlation.

Total lecture hours: **30 Hours**

Text Book:

1. P Ramakrishna Rao, "Digital Communication" McGraw Hill, 2011
2. Simon Haykin and Michael Moher, "Analog and Digital Communications ", John Wiley Student, 5thEdn.
3. B.P. Lathi, Zhi Ding and Hari Mohan Gupta, "Modern Digital and Analog Communication Systems, Oxford University Press, 4thEdn.
4. Herbert Taub and Donald L.Schilling, "Principles of Communication Systems", Tata Mc Graw Hill, 4thEdn.

Reference Book:

1. John G. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education India, 2nd Edn.
2. Schaum's Outlines on "Analog and Digital Communication", Hwei P Hsu, McGraw Hill, 3rdEdn.

CO-PO-PSO MAPPING

DIGITAL COMMUNICATION															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	1	2	2	-	-	-	-	-	-	-	2	1	-
CO2	3	2	2	2	1	-	-	-	-	-	-	-	2	2	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	2	1	-
CO4	3	2	3	2	-	-	-	-	-	-	-	-	2	2	1
Average	3.0	2.25	2	2	0.75	-	-	-	-	-	-	-	2	1.5	0.25
Level of Correlation:			3 - High			2 - Medium				1 - Low					

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
BUSINESS MANGEMENT	**BH3401**	**3-0-0**	**2**

Prerequisite:

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Comparing and contrasting efficient functional models of business management by integrating the three core areas such as Finance, Human Resource and Marketing Management.

CO2: Executing the Management principles in all the functional areas of business.

CO3: Correlating the interrelations and interdependence of the areas of Management in a business organisation.

CO4: Assessing the functional and managerial practices in business organisations.

Module I: Management Principles **08 Hours**

Management Concepts, Nature and Functions, Management Process and Roles of Managers, Levels of Management and Managerial Skills, Theories of Management – Contributions of F.W.Taylor, Henry Fayol, Elton Mayo, Line and Staff Relationship, Centralisation and Decentralisation, Delegation of Authority , Management thoughts in Modern Trend –Systems Approach

Module II: Financial Management **08 Hours**

Concept, Financial function and Role of Financial Managers, Instruments of raising short-term and long-term funds, Capital Structure, Techniques of Project Appraisal, Components of Working Capital, Operating Cycle, Factors affecting requirement of Working Capital.

Module III: Human Resource Management **07 Hours**

Nature and Scope of Human Resource Management, Manpower Planning, Recruitment and Selection Methods, Performance Appraisal, Need, Objectives, Modern methods of Appraisals: 720 degree, MBO, Assessment Centre Method, Talent Acquisition, Training Need Analysis, Career Planning, Organisational Citizenship Behaviour.

Module IV: Marketing Management **07 Hours**

Concept, Nature, Scope and Importance, Marketing Mix and 7P's of Marketing, Segmentation, Targeting, Positioning, Factors influencing consumer decision-making, e-marketing and Green Marketing

Total lecture hours: **30 Hours**

Text Book:

1. Modern Business Organisation and Management, S.A. Sherlekar, Himalaya Publishing House, 2016.
2. Essentials of Management, Stephen P. Robbins, 6th Edition, Pearson, 2010.
3. Financial Management, Sheeba Kapil, 1st Edition,Pearson, 2013.
4. Human Resource Management Text and Cases, K. Aswathappa, 10th Edition,TMH, 2023

Reference Book:

1. Marketing Management, Rajan Saxena, 6th Edition, TMH publishing house, 2022.
2. Principles of Management, Dipak Kumar Bhattacharyya, 1st Edition, Pearson, 2011

3. Mgmt (Principles of Management), Willium& Tripathy, 1st Edition, Cengage Learning, 2016

CO-PO-PSO MAPPING

BUSINESS MANGEMENT															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	-	2	-	2	-	2	2	3	3	3	3	3	-	-	-
CO2	-	-	-	-	-	1	3	3	3	3	3	3	-	-	-
CO3	-	-	-	-	2	2	1	3	3	3	3	3	-	-	-
CO4	-	-	-	-	-	1	1	3	3	3	3	3	-	-	-
Average	-	0.5	-	0.5	0.5	1.5	1.75	3	3	3	3	3	-	-	-
Level of Correlation: 3 - High 2 - Medium 1 – Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
ENTREPRENEURSHIP DEVELOPMENT	**BH3403**	**3-0-0**	**2**

Prerequisite:

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Exemplifying the business opportunities, social responsibilities and the support system for setting up an enterprise.

CO2: Determining stages of Entrepreneurial Process starting from idea generation, developing a business plan and operational aspects of an Enterprise.

CO3: Appraising the different funding options and Financial Management of an enterprise.

CO4: Assessing the Start-up management practices like incubation, mentorship and Government initiatives.

Module I: Introduction to Entrepreneurship **08 Hours**

Concept, Functions of an Entrepreneur, Entrepreneurial Process, Entrepreneurial Motivation and Barriers, Traits to be a successful Entrepreneur, Creativity and scope of Entrepreneurship in India: Types of new age business (FinTech, EdTech, Healthcare, Agripreneurship, Defence, Drone, Space, IT, Robotics, Digital Transformation, Women-Entrepreneurship, Social Entrepreneurship, Corporate Social Responsibility, Business Ethics – Role of Values in Management.

Module II: Entrepreneurial Idea into Action **08 Hours**

Developing a Business Idea; Opportunity, Methods and Creativity, Deciding to set up a start-up, Forms of business organisations (Sole tradership/propreitorship, Partnership, Joint-Stock Company) and MSMEs (Micro, Small and Medium enterprises), Size and Location of the enterprise, Feasibility Study: Market Survey, Techno-economic feasibility and preparing a Project Report.

Module III: Entrepreneurial Finance and Funding **07 Hours**

Sources of funding(Bootstrapping, Angel Investors, Venture Capital, Crowdfunding etc.) Project Investment Analysis, Break-Even Analysis, ROI Analysis, Basics of Income Statement and Balance Sheet.

Module IV: Managing an Enterprise **07 Hours**

The Start-up ecosystem, Business Incubators, Start-up Accelerators, Mentorship and Networking, Failure and Resilience, Risk Management, Ethical dilemmas and Exit Strategies, Start-up Policy and Initiatives of the Government.

Total lecture hours: **30 Hours**

Text Book:

1. Entrepreneurship: Successfully Launching New Ventures, B.R. Barringer, 6th, Pearson, 2020
2. Fundamentals of Entrepreneurship and Project planning, Madhurima Lall, 1st, Sultan Chand & Sons, 2021
3. Entrepreneurial Development,S.S. Khanka, 1st Edition, S Chand and Company, 1999
4. Entrepreneurship Development and Small business enterprises, P.M. Charantimath, 3rd Edition, Pearson, 2019

Reference Book:

1. Entrepreneurship: Theory, Process and Practice, Donald F Kuratco, 11th, Cengage, 2023
2. Entrepreneurship, Robert. D. Hisrich & Sabyasachi Sinha, 11th Edition, TMH, 2020

CO-PO-PSO MAPPING

ENTREPRENEURSHIP DEVELOPMENT															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	-	-	-	-	2	3	3	3	3	3	3	3	-	-	-
CO2	-	2	2	2	2	3	3	3	3	3	3	3	-	-	-
CO3	-	-	-	-	2	3	3	3	3	3	3	3	-	-	-
CO4	-	-	-	-	2	3	3	3	3	3	3	3	-	-	-
Average	-	0.5	0.5	0.5	2	3	3	3	3	3	3	3	-	-	-
Level of Correlation: 3 - High 2 - Medium 1 – Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
ENVIRONMENTAL ENGINEERING	**IP 3401**	**3-0-0**	**2**

Prerequisite: Basic Physics, Basic Chemistry

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Understand the multidisciplinary nature of environmental science and ecosystem structure and functions

CO2: Analyze various forms of environmental pollution and assess their impact using scientific parameters

CO3: Demonstrate knowledge of water and wastewater treatment processes and air pollution control technologies

CO4: Evaluate the role of environmental policies, EIA, and sustainable practices in pollution control and resource conservation

Module I: **10 Hours**

Fundamentals of Environment and Ecosystem: Multidisciplinary nature of environmental Engineering.

Study of Ecosystem: Definition, Properties, Structure and Function of an ecosystem. Food chains, food webs, Flow of Energy, Ecological Pyramids, Biogeochemical cycles, Types of ecosystems, Bioaccumulation, Bio magnification, ecosystem value, Degradation of Ecosystem.

Concept of Environment and pollution: Atmospheric chemistry, soil chemistry, water quality characteristics, DO, BOD and COD, water pollution, Marine Pollution, soil pollution, thermal pollution, nuclear hazard, Air Pollution: Air Quality, cause and effects of air pollution, Water and air quality standards, and Index, Noisepollution: Introduction, Noise standards, measurement, Ln Concept and control

Module II: **08 Hours**

Water treatment process: Pre-treatment of water, conventional process, advanced water treatment process.

Waste water treatment process: Natural Treatment, Engineering Treatment -Pre- treatment, primary and secondary waste water treatment process

Air Pollution Control: The natural self-cleansing properties of Environment, Air pollution meteorology, Atmospheric dispersion, Diffusion equation, ground level emission, plume rise, Effective stack height, Air Pollution control from stationarysources by installing Engineering devices, Flue gas desulphurisation, NOX removal.

Module III: **08 Hours**

Solid waste management: Source, classification, separation, storage and transportation of solid wastes, Waste minimization techniques, Benefits of waste minimization, reuse, recycle, thermal and biological treatment, secure land fill technique.

Impact of Environmental pollution and related issues: Global climate change, global warming and greenhouse gases, Acid rain, ozone layer depletion, health issues.

Module IV: **07 Hours**

Environmental Impact Assessment: EIA procedure, Preparation of an EIS From unsustainable to sustainable development, circular economy, Environmental Protection Act, Air (Prevention and Control

of Pollution) Act, Water (Preventionand Control of Pollution) Act, Wildlife Protection Act.

Total lecture hours: **30 Hours**

Text Book:

1. Fundamentals of Ecology, M.C.Dash, Tata McGraw Hill, 2006.
2. Environmental Pollution Control Engineering, C.S. Rao, New Age International Publishers, 2018
3. Environmental Engineering, G. Kiely, TMH, 2007
4.

Reference Book:

1. Environmental Engineering, H.S. Peavy, D.R. Rowe and G. Tchobanoglous, McGraw Hill.
2. Introduction to Environmental Engineering and Science, G.M. Masters, Pearson, 2015
3. Integrated Solid Waste Management, G. Tchobanoglous, McGraw Hill, 2014
4. Water Supply Engineering, S.K. Garg; Khanna Publishers, 37th Edition

CO-PO-PSO MAPPING

ENVIRONMENTAL ENGINEERING															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	1	1	1	2	3	1	1	2	1	2	2	2	3
CO2	3	3	2	2	2	2	3	1	1	2	1	2	2	2	3
CO3	3	3	3	2	2	2	3	1	2	2	2	3	3	3	3
CO4	2	2	2	2	1	3	3	2	2	2	2	3	3	3	2
Average	2.75	2.5	2	1.75	1.5	2.25	3	1.25	1.5	2	1.5	2.5	2.5	2.5	2.75
Level of Correlation: 3 - High 2 - Medium 1 – Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
INDUSTRIAL SAFETY ENGINEERING	**IP3403**	**3-0-0**	**2**

Prerequisite:

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Apply safety principles in various work environments, especially in construction and machine operations.

CO2: Identify safety hazards, implement safety measures,

CO3: Analyse risks to prevent accidents and injuries.

CO4: Understand of safety protocols, policies, and the responsibilities of individuals and organizations in ensuring a safe working environment.

Module I: **06 Hours**

Safety Introduction: Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need, types, advantages.

Module II: **07 Hours**

Personal Protection in work environment: Personal protection in the work environment, Types of PPEs, Personal protective equipment- respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping. Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.

Module III: **07 Hours**

Safety issues in Construction: Introduction to construction industry and safety issues in construction Safety in various construction operations – Excavation and filling – Under-water works – Under-pinning & Shoring – Ladders & Scaffolds – Tunneling – Blasting – Demolition – Confined space – Temporary Structures. Familiarization with relevant Indian Standards and the National Building Code provisions on construction safety. Relevance of ergonomics in construction safety. Ergonomics Hazards - Musculoskeletal Disorders and Cumulative Trauma Disorders.

Module IV: **07 Hours**

SafetyHazardsinMachines and Hazardidentificationandanalysis: Machinery safeguard-Point-of-Operation, Principle of machine guarding -types of guards and devices.Safetyinturning,andgrinding.WeldingandCutting-SafetyPrecautionsofGas welding and Arc Welding. Material Handling-Classification-safety consideration- manual and mechanical handling. Handling assessments and techniques- lifting, carrying, pulling, pushing, palletizing and stocking. Material Handling equipment-operation & maintenance.

Hazard and risk, Types of hazards –Classification of Fire, Types of Fire extinguishers, fire explosion and toxic gas release, Structure of hazard identification and risk assessment. Identificationofhazards:Inventoryanalysis,Fireandexplosionhazardratingofprocessplants

The Dow Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard and Operabilitystudy(HAZOP))–methodology,criticalityanalysis,correctiveactionandfollow-up. Control of Chemical Hazards, Hazardous properties of chemicals, Material Safety Data Sheets (MSDS).

Total lecture hours: **30 Hours**

Text Book:

1. R.K Jain (2000) Industrial Safety, Health and Environment management systems, Khanna Publications.
2. Paul S V (2000), Safety management System and Documentation training Programme handbook, CBS Publication.
3. Krishnan, N.V. (1997).Safety management in Industry. Jaico Publishing House, New Delhi.

Reference Book:

1. John V. Grimaldi and Rollin H.Simonds. (1989) Safety management. All India Traveller Book Seller, Delhi.
2. Ronald P. Blake. (1973). Industrial safety. Prentice Hall, New Delhi.
3. Alan Waring. (1996). Safety management system. Chapman & Hall, England.
4. Vaid, K.N., (1988). Construction safety management. National Institute of Construction Management and Research, Mumbai

CO-PO-PSO MAPPING

INDUSTRIAL SAFETY ENGINEERING															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	3	3	2	2	2	-	3	-	-	-	-	3	2	3
CO2	3	3	3	2	-	-	-	3	2	-	-	-	3	2	3
CO3	3	3	3	2	-	-	-	3	-	-	-	-	3	2	3
CO4	2	2	1	2	-	3	-	3	2	2	-	-	2	2	2
Average	2.75	2.75	2.5	2	0.5	1.25	-	3	1	0.5	-	-	2.75	2	2.75
Level of Correlation: 3 - High 2 - Medium 1 – Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
INSTRUMENTATION DEVICES AND SYSTEMS-II LABORATORY	**EI3501**	**0-0-3**	1.5

Prerequisite: Knowledge of Physics & Chemistry.

Course Outcomes:

At the end of the course, a student will be able to

CO1: Apply the principles of basic sciences for measurement of different physical parameters.

CO2 : Design measurement circuits/methods for various physical variables.

CO3: Analyze characteristics of various sensors/transducers

CO4: Illustrate a signal conditioning circuit for particular sensor/transducer.

List of Experiments: (At least 10 experiments should be done)

EXP 1: Performance evaluation of pressure gauges using Dead weight tester.

EXP 2: Measurement of flow using Turbine type flow meter /Electromagnetic flow meter.

EXP 3: Measurement of level using differential pressure transmitter/bubbler method.

EXP 4: Measurement of level using capacitive sensor.

EXP 5: pH measurement using electrode method.

EXP 6: Measurement of conductivity.

EXP 7: Measurement of humidity.

EXP 8: Measurement of acceleration using piezoelectric sensor.

EXP 9: Characterization of photo conductive cell.

EXP 10: Measurement of displacement/ temperature/ level using optical method.

EXP 11: Measurement of damping coefficients of mass spring damper/ 2^{nd} order system.

EXP 12: Measurement of speed using proximity sensor.

EXP 13: Measurement of acceleration using gyroscope.

EXP 14: Any hardware innovative project

Text Book:

1. Introduction to Measurement and Instrumentation- A.K. Ghosh, 3rd edition, PHI Learning.
2. Process Control Instrumentation Technology- C.D. Johnson,8th edition, PHI Learning.
3. Principles of Measurement Systems- J.P. Bentley, 3rd edition, Pearson Education, New Delhi

Reference Book:

1. Transducers and Instrumentation- D.V.S. Murthy, 2nd edition, PHI Learning, New Delhi,2009
2. Measurement Systems Application and Design- E.O. Doeblin, 4th edition McGraw-Hill, International, NY

CO-PO-PSO MAPPING

INSTRUMENTATION DEVICES AND SYSTEMS-II LABORATORY															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	1	2	2	-	-	-	-	-	-	1	3	2	1
CO2	3	2	3	3	3	-	-	-	1	1	1	2	3	2	1
CO3	3	3	2	3	2	-	-	-	-	-	-	2	3	2	1
CO4	2	2	2	2	3	-	-	-	-	-	-	1	3	2	1
Average	2.75	2.25	2	2.5	2.5	-	-	-	0.25	0.25	0.25	1.5	3	2	1
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
MICROPROCESSOR & MICROCONTROLLERS LABORATORY	EI3503	0-0-3	1.5

Prerequisite: Digital Electronics, Basic Programming Skills

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Execute assembly language programs for 8085, 8086, and 8051.

CO2: Interface microprocessors/microcontrollers with peripherals such as LEDs, stepper motors, ADC/DAC, and traffic control modules.

CO3: Simulate and implement simple microcontroller-based designs using Keil, Proteus, or equivalent.

CO4: Design simple systems using Advanced processors.

List of Experiments: (At least 10 experiments excluding Mini project should be done)

EXP 1: Write an assembly language program to perform arithmetic and logical operations using 8085/8086/8051.

EXP 2: Write an assembly language program to calculate the sum of a finite series of numbers.

EXP 3: Write an assembly language program to find the largest and smallest numbers from: (a) two given numbers (b) a set of N numbers.

EXP 4: Sort an array of numbers in ascending and descending order using assembly language.

EXP 5: Write an assembly language program to compute (a) Fibonacci series (b) Factorial of a given number.

EXP 6: Interface LEDs with 8051 and display rolling/flashing LED patterns.

EXP 7: Interface and control a stepper motor to rotate in forward and reverse directions.

EXP 8: Perform Analog-to-Digital (ADC) and Digital-to-Analog (DAC) conversions using interfacing circuits.

EXP 9: Simulate and implement a traffic light controller with different delays using 8085/ 8051.

EXP 10: Interface 8255 Programmable Peripheral Interface (PPI) to perform port configuration and data transfer.

EXP 11: Display data on an alphanumeric LCD using 8051 microcontrollers.

EXP 12: Use Keil or Proteus to simulate applications such as temperature sensing, IR sensors, or motor control.

EXP 13: Perform interrupt programming and timer control using 8051/ARM.

MP: Mini-project using 8051MC /ARM/ PIC/ AVR etc.

Text Book:

1. R. S. Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, 6th ed. Stamford, CT, USA: Cengage Learning, 2013.
2. M. A. Mazidi, J. G. Mazidi, and R. D. McKinlay, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, 2nd ed. Upper Saddle River, NJ, USA: Pearson, 2008.

Reference Book:

1. N. Sloss, D. Symes, and C. Wright, ARM System Developer's Guide: Designing and Optimizing System Software, 1st ed. San Francisco, CA, USA: Morgan Kaufmann, 2004.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

CO-PO-PSO MAPPING

MICROPROCESSOR & MICROCONTROLLERS LABORATORY															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	3	3	3	3	1	1	1	3	3	1	1	3	3	3
CO2	3	3	3	3	3	2	2	1	3	3	1	1	3	3	3
CO3	3	3	3	3	3	3	2	2	3	3	2	2	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	3.0	3.0	3.0	3.0	3.0	2.3	2.0	1.8	3.0	3.0	1.8	1.8	3.0	3.0	3.0
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
CONTROL SYSTEM ENGINEERING LABORATORY	EI3505	0-0-3	1.5

Prerequisite: Mathematics, Software/hardware tools

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Implement P, PI, and PID controllers in MATLAB/Simulink and on a trainer kit.

CO2 : Analyze system stability using Bode, Nyquist, and root locus plots in MATLAB.

CO3: Evaluate PID controller performance for DC motor speed by comparing simulation and experimental results.

CO4: Design and simulate RC lag/lead compensators in MATLAB and validate their impact on system response.

List of Experiments: (At least 10 experiments should be done)

EXP 1: Analyze control systems using MATLAB: polynomial form, block diagram simplification, and input response.

EXP 2: Simulate 1st and 2nd order systems in MATLAB/Simulink; evaluate time-domain specs.

EXP 3: Model a closed-loop system with proportional control and assess steady-state error.

EXP 4: Design a PI controller for a 1^{st} order and 2^{nd} order system and compare with P control performance

EXP 5: Design PID controllers and verify the results through simulation using MATLAB/Simulink.

EXP 6: Study the impact of P, PI, and PID controllers on step response using MATLAB.

EXP 7: Generate the Bode plot for a given transfer function using MATLAB and analyze gain and phase margins.

EXP 8: Generate the frequency response of a second-order system in MATLAB and compare it with its Bode plot**.**

EXP 9: Plot the Nyquist diagram for a given transfer function and assess system stability**.**

EXP 10: Plot the root locus of a given transfer function and verify breakaway and imaginary axis crossover points.

EXP 11: Design a passive RC-lag compensating network for given system specifications and obtain its frequency response**.**

EXP 12: Design a passive RC-lead compensating network for specified maximum phase lead and corner frequency, and evaluate its response**.**

EXP 13: Implement P, PI, and PID controllers using a control system trainer kit and observe system performance**.**

EXP 14: Design and test a PID controller for speed regulation of a DC motor using simulation and

trainer kit**.**

EXP 15: Observe the performance of a DC position control system for different angular position commands using hardware setup**.**

Text Book:

1. K. Ogata, Modern Control Engineering, PHI.
2. Gene Franklin, J. D. Powell, and Abbas Emami-Naeini, Feedback Control of Dynamic Systems, Prentice Hall.
3. I.J. Nagrath and M. Gopal, Control Systems Engineering, New Age International.
4. Norman S. Nise, Control Systems Engineering, Wiley**.**

Reference Book:

1. B. Kuo, Control System Engineering, PHI.
2. Eronini I. Umez-Eronini, System Dynamics and Control, Thomson Engineering.
3. D. Roy Choudhury**,** Modern Control Engineering, Prentice Hall India.
4. C. L. Phillips, & J. M. Parr, Feedback Control Systems, 5th Ed., Pearson, 2011.

CO-PO-PSO MAPPING

CONTROL SYSTEM ENGINEERING LABORATORY															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	2	1	3	-	-	-	1	1	-	1	3	3	1
CO2	3	3	1	2	3	-	-	-	1	1	-	1	3	2	1
CO3	3	3	2	3	3	1	1	-	1	1	1	2	3	3	2
CO4	3	3	3	2	3	-	1	-	1	1	1	2	3	3	2
Average	3	2.75	2	2	3	0.25	0.5	-	1	1	0.5	1.5	3	2.75	1.5
Level of Correlation: 3 - High 2 - Medium 1 - Low															

SIXTH
SEMESTER

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
PROCESS CONTROL	**EI3102**	**3-0-0**	**3**

Prerequisite: Knowledge of sensors/ transducers and control system.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Illustrate the principle of controller, final control element, control strategy and automation technique used for control of a process.

CO2: Analyze the performance of controllers, final control elements, control strategies and automation techniques.

CO3: Select appropriate controller, final control element, control strategy and automation technique for control of a process

CO4: Design a process control loop.

Module I: **9 Hours**

Introduction to Process Control-Process definition, what is process-control, Block diagram with examples. Controller Principle-Introduction, Process characteristics, process load, process lag, self-regulation. Control system parameters-error, variable range, control parameter range, control lag, Dead Time, Cycling, Controller modes, Discontinuous controller modes-two position mode, Multi position mode, Floating control mode. Continuous control modes: P, I, D mode. Composite control modes: PI, PD, PID. Controller tuning –Process Reaction Curve (PRC), Ziegler Nichols tuning.

Module II: **7 Hours**

Electronics Controller-Introduction, Electronics discontinuous controllers, electronic proportional controller, electronics integral controller, electronic derivative controller, PI, PD, PID controller.

Digital controller: Introduction, components and working of Direct Digital Control (DDC), benefits of DDC, Digital control realization.

Module III: **8 Hours**

Final control element: Introduction, Final control operation, Signal Conversion, Actuator-pneumatic actuation, hydraulic actuation, Electric actuation. Control element: Control valve characteristics, control valve categories.

Module IV: **6 Hours**

Programmable Logic Controllers: Introduction, Principle of operation, Architecture, Programming.

Total lecture hours: **30 Hours**

Text Book:

1. Process Control Instrumentation Technology by C.D. Johnson,8th edition, PHI Learning.
2. Computer-Based Industrial Control by Krishna Kant,PHI, 2009
3. Process control principles and applications by S. Bhanot, Oxford university Press,2010.

Reference Book:

1. Chemical process control by George Stephanopoulos, PHI Learning Private Limited, New Delhi, 2009
2. Digital Control and State Variable Methods by M.Gopal, Tata McGraw Hill, 2003

CO-PO-PSO MAPPING

PROCESS CONTROL														
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	2	1	1	-	-	-	-	1	3	2	3	2	1
CO2	3	3	3	2	2	-	-	-	-	1	3	3	3	2	1
CO3	3	3	3	2	2	-	-	-	1	1	3	3	3	2	1
CO4	3	3	3	3	2	-	-	-	1	2	3	3	3	2	1
Average	3	2.75	2.75	2	1.75	-	-	-	0.5	1.25	3	2.75	3	2	1
Level of Correlation:					3 - High				2 - Medium				1 - Low		

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
DIGITAL SIGNAL PROCESSING	EI3125	3-0-0	3

Prerequisite: Basic knowledge of Signals and systems, Fourier series and transform differential equations.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Analyze the mathematical operation on discrete signals and systems

CO2: Implement Z transform and the inverse Z transform of discrete signals.

CO3: Analyze DFT, Inverse DFT, and FFT operations on discrete-time signals.

CO4: Model Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters, and evaluate the performance to meet expected system specifications.

Module I: **08 Hours**

INTRODUCTION TO DIGITAL SIGNAL PROCESSING: Signals, systems, and signal processing, Classification of signals, The concept of frequency in continuous-time and discrete-time signals, Analog-to-Digital and Digital-to-Analog conversion.

DISCRETE-TIME SIGNALS AND SYSTEMS: Discrete-time signals and Discrete-time systems, Analysis of discrete-time linear time-invariant systems, Discrete-time systems described by difference equations, Implementation of discrete-time systems, Correlation of discrete-time signals.

Module II: **08 Hours**

THE Z-TRANSFORM AND ITS APPLICATION TO THE ANALYSIS OF LTI SYSTEMS: The Direct Z-Transform, The Inverse Z-Transform, Properties of the Z-Transform, Rational Z-Transforms, Poles and Zeros, Pole Location and Time-Domain Behaviour for Causal Signals, The System Function of a Linear Time-Invariant System, Inversion of the Z-Transform, The Inverse Z-Transform by Contour Integration, The Inverse Z-Transform by Power Series Expansion, The Inverse Z-Transform by Partial-Fraction Expansion, Solution of Difference Equations, Analysis of Linear Time-Invariant Systems in the Z-Domain, Response of Systems with Rational System Functions, Response of Pole-Zero Systems with Nonzero Initial Conditions, Transient and Steady-State Responses, Causality, and Stability.

Module III: **09 Hours**

THE DISCRETE FOURIER TRANSFORM: ITS PROPERTIES AND APPLICATIONS: Frequency Domain Sampling: The Discrete Fourier, Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform (DFT), The DFT as a Linear Transformation, Relationship of the DFT to Other Transforms, Properties of the DFT, Periodicity. Linearity. and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties, Linear Filtering Methods Based on the DFT, Use of the DFT in Linear Filtering, Filtering of Long Data Sequences, Frequency Analysis of Signals Using the DFT.

EFFICIENT COMPUTATION OF THE DFT: FAST FOURIER TRANSFORM ALGORITHMS: Efficient Computation of the DFT FFT Algorithms, Radix-2 FFT Algorithms, Implementation of FFT Algorithms, Applications of FFT Algorithms, Efficient Computation of the DFT of Two Real Sequences, Efficient Computation of the DFT of a 2N-Point Real Sequence, Use of the FFT Algorithm in Linear Filtering and Correlation.

Module IV: **05 Hours**

DESIGN OF DIGITAL FILTERS: Design of FIR Filters, Symmetric and Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters Using Windows, by the Frequency-Sampling Method, IIR Filter Design by Approximation of Derivatives, IIR Filter Design by Impulse Invariance, IIR Filter Design by

the Bilinear Transformation.

SUBJECT NAME **SUBJECT CODE** **L-T-P** **CREDIT**

Total lecture hours: **32 Hours**

Text Book:

1. Digital Signal Processing by John G. Proakis and Dimitris K. Manolakis, 4th edition,2007, Prentice Hall, Upper Saddle River, NJ.
2. Discrete-Time Signal Processing by Alan V. Oppenheim and Ronald W. Schafer, 3rd edition, 2010, Prentice Hall, Upper Saddle River, NJ.
3.
4.

Reference Book:

1. Digital Signal Processing by Sanjit Mitra, 4th edition, 2011, McGraw-Hill, New York, NY.
2. Digital Signal Processing by S. Salivahanan, A. Vallabraj & C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing by A. NagoorKani, TMH Education.
4.

CO-PO-PSO MAPPING

DIGITAL SIGNAL PROCESSING															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	1	2	2	1	1	1	2	1	2	1	3	1	1
CO2	3	3	1	2	2	1	1	1	2	1	2	1	3	1	1
CO3	3	2	1	2	2	1	1	1	1	1	2	1	3	2	1
CO4	3	3	3	3	3	3	2	1	1	2	2	2	3	2	3
Average	3	2.5	1.5	2.2	2.2	1.5	1.2	1	1.5	1.2	2	1.2	3	1.5	1.5
Level of Correlation: 3 - High 2 - Medium 1 - Low															

BIOMEDICAL INSTRUMENTATION EI3202 3-0-0 3

Prerequisite: Basic circuit theory, Differential Equations, Basic time/frequency domain concepts.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Explain the fundamentals of bioengineering and biomedical instrumentation systems, including the origin of bioelectrical signals and basic components of medical devices.
CO2: Familiarize with various medical equipment and their technical aspects.
CO3: Introduce the measurements involved in some medical equipment.
CO4: Identify, explain, and judge patient safety issues related to biomedical Instrumentation.

Module I: **10 Hours**

Introduction to Bioengineering, Biochemical and Biomedical Engineering, Sources of Biomedical Signals, Basic medical Instrumentation system, Performance requirements of medical Instrumentation system, general constraints in design of medical Instrumentation system &Regulation of Medical devices. Bioelectrical Signals: Origin of Bioelectric Signals, Electrocardiogram, Electroencephalogram, Electromyogram, Electrode-Tissue Interface, Polarization, Skin Contact Impedance, Motion Artifacts.

Module II: **08 Hours**

Electrodes for ECG: Limb Electrode, Floating Electrodes, Prejelled disposable Electrodes, Electrodes for EEG, Electrodes for EMG.

Transducers for Biomedical Applications, Displacement, Position and flow pressure and temperature Transducers, Biosensors or Biochemical Sensor (Urea, Glucose, spO2, pcO2 measurement). Laser Based Applications. Blood flow and Blood Pressure Measurement (Invasive and Non-Invasive techniques), Pulse oximeter

Module III: **06 Hours**

Laser Based Applications. Blood flow and Blood Pressure Measurement (Invasive and Non-Invasive techniques), Pulse oximeter,

Module IV: **06 Hours**

General considerations for Signal conditioners, Preamplifiers, Differential Amplifier, Isolation Amplifier, Electrostatic and Electromagnetic Coupling to AC Signals, Proper Grounding (Common Impedance Coupling), Biomedical Safety and Standards.

Total lecture hours: **30 Hours**

Text Book:

1. R. S. Khandpur, Handbook of Biomedical Instrumentation, 2nd ed., New Delhi, India: Tata McGraw-Hill, 2003.
2. L. Cromwell, Biomedical Instrumentation and Measurement, 2nd ed., Pearson India, 2015.
3. J. G. Webster, Medical Instrumentation: Application and Design, 4th ed., Hoboken, NJ, USA: Wiley, 2009.
4. M. C. Mehta and A. Mehta, Principles of Medical Electronics and Biomedical Instrumentation, New Delhi, India: S. Chand & Co., 2013.

Reference Book:

1. M. M. Domach, Introduction to Biomedical Engineering, Pearson Education Inc., 2004.
2. M. R. Neuman, Biomedical Sensors and Instruments, 2nd ed., Boca Raton, FL, USA: CRC Press, 2006.
3. J. Enderle, S. Blanchard, and J. Bronzino, Introduction to Biomedical Engineering, 3rd ed., Burlington, MA, USA: Elsevier Academic Press, 2012.

4. R. Pallas-Areny and J. G. Webster, Sensors and Signal Conditioning, 2nd ed., New York, NY, USA: Wiley, 2001.

CO-PO-PSO MAPPING

BIOMEDICAL INSTRUMENTATION															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	3	3	2	2	1	0	2	3	3	2	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	2	3	2	3	2	3
CO3	3	3	3	3	3	1	1	1	1	1	1	1	3	3	3
CO4	3	3	3	3	3	2	2	2	2	2	2	2	3	3	3
Average	3	3	3.0	2.75	2.75	2.5	1.25	2.0	.2.5	2.0	2.0	2.0	3	2.75	3
Level of Correlation:			3 - High			2 - Medium				1 - Low					

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
COMPUTER NETWORKS	EI3204	3-0-0	3

Prerequisite: Discrete Mathematics, Basics of Data Communication

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Comprehend the concepts of data communication network types and protocol and OSI model.

CO2: Illustrate the Data link layer and MAC layer of OSI architecture.

CO3: Identify the protocols and services of wired and wireless LAN.

CO4: Recognize the routing and switching of Network layers and Internet Protocol.

Module I: 6 Hours

Data communication: Components, Data representation, Data flow, Networks: Network criteria, Physical Structures, Network types: LAN, WAN, Switching, The Internet.

Network Models: Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP.

Module II: 8 Hours

Data-link Layer: Nodes and Links, Services, Sublayers, Link Layer addressing: Types of addresses, ARP. Data Link Control (DLC) services: Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Piggybacking.

Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/ CA

Module III: 8 Hours

Wired and Wireless LANs: Ethernet Protocol, Standard Ethernet. Introduction to wireless LAN: Architectural Comparison, Characteristics, Access Control.

Module IV: 8 Hours

Network Layer: Network Layer Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution, Forwarding of IP Packets: Based on destination Address and Label.

Network Layer Protocols: Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams.

Total lecture hours: 30 Hours

Text Book:

1. Behrouz A Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill, 2013, ISBN: 1-25-906475-3.
2. Wayne Tomasi, "Introduction to Data Communication and Networking", Pearson Education.

Reference Book:

1. James J Kurose, Keith W Ross, "Computer Networks", Pearson Education.
2. Andrew S Tanenbaum, "Computer Networks", Prentice Hall.
3. William Stallings, "Data and Computer Communications", Prentice Hall.

CO-PO-PSO MAPPING

COMPUTER NETWORKS															
Course outcome	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	1	1	1	-	-	-	-	1	-	1	3	1	-
CO2	3	3	2	2	2	-	-	-	-	1	-	1	3	2	-
CO3	3	3	2	2	2	-	-	-	1	1	-	2	3	3	2
CO4	3	3	3	2	3	-	-	-	1	1	-	2	3	3	2
Average	3	2.75	2	1.75	2	0	0	0	1	1	0	1.5	3	2.25	1
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
MEMS and NEMS	**EI3206**	**3-0-0**	**3**

Prerequisite: Nil

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Acquire the knowledge of mechanisms in MEMS.

CO2: Obtain the knowledge of MEMS fabrication.

CO3: Acquire knowledge of basic approaches for various sensors and actuators design.

CO4: Acquire the knowledge of nano-structured materials, micro and nano-scale devices.

Module I: **06 Hours**

Micro and Nano scale systems: Introduction to Design of MEMS and NEMS, Overview of Nano and Micro electromechanical Systems. Applications of Micro and Nano electro mechanical systems. Materials for MEMS: Silicon, silicon compounds, polymers, metals.

Module II: **08 Hours**

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA) Technology; Packaging: Microsystems packaging.

Module III: **08 Hours**

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo-resistive Pressure sensors. Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps.

Module IV: **08 Hours**

Molecular and Nanostructure Dynamics: Shrodinger Equation and Wave function Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

Total lecture hours: **30 Hours**

Text Book:

1. Tai-ran Hsu, MEMS and microsystems design and manufacture, Nanoscale Engineering, TMGH, 2008.
2. Microelectromechanical Systems by Nitaigour Mahalik.
3. Chang Liu, Foundations of MEMS, Pearson Education Inc., 2012.
4. Sergey Edward Lyshevski, MEMS and NEMS: Systems, Devices, and Structures, CRC, 2002.

Reference Book:

1. Stephen D Senturia, Microsystem Design, Springer Publication, 2000.
2. P.Seshu, Text Book of Finite Element Analysis, PHI,2006.
3. Designing CMOS MEMS by Lisa Su and Marija Vasilevska.
4. Introduction to Microelectromechanical Systems Engineering by Nadim Maluf and Kirt Williams.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

CO-PO-PSO MAPPING

MEMS and NEMS															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO3
CO1	3	2	2	1	2	-	-	-	3	2	1	-	3	2	1
CO2	3	-	2	1	2	-	-	-	2	2	1	-	3	2	-
CO3	3	3	-	2	-	-	-	-	1	-	-	1	3	2	2
CO4	3	3	-	2	-	-	-	-	1	-	-	1	3	1	1
Average	3	2	1	1.5	1	-	-	-	1.75	1	0.5	0.5	3	1.75	1
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
POWER ELECTRONICS	**EI3208**	**3-0-0**	**3**

Prerequisite: Circuit Analysis

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Apply V-I characteristics of SCR, TRIAC, MOSFET, and IGBT in power converters.

CO2: Analyse single/three-phase rectifiers with different loads and inductive effects.

CO3: Evaluate DC-DC converters and inverters for voltage control and efficiency.

CO4: Design and simulate PWM-based inverters, AC controllers, and cycloconverters.

Module I: Fundamentals of Power Electronics & Power Semiconductor Devices 07 Hours

Introduction: Concept of power electronics, scope and applications, types of power converters, power semiconductor switches and their V-I characteristics Power diodes, SCR, TRIAC, power MOSFET, IGBT. Thyristor ratings and protection, methods of SCR commutation, gate drive circuits, switching and conduction losses in a generic power semiconductor device.

Module II: Phase-Controlled Rectifiers 08 Hours

Phase-Controlled Rectifiers: Principles of single-phase half and fully-controlled converter with R, RL, and RLE load with and without freewheeling diode, Principles of three-phase fully-controlled converter operation with RLE load, Effect of load and source inductances, Single phase and Three phase dual converters.

Module III: Choppers (DC-DC Converters) 07 Hours

Introduction, Basic principles of step-down and step-up operation, chopper classification study of Buck, Boost and Buck-Boost regulators, Introduction to forward and fly back converters, concept of DC-DC converters.

Module IV: Inverters, AC Voltage Controllers, and Cycloconverters 08 Hours

Inverters: Introduction, principle of operation, performance parameters, single phase bridge inverters with R, RL and RLC loads, 3-phase bridge inverters- 180- and 120-degrees mode of operation, Voltage control of single-phase inverters –single pulse width modulation, multiple pulse width modulation. AC Voltage Controllers and Cycloconverters: Introduction, principle of operation of single-phase voltage controllers for R, RL loads and its applications, principle of single-phase cycloconverter with R and RL load and its applications

Total lecture hours: 30 Hours

Text Book:

1. P.S. Bimbhra, “Power Electronics”, Khanna Publication, 2012.
2. M D Singh, K B Khanchandani, Power Electronics, Tata McGraw Hill Publishing Company Limited, 2009.
3. Mohan Undeland Robin, Power Electronics - Converters, Applications and Design, John Wiley & Sons, 2006.
4. V. R. Moorthi, Power Electronics: Devices, Circuits and Industrial Applications, Oxford University Press.

Reference Book:

1. M.H. Rashid, “Power Electronics”, Pearson Publication, 2003.
2. B. K. Bose, Modern Power Electronics and AC Drives, Pearson Education.
3. L. Umanand, Power Electronics: Essentials and Applications, Wiley India.
4. Daniel W. Hart, Power Electronics, McGraw-Hill.

CO-PO-PSO MAPPING

POWER ELECTRONICS															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO3
CO1	3	2	2	2	3	1	1	1	1	2	1	2	1	1	1
CO2	3	3	2	3	3	1	1	1	2	2	1	2	1	1	1
CO3	3	3	3	3	3	1	1	1	2	2	1	2	1	1	1
CO4	3	3	3	3	3	1	1	1	2	3	2	2	1	1	1
Average	3.0	2.75	2.5	2.75	3.0	1.0	1.0	1.0	1.75	2.25	1.25	2.0	1.0	1.0	1.0
Level of Correlation:				3 - High			2 - Medium				1 - Low				

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
INDUSTRIAL INTERNET OF THINGS	**EI3212**	**3-0-0**	**3**

Prerequisite: IoT Basics, Industrial Automation

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Apply IIoT smart sensors for real-time monitoring in manufacturing and healthcare with Industry 4.0/5.0 and AR/VR.

CO2: Analyse IIoT data using AI/ML for predictive maintenance and quality control.

CO3: Evaluate IIoT security and inventory methods like JIT and MRP for safety and efficiency.

CO4: Create IIoT architectures combining sensing, analytics, and security for sustainable Industry 5.0 applications.

Module I: Fundamentals of Industry 4.0 and 5.0 with IIoT **08 Hours**

Introduction to Industry 4.0 and Industry 5.0: Evolution, characteristics, and principles. Smart business concepts and global impacts. Definition and Role of IIoT in Industry 4.0 and 5.0, IIoT architecture and foundational concepts. Applications of IIoT in smart factories, cities, agriculture, and Industry 5.0 scenarios, Future-Ready IIoT Architectures.

Module II: IIoT Sensing and Applications **08 Hours**

Industrial sensors (Traditional vs. Modern Sensing in Industrial Environments) and smart sensors: Roles and applications. Industry use cases: Smart healthcare, smart manufacturing, supply chains (Industry 5.0-enabled Green Logistics), Integration of AR/VR and emerging tech in IIoT applications.

Module III: IIoT Analytics and Intelligence **07 Hours**

Introduction to IIoT data analytics: Role of Data Analytics in Industrial Operations, Types and frameworks, Industrial Internet Reference Architecture (IIRA) and Analytics. Artificial Intelligence and Machine Learning applications in IIoT, Challenges and Usefulness in Industry 5.0 Settings, Case studies in analytics for predictive maintenance, quality, and healthcare.

Module IV: Safety, Security, and Inventory Management in IIoT **07 Hours**

IIoT applications for industrial safety and plant security. Network and mobile device security techniques. Inventory control methods (**Inventory Types: Finished Goods, Work-in-Progress, Raw Materials, MRO, Inventory Techniques: JIT, MRP, EOQ, DSI)** and quality management using IIoT systems.

Total lecture hours: **30 Hours**

Text Book:

1. Sudip Mishra, Chandana Roy, and Anandarup Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0, CRC Press., 2020.
2. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, Apress, 2017.
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press.
4. Jay Lee, Behrad Bagheri, Hung-An Kao, "A Cyber-Physical Systems architecture for Industry 4.0-based manufacturing systems", Springer.

Reference Book:

1. R. Anandan, Suseendran Gopalakrishnan, S. Pal, N. Zaman, Industrial Internet of Things (IIoT): Intelligent Analytics for Predictive Maintenance, Wiley-Scrivener, 2022.
2. Ovidiu Vermesan & Peter Friess, "Internet of Things – From Research to Market Deployment",

River Publishers.
3. Kevin Ashton, "How Protocol Conversion Addresses IIoT Challenges", RedLion White Paper.
4. Deloitte Insights, "Inside the Internet of Things (IoT)", Deloitte University Press.

CO-PO-PSO MAPPING

INDUSTRIAL INTERNET OF THINGS															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	2	1	3	1	1	1	2	1	1	2	3	2	1
CO2	2	3	2	3	3	1	1	1	2	2	1	2	2	3	2
CO3	2	2	3	2	2	2	2	3	2	2	1	2	1	2	3
CO4	3	3	3	3	3	2	2	2	3	3	2	3	3	3	3
Average	2.5	2.5	2.5	2.25	2.75	1.5	1.5	1.75	2.25	2	1.25	2.25	2.25	2.5	2.25
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
PULSE AND DIGITAL CIRCUITS	EI3214	3-0-0	3

Prerequisite: Basic Electronics, Analog Electronic Circuits

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Analyze the response of linear and non-linear wave shaping circuits to different input signals and apply the concepts in signal conditioning applications.

CO2: Design and implement analog signal processing circuits using operational amplifiers including active filters, waveform generators, and data converters.

CO3: Design and evaluate various multivibrator circuits for timing and waveform generation applications using BJT configurations.

CO4: Illustrate the working of negative resistance devices, PLLs, IC 555-based timers and instrumentation amplifiers for time-base generation and frequency synthesis.

Module I: **07 Hours**

Linear Wave Shaping Circuit: High pass and Low pass RC circuits and their response for Sinusoidal, Step, Pulse, Square and Ramp inputs, High pass RC network as Differentiator, Low pass RC circuit as an Integrator.

Non-Linear Wave Shaping Circuit: Diode clippers, Transistor clippers, clipping at two independent levels, Comparators, clamping operation, clamping circuit taking Source and Diode resistances into account, Clamping Circuit Theorem.

Module II: **08 Hours**

Op-Amp and its Applications: Review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: First & Second order low pass / high pass, band pass, band reject, and all pass filters, design guidelines. Universal active filter design, Saw tooth wave generator OP Amps. Voltage Controlled Oscillator.

DAC & ADC: Weighted resistor, R-2R ladder, resistor string etc. Single slope, dual slope, successive approximation, flash ADC. Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.

Module III: Multi vibrator and Triggering circuit **08 Hours**

Bistable Multi Vibrator: Analysis and Design of Fixed Bias, Self-Bias Bistable Multi Vibrator, Collector catching Diodes, Commutating Capacitors, Methods of Triggering using RC network & Diode, Emitter Coupled Bistable Multi Vibrator (Schmitt trigger).

Monostable Multi Vibrator: Analysis and Design of Collector Coupled Monostable Multi Vibrator, Triggering method of a Monostable Multi Vibrator, Application of Monostable Multi Vibrator as a Voltage to Time Converter.

Astable Multi Vibrator: Analysis and Design of Collector Coupled Astable Multi vibrator, Application of Astable Multi Vibrator as a Voltage to Frequency Converter.

Module IV: **07 Hours**

Negative Resistance Switching Devices: Voltage Controllable Negative resistance devices, Tunnel Diode operation and characteristics, Monostable, Astable, Bistable circuits using tunnel diode, Voltage controlled Negative Resistance Switching Circuits.

Time Base Generators and IC Applications: Time-Base Generators, General features of a Time- base signal, IC 555 Timer as a Monostable, astable Multivibrator with its applications. Phase Locked Loop:

Operating principle of PLL, Phase detectors, Exclusive-OR phase detector, Monolithic phase detector, Instrumentation Amplifier and its applications.

Total lecture hours: **30 Hours**

Text Book:

1. Pulse and Digital Circuits by A. Anand Kumar, PHI.
2. Pulse, Digital and Switching Waveforms, Second Edition – Jacob Millman, Herbert Taub and Mothiki S Prakash Rao (TMH Publication).
3. Op-Amps and Linear Integrated Circuits- Ramakant A. Gayakwad (PHI Publication).
4.

Reference Book:

1. Pulse and Digital Circuits by K.Venkata Rao, K Rama Sudha and G. Manmadha Rao, Pearson Education, 2010.
2. Op-Amps and Linear Integrated Circuits – Robert F. Coughlin, Frederick F. Driscoll.
3.
4.

CO-PO-PSO MAPPING

PULSE AND DIGITAL CIRCUITS															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	0	0	0	0	0	0	0	0	0	1	2	0	0
CO2	3	2	3	2	2	0	0	0	0	1	0	1	3	2	0
CO3	3	2	3	1	0	0	0	0	0	1	0	1	3	0	0
CO4	2	1	2	1	0	0	0	0	0	0	0	1	2	2	0
Average	2.75	1.75	2	1	0.5	0	0	0	0	0.5	0	1	2.5	1	0
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

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Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
EMBEDDED SYSTEMS	**EI3216**	**3-0-0**	**3**

Prerequisite: Digital Electronic Circuits, Hexadecimal Arithmetic, Basic Programming Skills.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Analyze various components, characteristics, and attributes of embedded systems.

CO2: Apply appropriate computational models and scheduling algorithms for implementation of embedded systems.

CO3: Analyze Hardware Software co-design and task synchronization issues with reference to embedded systems.

CO4: Apply knowledge of microprocessors and microcontrollers to design of embedded systems.

Module I: **8 Hours**

Introduction to Embedded system- What is an Embedded System? Classification, Application areas, Purpose of Embedded Systems.

Typical Embedded System- Core of embedded Systems, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other systems components.

Module II: **8 Hours**

Characteristics and Modeling of Embedded Systems-Characteristics and Quality Attributes of Embedded Systems. Computational Models- DFG, FSMD, Issues in Hardware Software Co-design, UML.

Module III: **8 Hours**

Real Time Operating System- GPOS vs RTOS, Multiprocessing and Multitasking, Task Scheduling, Task Synchronization.

EDLC - Embedded Product Development Life Cycle.

Module IV: **6 Hours**

Overview of PIC and AVR family of microcontrollers and RISC based processors.

Examples- Washing Machine, Digital Camera etc.

Total lecture hours: **30 Hours**

Text Book:

1. K. Shibu, Introduction to Embedded Systems, 2nd Edition, TMH , 2009.
2. Raj Kamal, Embedded Systems- Architecture, Programming and Design, 3rd Edition, Mc Graw Hill Education, 2017.

Reference Book:

1. J.W. Valvano, "Embedded Microcomputor System: Real Time Interfacing", Brooks/Cole, 2000.

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CO-PO-PSO MAPPING

EMBEDDED SYSTEMS															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	3	3	2	2	2	1	1	1	1	-	1	3	3	3
CO2	3	3	3	2	2	3	2	1	1	1	-	1	3	3	3
CO3	3	3	3	2	2	3	2	1	1	1	-	1	3	3	3
CO4	3	3	3	2	3	3	3	2	2	1	-	1	3	3	3
Average	3	3	3	2	2.25	2.75	2	1.25	1.25	1	0	1	3	3	3
Level of Correlation:					3 - High				2 - Medium				1 – Low		

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Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
MACHINE LEARNING	EI3225	3-0-0	3

Prerequisite: Data Structures, Basics of Probability and Statistics

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Grasp and develop algorithms for linear, logistic, and multivariate regression.

CO2: Design and implement linear and nonlinear classifiers based on SVM, Neural networks and Decision trees.

CO3: Identify and implement clustering techniques for moderate to large size data.

CO4: Evaluate and interpret the results of the machine learning algorithms.

Module I: Introduction to probability and linear algebra **04 Hours**

Review of Probability Theory and Linear algebra, Convex Optimization, relationship between AI, ML, and DL

Module II: **10 Hours**

Introduction to Statistical Decision Theory, Regression: Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Logistic Regression, Partial Least Squares Classification: Linear Classification, LDA

Introduction to Perceptron and SVM, Neural Networks: Introduction, Early Models, Perceptron Learning, Back-propagation, Initialization of neural network, Training and Validation, Parameter Estimation

Module III: **10 Hours**

Introduction to Bayesian Learning, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naive Bayes classifier

Decision Trees - Stopping Criterion and Pruning, Loss function, Categorical Attributes, Multiway Splits, Missing values, Instability, Regression Trees. Bootstrapping and Cross Validation, Class Evaluation, Measures, ROC curve, MDL, Ensemble methods, Committee Machines and Stacking.

Module IV: **06 Hours**

Partitional clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density- Based Clustering, Gaussian Mixture Models, Expectation Maximization, Learning Theory, Re-enforcement Learning

Total lecture hours: **30 Hours**

Text Book:

1. Rajiv Chopra, Machine Learning, Khanna Book Publishing Company, 2023.
2. Hastie, T. R. Tibshirani, and J. G. Friedman, “The Elements of Statistical Learning: Data Mining, Inference and Prediction”, New York, NY: Springer,
3. EthemAlpaydin, “Introduction to Machine Learning”, PHI, 2005.
4. Andreas C. Müller and Sarah Guido, Introduction to Machine Learning with Python, O'Reilly Media, 2016

Reference Book:

1. Bishop Christopher, “Neural Networks for Pattern Recognition”, New York, NY: Oxford University Press,
2. Mitchell Tom, “Machine learning”, New York, NY: McGraw-Hill,

3. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani "Introduction to Statistical Learning", Springer, 2013.
4. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press.

CO-PO-PSO MAPPING

MACHINE LEARNING														
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	3	2	2	2	0	0	0	0	1	0	1	3	2	0
CO2	3	2	3	2	3	0	0	0	1	1	1	2	3	3	1
CO3	2	3	2	2	2	0	0	0	1	1	0	1	3	2	0
CO4	3	3	2	3	2	0	0	0	1	2	0	2	3	3	1
Average	2.75	2.75	2.25	2.25	2.25	0	0	0	0.75	1.25	0.25	1.5	3	2.5	0.5
Level of Correlation: 3 - High 2 - Medium 1 – Low															

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Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
BUSINESS MANGEMENT	BH3401	3-0-0	2

Prerequisite:

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Comparing and contrasting efficient functional models of business management by integrating the three core areas such as Finance, Human Resource and Marketing Management.

CO2: Executing the Management principles in all the functional areas of business.

CO3: Correlating the interrelations and interdependence of the areas of Management in a business organisation.

CO4: Assessing the functional and managerial practices in business organisations.

Module I: Management Principles **08 Hours**

Management Concepts, Nature and Functions, Management Process and Roles of Managers, Levels of Management and Managerial Skills, Theories of Management – Contributions of F.W.Taylor, Henry Fayol, Elton Mayo, Line and Staff Relationship, Centralisation and Decentralisation, Delegation of Authority , Management thoughts in Modern Trend –Systems Approach

Module II: Financial Management **08 Hours**

Concept, Financial function and Role of Financial Managers, Instruments of raising short-term and long-term funds, Capital Structure, Techniques of Project Appraisal, Components of Working Capital, Operating Cycle, Factors affecting requirement of Working Capital.

Module III: Human Resource Management **07 Hours**

Nature and Scope of Human Resource Management, Manpower Planning, Recruitment and Selection Methods, Performance Appraisal, Need, Objectives, Modern methods of Appraisals: 720 degree, MBO, Assessment Centre Method, Talent Acquisition, Training Need Analysis, Career Planning, Organisational Citizenship Behaviour.

Module IV: Marketing Management **07 Hours**

Concept, Nature, Scope and Importance, Marketing Mix and 7P's of Marketing, Segmentation, Targeting, Positioning, Factors influencing consumer decision-making, e-marketing and Green Marketing

Total lecture hours: **30 Hours**

Text Book:

1. Modern Business Organisation and Management, S.A. Sherlekar, Himalaya Publishing House, 2016.
2. Essentials of Management, Stephen P. Robbins, 6th Edition, Pearson, 2010.
3. Financial Management, Sheeba Kapil, 1st Edition,Pearson, 2013.
4. Human Resource Management Text and Cases, K. Aswathappa, 10th Edition,TMH, 2023

Reference Book:

1. Marketing Management, Rajan Saxena, 6th Edition, TMH publishing house, 2022.
2. Principles of Management, Dipak Kumar Bhattacharyya, 1st Edition, Pearson, 2011
3. Mgmt (Principles of Management), Willium& Tripathy, 1st Edition, Cengage Learning, 2016

CO-PO-PSO MAPPING

BUSINESS MANGEMENT															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	-	2	-	2	-	2	2	3	3	3	3	3	-	-	-
CO2	-	-	-	-	-	1	3	3	3	3	3	3	-	-	-
CO3	-	-	-	-	2	2	1	3	3	3	3	3	-	-	-
CO4	-	-	-	-	-	1	1	3	3	3	3	3	-	-	-
Average	-	0.5	-	0.5	0.5	1.5	1.75	3	3	3	3	3	-	-	-
Level of Correlation:						3 - High			2 - Medium				1 – Low		

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
ENTREPRENEURSHIP DEVELOPMENT	BH3403	3-0-0	2

Prerequisite:

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Exemplifying the business opportunities, social responsibilities and the support system for setting up an enterprise.

CO2: Determining stages of Entrepreneurial Process starting from idea generation, developing a business plan and operational aspects of an Enterprise.

CO3: Appraising the different funding options and Financial Management of an enterprise.

CO4: Assessing the Start-up management practices like incubation, mentorship and Government initiatives.

Module I: Introduction to Entrepreneurship **08 Hours**

Concept, Functions of an Entrepreneur, Entrepreneurial Process, Entrepreneurial Motivation and Barriers, Traits to be a successful Entrepreneur, Creativity and scope of Entrepreneurship in India: Types of new age business (FinTech, EdTech, Healthcare, Agripreneurship, Defence, Drone, Space, IT, Robotics, Digital Transformation, Women-Entrepreneurship, Social Entrepreneurship, Corporate Social Responsibility, Business Ethics – Role of Values in Management.

Module II: Entrepreneurial Idea into Action **08 Hours**

Developing a Business Idea; Opportunity, Methods and Creativity, Deciding to set up a start-up, Forms of business organisations (Sole tradership/propreitorship, Partnership, Joint-Stock Company) and MSMEs (Micro, Small and Medium enterprises), Size and Location of the enterprise, Feasibility Study: Market Survey, Techno-economic feasibility and preparing a Project Report.

Module III: Entrepreneurial Finance and Funding **07 Hours**

Sources of funding(Bootstrapping, Angel Investors, Venture Capital, Crowdfunding etc.) Project Investment Analysis, Break-Even Analysis, ROI Analysis, Basics of Income Statement and Balance Sheet.

Module IV: Managing an Enterprise **07 Hours**

The Start-up ecosystem, Business Incubators, Start-up Accelerators, Mentorship and Networking, Failure and Resilience, Risk Management, Ethical dilemmas and Exit Strategies, Start-up Policy and Initiatives of the Government.

Total lecture hours: **30 Hours**

Text Book:

1. Entrepreneurship: Successfully Launching New Ventures, B.R. Barringer, 6th, Pearson, 2020
2. Fundamentals of Entrepreneurship and Project planning, Madhurima Lall, 1st, Sultan Chand & Sons, 2021
3. Entrepreneurial Development,S.S. Khanka, 1st Edition, S Chand and Company, 1999
4. Entrepreneurship Development and Small business enterprises, P.M. Charantimath, 3rd Edition, Pearson, 2019

Reference Book:

1. Entrepreneurship: Theory, Process and Practice, Donald F Kuratco, 11th, Cengage, 2023
2. Entrepreneurship, Robert. D. Hisrich & Sabyasachi Sinha, 11th Edition, TMH, 2020

CO-PO-PSO MAPPING

ENTREPRENEURSHIP DEVELOPMENT															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	-	-	-	-	2	3	3	3	3	3	3	3	-	-	-
CO2	-	2	2	2	2	3	3	3	3	3	3	3	-	-	-
CO3	-	-	-	-	2	3	3	3	3	3	3	3	-	-	-
CO4	-	-	-	-	2	3	3	3	3	3	3	3	-	-	-
Average	-	0.5	0.5	0.5	2	3	3	3	3	3	3	3	-	-	-
Level of Correlation: 3 - High 2 - Medium 1 – Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

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Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
ENVIRONMENTAL ENGINEERING	**IP 3401**	**3-0-0**	**2**

Prerequisite: Basic Physics, Basic Chemistry

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Understand the multidisciplinary nature of environmental science and ecosystem structure and functions

CO2: Analyze various forms of environmental pollution and assess their impact using scientific parameters

CO3: Demonstrate knowledge of water and wastewater treatment processes and air pollution control technologies

CO4: Evaluate the role of environmental policies, EIA, and sustainable practices in pollution control and resource conservation

Module I: **10 Hours**

Fundamentals of Environment and Ecosystem: Multidisciplinary nature of environmental Engineering.

Study of Ecosystem: Definition, Properties, Structure and Function of an ecosystem. Food chains, food webs, Flow of Energy, Ecological Pyramids, Biogeochemical cycles, Types of ecosystems, Bioaccumulation, Bio magnification, ecosystem value, Degradation of Ecosystem.

Concept of Environment and pollution: Atmospheric chemistry, soil chemistry, water quality characteristics, DO, BOD and COD, water pollution, Marine Pollution, soil pollution, thermal pollution, nuclear hazard, Air Pollution: Air Quality, cause and effects of air pollution, Water and air quality standards, and Index, Noisepollution: Introduction, Noise standards, measurement, Ln Concept and control

Module II: **08 Hours**

Water treatment process: Pre-treatment of water, conventional process, advanced water treatment process.

Waste water treatment process: Natural Treatment, Engineering Treatment -Pre- treatment, primary and secondary waste water treatment process

Air Pollution Control: The natural self-cleansing properties of Environment, Air pollution meteorology, Atmospheric dispersion, Diffusion equation, ground level emission, plume rise, Effective stack height, Air Pollution control from stationarysources by installing Engineering devices, Flue gas desulphurisation, NOX removal.

Module III: **08 Hours**

Solid waste management: Source, classification, separation, storage and transportation of solid wastes, Waste minimization techniques, Benefits of waste minimization, reuse, recycle, thermal and biological treatment, secure land fill technique.

Impact of Environmental pollution and related issues: Global climate change, global warming and greenhouse gases, Acid rain, ozone layer depletion, health issues.

Module IV: **07 Hours**

Environmental Impact Assessment: EIA procedure, Preparation of an EIS From unsustainable to

sustainable development, circular economy, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Preventionand Control of Pollution) Act, Wildlife Protection Act.

Total lecture hours: **30 Hours**

Text Book:

1. Fundamentals of Ecology, M.C.Dash, Tata McGraw Hill, 2006.
2. Environmental Pollution Control Engineering, C.S. Rao, New Age International Publishers, 2018
3. Environmental Engineering, G. Kiely, TMH, 2007
4.

Reference Book:

1. Environmental Engineering, H.S. Peavy, D.R. Rowe and G. Tchobanoglous, McGraw Hill.
2. Introduction to Environmental Engineering and Science, G.M. Masters, Pearson, 2015
3. Integrated Solid Waste Management, G. Tchobanoglous, McGraw Hill, 2014
4. Water Supply Engineering, S.K. Garg; Khanna Publishers, 37th Edition

CO-PO-PSO MAPPING

ENVIRONMENTAL ENGINEERING															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	1	1	1	2	3	1	1	2	1	2	2	2	3
CO2	3	3	2	2	2	2	3	1	1	2	1	2	2	2	3
CO3	3	3	3	2	2	2	3	1	2	2	2	3	3	3	3
CO4	2	2	2	2	1	3	3	2	2	2	2	3	3	3	2
Average	2.75	2.5	2	1.75	1.5	2.25	3	1.25	1.5	2	1.5	2.5	2.5	2.5	2.75
Level of Correlation: 3 - High 2 - Medium 1 – Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

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Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
INDUSTRIAL SAFETY ENGINEERING	**IP3403**	**3-0-0**	**2**

Prerequisite:

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Apply safety principles in various work environments, especially in construction and machine operations.

CO2: Identify safety hazards, implement safety measures,

CO3: Analyse risks to prevent accidents and injuries.

CO4: Understand of safety protocols, policies, and the responsibilities of individuals and organizations in ensuring a safe working environment.

Module I: **06 Hours**

Safety Introduction: Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need, types, advantages.

Module II: **07 Hours**

Personal Protection in work environment: Personal protection in the work environment, Types of PPEs, Personal protective equipment- respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping. Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.

Module III: **07 Hours**

Safety issues in Construction: Introduction to construction industry and safety issues in construction Safety in various construction operations – Excavation and filling – Under-water works – Under-pinning & Shoring – Ladders & Scaffolds – Tunneling – Blasting – Demolition – Confined space – Temporary Structures. Familiarization with relevant Indian Standards and the National Building Code provisions on construction safety. Relevance of ergonomics in construction safety. Ergonomics Hazards - Musculoskeletal Disorders and Cumulative Trauma Disorders.

Module IV: **07 Hours**

SafetyHazardsinMachines and Hazardidentificationandanalysis: Machinery safeguard-Point-of-Operation, Principle of machine guarding -types of guards and devices.Safetyinturning,andgrinding.WeldingandCutting-SafetyPrecautionsofGas welding and Arc Welding. Material Handling-Classification-safety consideration- manual and mechanical handling. Handling assessments and techniques- lifting, carrying, pulling, pushing, palletizing and stocking. Material Handling equipment-operation & maintenance.

Hazard and risk, Types of hazards –Classification of Fire, Types of Fire extinguishers, fire explosion and toxic gas release, Structure of hazard identification and risk assessment. Identificationofhazards:Inventoryanalysis,Fireandexplosionhazardratingofprocessplants

The Dow Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard and Operabilitystudy(HAZOP))–methodology,criticalityanalysis,correctiveactionandfollow-up. Control of Chemical Hazards, Hazardous properties of chemicals, Material Safety Data Sheets (MSDS).

Total lecture hours: **30 Hours**

Text Book:

1. R.K Jain (2000) Industrial Safety, Health and Environment management systems, Khanna Publications.
2. Paul S V (2000), Safety management System and Documentation training Programme handbook, CBS Publication.
3. Krishnan, N.V. (1997).Safety management in Industry. Jaico Publishing House, New Delhi.

Reference Book:

1. John V. Grimaldi and Rollin H.Simonds. (1989) Safety management. All India Traveller Book Seller, Delhi.
2. Ronald P. Blake. (1973). Industrial safety. Prentice Hall, New Delhi.
3. Alan Waring. (1996). Safety management system. Chapman & Hall, England.
4. Vaid, K.N., (1988). Construction safety management. National Institute of Construction Management and Research, Mumbai

CO-PO-PSO MAPPING

INDUSTRIAL SAFETY ENGINEERING															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	3	3	2	2	2	-	3	-	-	-	-	3	2	3
CO2	3	3	3	2	-	-	-	3	2	-	-	-	3	2	3
CO3	3	3	3	2	-	-	-	3	-	-	-	-	3	2	3
CO4	2	2	1	2	-	3	-	3	2	2	-	-	2	2	2
Average	2.75	2.75	2.5	2	0.5	1.25	-	3	1	0.5	-	-	2.75	2	2.75
Level of Correlation: 3 - High 2 - Medium 1 – Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
PROCESS CONTROL LABORATORY	**EI3502**	**0-0-3**	**1.5**

Prerequisite: Control System Engineering

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Design and conduct experiments for process characteristics identification.

CO2 : Identify the control need in a given process and apply appropriate control strategy.

CO3: Select and use latest hardware and software tools for various processes and systems.

CO4: Illustrate methods to automate a process.

List of Experiments: (At least 10 experiments should be done)

EXP 1: Summarize the behavior of first order and second order process.

EXP 2: Design of a compensatory network (lead, lag, lead-lag) for the given specifications.

EXP 3: Apply classical tuning techniques to optimize PID parameters for different process loops.

EXP 4: Control a heater to maintain a set temperature using PID logic; observe transient response.

EXP 5: Control and analyze the water level in a tank using PID controllers.

EXP 6: Maintain constant pressure in a vessel; understand dead time and gain in pressure systems.

EXP 7: Implementation of feedforward control strategy.

EXP 8: Implementation of cascade control strategy.

EXP 9: Understand PLC hardware, I/O modules, and develop basic ladder logic programs.

EXP 10: Implement AND, OR, XOR, MUX logic using ladder diagrams.

EXP 11: Use ON-delay and OFF-delay timers for sequential operations (e.g., lamp blinking).

EXP 12: Implement object sorting or item movement on a conveyor belt with start/stop and emergency control.

EXP 13: Develop a PLC program for a tank level control using level sensors and pumps.

EXP 14: Simulate lift control using PLC logic.

EXP 15: Develop a PLC program for bottling plant.

EXP 16: Design a traffic light control system using timers and sequencing logic.

EXP 17: Any hardware innovative project

Text Book:

1. Process Control Instrumentation Technology by C.D. Johnson,8th edition, PHI Learning.
2. Computer-Based Industrial Control by Krishna Kant, PHI, 2009
3. Chemical process control by George Stephanopoulos, PHI Learning Private Limited, New Delhi, 2009.
4. Process control principles and applications by S. Bhanot, Oxford university Press,2010.

Reference Book:

1. Digital Control and State Variable Methods by M.Gopal, Tata McGraw Hill, 2003
2. Modern Control Engineering by K. Ogata, PHI.

CO-PO-PSO MAPPING

PROCESS CONTROL LABORATORY															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	3	3	2	–	–	–	1	2	1	2	3	3	2
CO2	3	3	3	2	1	–	–	–	2	2	2	2	3	3	2
CO3	3	2	3	2	3	–	–	–	1	2	2	2	3	3	2
CO4	3	2	2	2	3	–	–	–	1	2	2	3	3	3	2
Average	3	2.25	2.75	2.25	2.25	–	–	–	1.25	2	1.75	2.25	3	3	2
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
DIGITAL SIGNAL PROCESSING LABORATORY	EI3525	0-0-3	1.5

Prerequisite: Signals and Systems

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Simulate and manipulate basic signals using MATLAB for various DSP applications.

CO2: Compute and analyse linear, circular convolution, correlation of discrete-time signals and solve difference equations.

CO3: Perform DFT and FFT analysis, and interpret magnitude and phase spectra.

CO4: Design and implement FIR and IIR digital filters to meet given specifications.

LIST OF EXPERIMENTS

(Any 10 experiments should be performed)

EXP 1: Simulation of basic signals (unit step, impulse, ramp, exponential, sine, cosine) using MATLAB.

EXP 2: Linear convolution of two sequences – Verify commutative, distributive, and associative properties.

EXP 3: Auto-correlation and cross-correlation of two sequences – Verify symmetry and linearity properties.

EXP 4: Solve a given difference equation using MATLAB – Analyze system response.

EXP 5: Compute N-point DFT of a sequence and plot magnitude and phase spectra – Verify using built-in function.

EXP 6: Perform circular convolution of two sequences using MATLAB.

EXP 7: Linear convolution using Overlap-Add and Overlap-Save methods for long duration signals.

EXP 8: FFT computation using DIT-FFT and DIF-FFT algorithms – Analyze and compare performance.

EXP 9: Design and implementation of FIR filters using window methods – Plot frequency response.

EXP 10: Design and implementation of IIR filters using Butterworth and Chebyshev methods.

EXP 11: Perform spectral analysis of a real-time signal using FFT.

EXP 12: Reconstruct signals using inverse DFT – Analyze effects of zero-padding and spectral leakage.

EXP 13: Analyze quantization effects and round-off errors in digital signal processing.

EXP 14: Z-transform and inverse Z-transform – Simulation and verification using MATLAB.

EXP 15: Apply digital FIR/IIR filters to an audio signal and observe time-frequency characteristics.

EXP 16: Mini-projects: Audio equalizer design, ECG signal filtering, noise removal, etc.

Text Book:

1. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4th ed. Upper Saddle River, NJ, USA: Prentice Hall, 2006.
2. S. K. Mitra, Digital Signal Processing: A Computer-Based Approach, 4th ed. New York, NY, USA: McGraw-Hill, 2011.
3.
4.

Reference Book:

1. A. V. Oppenheim and R. W. Schafer, *Discrete-Time Signal Processing*, 3rd ed. Upper Saddle River, NJ, USA: Pearson, 2010.

2. R. G. Lyons, *Understanding Digital Signal Processing*, 3rd ed. Upper Saddle River, NJ, USA: Pearson, 2010.
3. M. H. Hayes, Digital Signal Processing, New York, NY, USA: Schaum's Outline Series, McGraw-Hill, 1998.
4.

CO-PO-PSO MAPPING

DIGITAL SIGNAL PROCESSING LABORATORY															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2
CO2	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2
CO3	3	3	3	3	2	-	-	-	-	-	-	1	3	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3
Average	3	2.7	2.5	2.5	2.2	-	-	-	-	-	-	1.3	3	2.7	2.2
Level of Correlation:			3 - High			2 - Medium				1 - Low					

SEVENTH SEMESTER

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
INDUSTRIAL INSTRUMENTATION	**EI4201**	**3-0-0**	**3**

Prerequisite: Sensor/Transducer

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Apply mechanical transducers for measuring density, level, viscosity, and angular motion.

CO2: Analyze passive electrical transducers for sensing physical and chemical parameters.

CO3: Evaluate advanced sensor technologies for industrial and biomedical applications.

CO4: Design and recommend transducer-based systems for real-world engineering problems.

Module I: **04 Hours**

Mechanical Transducers:

Basics of Density Measurement: Hydrometer System, Air Bubbler System, U-Tube Weighing System.

Basics of Liquid Level Measurement: Float Element, Level to Pressure Converter, Level to Force Converter.

Basics of Viscosity Measurement: Viscosity to Pressure Converter, Viscosity to Torque Converter, Viscosity to Displacement Converter.

Basics of Gyroscope, Rate Gyro, Integrating Gyro.

Module II: **08 Hours**

Passive Electrical Transducers:

Temperature measurement of Fluid in Motion, Thermal Radiation Detectors, Hot Wire Resistance Transducers, Hot Wire Level Transducer, Hot Wire Pressure Transducers, Thermal Conductive Gauge, Gas Analysis for composition, Hot Wire Anemometer.

Strain Gauge Applications: Calibration of Strain Gauges, Experimental Stress Analysis, Stress-Strain Relationships, Strain-Gauge Transducer Systems, Strain-Gauge Force Transducer, Strain-Gauge Flow Transducer, Strain-Gauge Accelerometers, Strain-Gauge Torque Transducer, Strain-Gauge Pressure Transducer.

Module III: **08 Hours**

Resistive Pressure Transducer, Resistive Moisture Transducers, Moisture Content of Solids, Concentration of Electrolytic Solutions, Relative Humidity of Gases, Resistive Magnetic Flow Transducers, Resistive Optical Radiation Transducers.

Ionization Transducers: Ionization Vacuum Gages, Ionization Displacement Transducer, Nuclear Radiation Transducers, Ionization Chamber, Proportional Counter, Geiger-Müller Counter, Scintillation Counter, Solid State Transducer for Radiation, Radioactive Vacuum Gages, Radioactive Thickness Gauge, Radioactive Level Gauges.

Module IV: **10 Hours**

Development in Sensor Technology

Introduction; **Semiconductor Sensors:** Basics, Materials and Techniques; **Smart Sensors:** Definition of Smart Sensor, Configuration of Smart Sensor; **Microsensors:** Introduction, A Microsize Microphone, Inertial Sensors, Hall Effect Sensors, Polymer Sensor; **IR Radiation Sensors:** Basics, Thermal Detectors, Quantum Detectors, IR Thermometry; **Ultrasonic sensors:** Introduction, Basics of Ultrasonics, Sonar, Ultrasonic Sensing System, Ultrasonic Flow Meters, Doppler Flow Meter, Cross Correlation Flow Meter, Surface Acoustic Wave (SAW) Sensors, Coriolis type Flowmeter; **Fibre Optic Sensors:** introduction, Basics, Typical Fibre Optic Sensors, Fibre Optic pH Sensor, Fibre Optic Humidity Sensor; **Chemical Sensors:** Introduction, Semiconductor Gas Detectors, Ion Selective

Electrodes, Conductometric Sensors, Mass Sensor; **Bio Sensors:** Introduction, Biosensor Structure, Biomedical Sensors, Quartz Crystal Microbalance.

Total lecture hours: **30 Hours**

Text Book:

1. D. V. S. Murty, Transducers and Instrumentation, New Delhi, India: PHI Learning, 2009.
2. E. O. Doebelin, Measurement Systems: Application and Design, 5th ed., New Delhi, India: Tata McGraw-Hill.
3. K. Ghosh, Introduction to Measurements and Instrumentation, 4th ed., New Delhi, India: PHI Learning, 2012.
4. J. Fraden, Handbook of Modern Sensors: Physics, Designs, and Applications, 4th ed., New York, NY, USA: Springer, 2010.

Reference Book:

1. S. Rangan, G. R. Sarma, and V. S. V. Mani, Instrumentation Devices and Systems, New Delhi, India: Tata McGraw-Hill.
2. C. Nakra and K. K. Chaudhry, Instrumentation Measurement and Analysis, New Delhi, India: McGraw-Hill Education.
3. S. Morris, Measurement and Instrumentation Principles, Elsevier, India.
4. R. K. Rajput, Electronic Measurements and Instrumentation, New Delhi, India: S. Chand & Co., 2012.

CO-PO-PSO MAPPING

INDUSTRIAL INSTRUMENTATION															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	1	2	2	0	0	0	0	0	0	0	3	2	3
CO2	3	3	2	3	3	0	0	0	0	0	0	0	3	2	2
CO3	2	2	2	2	3	1	1	1	1	1	1	1	3	3	3
CO4	3	3	3	3	3	2	2	2	2	2	2	2	2	3	-
Average	2.75	2.5	2.0	2.5	2.75	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.75	2.5	2.67
Level of Correlation: 3 – High 2 – Medium 1 – Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
ADVANCED CONTROL SYSTEM	**EI4203**	**3-0-0**	**3**

Prerequisite: Control System Engineering.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Analyze dynamical systems by comparing transfer function and state space modeling, assessing their suitability for linear, nonlinear, time-varying, and time-invariant systems.

CO2: Apply state space methods to compute state transition matrices, assess controllability and observability, and solve state equations for continuous and discrete systems.

CO3: Design state feedback controllers and observers for LTI systems to meet performance criteria like pole placement and stability.

CO4: Create state space and transfer function models for mechanical, electrical, and electromechanical systems, incorporating nonlinearities like saturation and friction.

Module I: **6 Hours**

Introduction to Advanced Control Systems: Purpose of feedback control, Definitions: Systems, dynamical Vs Static systems, linear Vs nonlinear systems, time varying Vs time invariant systems, continuous Vs discrete systems, etc.

Modelling approaches of dynamical systems: Transfer function modelling vs state space modelling.

Module II: **8 Hours**

State space analysis: State, state vector and state space, State space representation of systems, Motivating examples to understand the advantages of state space modelling compare to transfer function modelling, the concept of state, state variables and state model, Motivating examples: Mechanical systems and electrical networks

State space representation: General form of state space representation of LTI systems, Examples: Mechanical systems, Electrical networks, electromechanical systems, pneumatic and hydraulic systems, state space representation of nonlinear systems.

Solutions of state equations: Computation methods of STM, properties of STM, Solution of state equation (homogeneous and non-homogeneous state equation), Determination of State transition matrix, Controllability, Observability, Discrete time system, discretization of continuous time state space equation. solution of homogeneous state equations, Diagonalization

Module III: **8 Hours**

Pole placement and observer design: controllability, observability and diagonal, transformations in state space analysis and design. State observer. Solution of state equation.

Realization of the transfer function from a given State model: TF from SS, characteristics polynomial, concepts of eigenvalues and pole, basic concepts of zeros.

Realization of the state space model from transfer function: Concepts of non-uniqueness of state space realization of state space model.

Module IV: **8 Hours**

Nonlinear System: Behavior of nonlinear systems, Common physical non-linearities: Saturation, Friction, Relay, Backlash.

The Describing Function Method: Basic Concepts: Derivation of Describing Functions: Dead zone and Saturation.

Total lecture hours: **30 Hours**

Text Book:

1. K.Ogata, Modern Control Engineering, Pearson.

2. Gene Franklin, J. D. Powell, and Abbas Emami-Naeini, Feedback Control of Dynamic Systems, Prentice Hall.

.

Reference Book:

1. B. Kuo, Control System Engineering, PHI.
2. Eronini I. Umez-Eronini, System Dynamics and Control, Thomson Engineering.

CO-PO-PSO MAPPING

ADVANCED CONTROL SYSTEM															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	3	1	2	2	1	1	1	-	-	-	2	3	2	1
CO2	3	2	1	2	3	-	-	--	-	-	-	2	3	3	-
CO3	3	2	3	2	3	1	1	1	1	1	1	2	3	3	1
CO4	3	2	3	2	3	1	1	1	1	1	1	2	3	3	1
Average	3.0	2.3	2.0	2.0	2.8	1.0	1.0	1.0	1.0	1.0	1.0	2.0	3.0	2.8	1.0
Level of Correlation: 3 – High 2 – Medium 1 – Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
INTRODUCTION TO MICROFABRICATION	**EI4205**	**3-0-0**	**3**

Prerequisite: Basic knowledge of semiconductor physics and electronic devices.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Apply the knowledge of crystal structure, defects, and clean room in crystal growth and wafer cleaning process.

CO2: Analyze the kinetics and process of oxidation in microfabrication

CO3: Evaluate the different lithography schemes and its metrics involved in IC fabrication

CO4: Analyze the advancements in CMOS process fabrication of diffusion, ion implantation, deposition, and CVD technology etching and metallization to evaluate different metrics in microfabrication.

Module I: Introduction **08 Hours**

History of IC's; Operation & Models for Devices of Interest: CMOS and MEMS. Electronic Materials: Crystal Structures, Defects in Crystals, Si, Poly Si, Si Crystal Growth. Clean room and Wafer Cleaning: Definition, Need of Clean Room, RCA cleaning of Si.

Oxidation: Dry and Wet Oxidation, Kinetics of Oxidation, Oxidation Rate Constants, Device Isolation, LOCOS.

Lithography: Overview of Lithography, Radiation Sources, Masks, Photoresist, Components of Photoresist Optical Aligners, Resolution, Depth of Focus, Advanced Lithography: E-beam Lithography, X-ray Lithography, Ion Beam Lithography.

Module II: Diffusion and Ion Implantation **08 Hours**

Successive Diffusion, Lateral Diffusion, Diffusion System.

Ion Implantation: Problems in Thermal Diffusion, Advantages of Ion Implantation, Applications in ICs, Ion Implantation System, Ion Implantation Damage, Post Implantation Annealing.

Module III: Thin Film Deposition and CVD **08 Hours**

Physical Vapor Deposition: Thermal evaporation, Resistive Evaporation, Electron beam evaporation, Laser ablation, Sputtering

Chemical Vapor Deposition: Advantages and disadvantages of Chemical Vapor deposition (CVD) techniques over PVD techniques, Different kinds of CVD techniques: APCVD, LPCVD, Metalorganic CVD (MOCVD), Plasma Enhanced CVD etc.

Module IV: Etching & Metallization **06 Hours**

Anisotropy, Selectivity, Wet Etching, Plasma Etching, Reactive Ion Etching.

Metallization: Overview of Interconnects, Contacts, Metal gate/Poly Gate, Problems in Aluminum Metal contacts, Al spike, Electromigration, Metal Silicides, Multi-Level Metallization, Planarization.

Total lecture hours: **30 Hours**

Text Book:

1. Silicon VLSI Technology, Plummer, Deal and Griffin ,1st Edition, Pearson Education, 2009.
2. Fundamental of Semiconductor Fabrication, Sze and May, 2nd Edition, Wiley India, 2009.

Reference Book:

1. Silicon Process Technology, S K Gandhi, 2nd Edition, Wiley India, 2009.

CO-PO-PSO MAPPING

INTRODUCTION TO MICROFABRICATION															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	3	3	3	1	1	3	1	1	1	-	1	3	3	3
CO2	3	3	3	3	1	1	3	1	1	1	-	1	3	3	3
CO3	3	3	3	3	1	1	3	1	1	1	-	1	3	3	3
CO4	3	3	3	3	1	1	3	1	1	1	-	1	3	3	3
Average	3	3	3	3	1	1	3	1	1	1	0	1	3	3	3
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
NATURAL LANGUAGE PROCESSING	EI4207	3-0-0	3

Prerequisite: Discrete Mathematics, Probability & Statistics, Data Structures, Basic Python Programming, Machine Learning Fundamentals

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Analyze linguistic phenomena and apply formal grammars for modeling word and document structures.

CO2: Implement syntax analysis techniques using treebanks and parsing algorithms to resolve syntactic ambiguities.

CO3: Apply statistical methods to build language models and compute probabilities for language modeling and semantic interpretation.

CO4: Design and evaluate NLP algorithms for semantic parsing and meaning representation using supervised and unsupervised learning.

Module I: Structure of Words and Documents **08 Hours**

Words and their components: Issues and challenges in morphology, morphological models.

Structure of documents: Introduction to document structure analysis, methods, complexity, and performance of different approaches

Module II: Syntax Analysis **07 Hours**

Parsing natural language, introduction to treebanks and their role in syntax, syntactic structure representation. Parsing algorithms, models for ambiguity resolution, multilingual issues in parsing.

Module III: Semantic Parsing **08 Hours**

ntroduction to semantic parsing, semantic interpretation, system paradigms, word sense systems and software.

Module IV: Meaning Representation and Language Modeling **07 Hours**

Predicate-argument structure, meaning representation systems, and software. Introduction, N-Gram models, language model evaluation, parameter estimation, language model adaptation, types of language models, language-specific and multilingual/cross lingual modeling issues.

Total lecture hours: **30 Hours**

Text Book:

1. Tanveer Siddiqui, U. S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press
2. Daniel M. Bikel and Imed Zitouni, Multilingual Natural Language Processing Applications: From Theory to Practice, Pearson
3. Daniel Jurafsky and James H. Martin, Speech and Language Processing, Pearson Publications

Reference Book:

1. Christopher D. Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing, MIT Press, 2003
2. Rajesh Arumugam, Raja Lingappa Shanmugamani, Hands-On Natural Language Processing with Python, Packt Publishing, 2018
3. Jacob Eisenstein, *Introduction to Natural Language Processing*, MIT Press
4. Steven Bird, Ewan Klein, and Edward Loper, Natural Language Processing with Python,

O'Reilly

CO-PO-PSO MAPPING

NATURAL LANGUAGE PROCESSING															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	2	1	0	0	0	0	0	1	0	0	3	2	0
CO2	3	3	3	2	1	0	0	0	0	0	0	0	3	3	0
CO3	3	3	3	3	2	0	0	0	0	0	0	0	3	3	0
CO4	3	3	3	2	2	0	0	0	0	1	0	0	3	3	0
Average	**3**	**2.75**	**2.75**	**2**	**1.25**	**0**	**0**	**0**	**0**	**0.5**	**0**	**0**	**3**	**2.75**	**0**
Level of Correlation:					3 - High				2 - Medium				1 - Low		

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
ADVANCED PROCESS CONTROL	**EI4211**	**3-0-0**	**3**

Prerequisite: Control System Engineering

Course Outcomes:

At the end of the course, a student will be able to:

- **CO1:** Explain the evolution and significance of process control systems.
- **CO2:** Identify and explain the design aspects and hardware components of process control systems.
- **CO3:** Analyze and compare various advanced control strategies.
- **CO4:** Evaluate the architecture and benefits of Distributed Control Systems (DCS) in comparison to centralized systems.

Module I: **7 Hours**

History of process control systems- Examples of process control system (Heat exchanger, Continuous Stirred –Tank Heater/ Reactor (CSTR), Incentives for process control: suppress the influence of external disturbances, ensure the History of process control systems- Examples of process control system (Heat exchanger, Continuous Stirred –Tank Heater/ Reactor (CSTR), Incentives for process control: suppress the influence of external disturbances, ensure the stability of a process, optimize the performance of a process.

Module II: **7 Hours**

Design aspects of a process control system: Classification of variables in a process, Design elements of a control system, Control aspect of a complete process plant.

Hardware for a process control system.

Module III: **9 Hours**

Control system with multiple loops-cascade control, selective control, split range control. Feed forward and ratio control-Logic of feed forward control, problem of designing feed forward controllers, practical aspects on the design of FF controllers, Feed forward-Feedback control, Ratio control.

Adaptive control and Inferential control

Module IV: **7 Hours**

Distributed Digital Control: introduction, Distributed Vs. centralized control, Advantage of DCS. DCS (Distributed Control System): Distributed Control sub-system, local field station, presentation and monitoring device, communication options in Distributed Control System

Total lecture hours: **30 Hours**

Text Book:

1. Chemical process control by George Stephanopoulos ,PHI Learning Private Limited, New Delhi, 2009.
2. Computer based Industrial Control, 2nd ed. by K. Kant.,2009
3. Industrial Instrumentation and Control, 3rd ed. by S K Singh.

Reference Book:

1. Process control (Instrument Engineer Handbook), by Bela G. Liptak, Butterworth Heinemann Publication, 3rd Edition.
2. Industrial Automation and Process Control by Jon Stenerson, Prentice Hall, 2003.

CO-PO-PSO MAPPING

ADVANCED PROCESS CONTROL															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	1	1	-	-	-	-	-	2	-	2	3	2	1
CO2	3	2	1	1	1	-	-	-	-	2	-	2	3	2	1
CO3	3	2	2	2	2	-	-	-	-	2	1	2	3	3	1
CO4	3	2	2	2	3	-	-	-	-	2	1	2	3	2	1
Average	3	2	1.5	1.5	1.5	0	0	0	0	2	0.5	2	3	2	1
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
SMART & WIRELESS INSTRUMENTATION	**EI4213**	**3-0-0**	**3**

Prerequisite: Wireless Sensor Network, Digital Communication.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Analyze Smart and Wireless Instrumentation with respect to various performance parameters.

CO2: Design and develop Applications using WSN (Wireless sensor Network).

CO3: Understand the various applications of Smart & Wireless Instrumentation.

CO4: Analyze the wireless digital communication.

Module I: **8 Hours**

Introduction: Smart Instrumentation (Materials, automation systems, sensing and Sensors, Sensor Classifications, Wireless Sensor Networks, History of Wireless Sensor networks (WSN), Communication in a WSN, important design constraints of a WSN like Energy, Self-Management, Wireless Networking, Decentralized Management, Design Constraints, Security etc.

Module II: **9 Hours**

Node architecture: The sensing subsystem, Analog to Digital converter, the processor subsystem, architectural overview, microcontroller, digital signal processor, application specific integrated circuit, field programmable gate array (FPGA), comparison, communication interfaces, serial peripheral interface, inter integrated circuit, the IMote node architecture, The XYZ node architecture, the Hogthrob node architecture.

Module III: **7 Hours**

Fundamentals of Wireless Digital Communication Basic components, source encoding, the efficiency of a source encoder, pulse code modulation and delta modulation, channel encoding, types of channels, information transmission over a channel, error recognition and correction, modulation, modulation types, quadratic amplitude modulation, signal propagation.

Module IV: **6 Hours**

Applications: Structural health monitoring - sensing seismic events, single damage detection using natural frequencies, multiple damage detection using natural frequencies, multiple damage detection using mode shapes, coherence, piezoelectric effect, traffic control, health care - available sensors, pipeline monitoring, precision agriculture, active volcano, underground mining.

Total lecture hours: **30 Hours**

Text Book:

1. Fundamentals of wireless sensor networks: theory and practice - Waltenegus Dargie, Christian Poellabauer, A John Wiley and Sons, Ltd., Publication.
2. Smart Sensors, Measurement and Instrumentation, Subhas Chandra Mukhopadhyay, Springer Heidelberg, New York, Dordrecht London, 2013.
3. Wireless Sensors and Instruments: Networks, Design and Applications, Halit Eren, CRC Press, Taylor, and Francis Group, 2006.
4. Intelligent Instrumentation: Principles and Applications, Manabendra Bhuyan, CRC Press; 1st edition, 2017.

Reference Book:

1. Uvais Qidwai, Smart Instrumentation: A data flow approach to Interfacing, Chapman & Hall; 1st Edn, December 2013.

2. Wireless Sensor Networks: Architectures and Protocols, Edgar H. Callaway Jr., and Ed gar H. Callaway.

CO-PO-PSO MAPPING

SMART & WIRELESS INSTRUMENTATION															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	3	2	3	3	2	2	-	-	-	-	-	3	2	-
CO2	3	3	2	3	3	2	2	-	-	-	-	-	3	2	2
CO3	3	3	2	3	3	2	2	-	-	-	-	-	2	2	3
CO4	3	3	2	3	3	2	2	-	-	-	-	-	2	2	2
Average	3	3	2	3	3	2	2	-	-	-	-	-	2.5	2	2.3
Level of Correlation: 3 – High 2 – Medium 1 – Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
ELECTRONICS FOR SENSOR DESIGN	**EI4215**	**3-0-0**	**3**

Prerequisite: Basic electronics, Mathematics, Physics

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Apply sensor interfacing and signal conditioning with op-amps and protection circuits.

CO2: Analyze ADC/DAC and noise reduction techniques for accurate sensor data.

CO3: Evaluate sensor system performance in signal quality and IoT communication.

CO4: Create integrated sensor networks using adaptive processing and IoT for automation and healthcare.

Module I: Fundamentals of Sensors and Electronic Interfacing **07 Hours**

Introduction to sensor classification and characteristics, Electrical properties of sensors (resistive, capacitive, inductive, piezoelectric), Electronic characteristics: impedance, bandwidth, linearity, hysteresis, Signal interfacing basics: loading effect, impedance matching, protection circuits. internet

Module II: Signal Conditioning and Analog Electronics for Sensors **08 Hours**

Operational Amplifiers: Inverting, non-inverting, differential amplifiers, and voltage followers. Signal Conditioning Circuits: Amplification, filtering (low-pass, high-pass), and impedance matching. Sensor-Specific Circuits: Bridge circuits for resistive sensors (e.g., strain gauges, RTDs), charge amplifiers for piezoelectric sensors. Noise Reduction Techniques: Grounding, shielding, and low-noise amplifier design.

Module III: Digital Electronics and Sensor Interfacing **08 Hours**

Analog-to-Digital Conversion (ADC): Types (successive approximation, sigma-delta), resolution, and sampling. Digital-to-Analog Conversion (DAC): Binary-weighted and R-2R ladder DACs. Microcontroller Interfacing: Interfacing sensors with microcontrollers (e.g., Arduino, PIC, Raspberry Pi) using I2C, SPI, or UART protocols. Smart Sensors: Architecture, embedded processing, and data communication.

Module IV: Signal Processing and Applications of Sensor Systems **07 Hours**

Adaptive Signal Processing: Filtering techniques (FIR, IIR), noise cancellation. Sensor Network Design: Wireless sensor networks, IoT integration, and data fusion. Applications: Sensor systems in industrial automation, environmental monitoring, and healthcare.

Total lecture hours: **30 Hours**

Text Book:

1. J. Fraden, Handbook of Modern Sensors: Physics, Designs, and Applications, 4th Ed., Springer, 2010.
2. J. G. Webster, The Measurement, Instrumentation and Sensors Handbook, CRC Press, 1999.
3. S. Franco, Design with Operational Amplifiers and Analog Integrated Circuits, 4th Ed., McGraw Hill, 2014.
4. S. C. Mukhopadhyay, Smart Sensors, Measurement and Instrumentation, Springer, 2013.

Reference Book:

1. A. D. Helfrick, & W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, 5th Ed., PHI, 2003.
2. N. Kirianaki, S. Yurish, N. Shpak, & V. Deynega**,** Data Acquisition and Signal Processing for Smart Sensors, John Wiley & Sons, 2002.
3. Joseph J. Carr, Sensors and Circuits, Prentice Hall, 1993.
4. C. S. Rangan, G.R. Sarma, &V.S. V Mani, Instrumentation Devices and Systems, Tata McGraw Hill, 2008.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

CO-PO-PSO MAPPING

ELECTRONICS FOR SENSOR DESIGN															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	3	1	3	-	-	-	2	1	-	2	3	2	-
CO2	3	3	2	3	3	-	-	1	2	-	-	-	3	3	2
CO3	3	3	2	3	3	2	2	-	2	2	-	3	3	3	3
CO4	3	3	3	3	3	3	3	2	3	2	2	3	3	3	3
Average	3.00	2.75	2.50	2.50	3.00	1.75	1.75	1.00	2.25	1.75	1.00	2.50	3.00	2.75	2.25
Level of Correlation:			3 – High			2 – Medium				1 – Low					

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

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Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
DIGITAL IMAGE PROCESSING	EI4217	3-0-0	3

Prerequisite: Basic knowledge in Digital Signal Processing and Linear Algebra.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Explain the fundamentals of digital image and its processing.
CO2: Articulate image enhancement techniques in spatial and frequency domains.
CO3: Implement the mathematical modeling for image restoration and compression.
CO4: Examine the concept of image segmentation and morphological operations.

Module I: **8 Hours**

Digital Image Fundamentals: What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition.

Image Enhancement in the Spatial Domain: Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters

Image Enhancement in the Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of TwoVariables, Properties of the 2-DDFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering.

Module II: **8 Hours**

Image Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error(Wiener) Filtering, Constrained Least Squares Filtering.

Image Segmentation: Point, Line, Edge detection, Thresholding, Region Based segmentation, Hough Transform.

Module III: **8 Hours**

Image Compression:Lossy and lossless compression schemes, prediction-based compression schemes, vector quantization, sub-band encoding schemes, JPEG compression standard, Fractal compression scheme, Wavelet compression scheme.

Module IV: **6 Hours**

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing.

Total lecture hours: **30 Hours**

Text Book:

1. Rafael C Gonzalez, Richard E Woods 2nd Edition, Digital Image Processing, Pearson Education, 2003.
2. A.K. Jain, Fundamentals of Digital Image Processing, PHI.

Reference Book:

1. William K Pratt, Digital Image Processing, John WileyPublishers
2. Milan Sonka , Vaclav Hlavac , Roger Boyle, Image Processing Analysis and Machine Vision,

Thompson Learning(1999).

CO-PO-PSO MAPPING

DIGITAL IMAGE PROCESSING															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	2	1	1	1	1	1	-	-	-	-	3	2	1
CO2	3	3	3	2	2	2	2	2	-	-	-	-	3	3	2
CO3	3	3	3	2	2	2	2	2	-	-	-	-	3	3	2
CO4	3	3	3	3	3	3	3	3	-	-	-	-	3	3	3
Average	3	2.7	2.7	2	2	2	2	2	-	-	-	-	3	2.7	2
Level of Correlation: 3 - High 2 - Medium 1 - Low															

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
ADVANCED ARTIFICIAL INTELLIGENCE	**EI4101**	**3-0-0**	**3**

Prerequisite: Machine Learning, Basic Knowledge of Python.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Apply heuristic search and planning techniques for solving AI problems.

CO2: Represent and reason with knowledge using propositional and first-order logic.

CO3: Design AI systems using statistical and ensemble-based learning techniques in real-world applications.

CO4: Analyze and implement deep learning architectures for intelligent decision-making systems.

Module I: Principles of AI and Search Techniques **06 Hours**

Introduction to AI: Definition, history, types (narrow, general, super AI), applications, State Space Representation, Planning and Production Systems, Uninformed Search: Depth-First Search, Breadth-First Search, Informed Search: Greedy, A, Hill Climbing, Simulated Annealing, Problem Reduction: AND-OR graphs, AO algorithm, Constraint Satisfaction Problems (CSP)

Module II: Knowledge Representation and Reasoning **08 Hours**

Agents and environments, Knowledge-based agents, Propositional Logic, Syntax and Semantics, Logical inference, First-order Logic: Representation, quantifiers, inference, Ontological Engineering and Semantic Networks (Intro)

Module III: Learning Paradigms and Applications **08 Hours**

Forms of Learning: Supervised, Unsupervised, Reinforcement, Ensemble Learning: Bagging, Boosting, Stacking, Probabilistic Models: Naïve Bayes, HMMs, Bayesian Networks, Kernel Machines and Support Vector Machines (advanced aspects), Case Studies: AI in Healthcare, Signal Processing, and Smart Antennas

Module IV: Deep Learning and Neural Architectures **08 Hours**

Computational Graphs for Deep Learning, Feedforward and Deep Neural Networks, Convolutional Neural Networks (CNN) and applications in vision, Recurrent Neural Networks (RNN), LSTM, GRU, Transformers and Attention Mechanisms (Intro), Transfer Learning and Pretrained Models (e.g., BERT, ResNet), Reinforcement Learning: Q-Learning, Deep Q Networks (introductory)

Total lecture hours: **30 Hours**

Text Book:

1. Stuart J Russell, Peter Norwig, Artificial Intelligence – A modern approach, 2015, 3rd edition, Pearson, India.
2. Goodfellow, "Deep learning," Cambridge, Massachusetts: The MIT Press, 2016.

Reference Book:

1. Vinod Chandra S.S, AnandHareendran S., Artificial Intelligence: Principles and Applications, 2020, 2nd Edition, PHI Learning Pvt. Ltd., India
2. Alpaydinethem, Introduction to Machine Learning, 2019, 3rd edition, PHI Learning Pvt. Ltd., India.

CO-PO-PSO MAPPING

ADVANCED ARTIFICIAL INTELLIGENCE															
Course outcome	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO l	PSO 2	PSO 3
CO1	3	2	1	2	-	-	-	-	-	-	-	-	3	1	-
CO2	3	3	2	2	2	-	-	-	-	-	-	-	3	2	-
CO3	3	2	2	2	2	-	-	-	-	-	-	-	3	2	-
CO4	3	2	2	2	2	-	-	-	-	1	-	-	3	2	-
Average	3	2.25	1.75	2	2	-	-	-	-	0.25	-	-	3	1.75	-
Level of Correlation:						3 - High			2 - Medium				1 - Low		