Course Scheme for Undergraduate (Honors) Programme

In

Instrumentation & Control Engineering

Department of Electrical & Instrumentation

Engineering

Sant Longowal Institute of Engineering & Technology
Longowal-148106
Phone: 01672-253119/253120 Fax: 01672-280057
Website: www.sliet.ac.in

List of advanced level courses for B.E (Honors) in Instrumentation and Control Engineering

Semester-V							
S No.	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**Hrs**	**Credits**
1	HDIE-611	Sensors Technology	3	1	0	4	4
2	HDIE-612	Internet of Things	3	1	0	4	4
Semester-VI							
S No.	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**Hrs**	**Credits**
1	HDIE-621	Wireless Sensor Networks	3	1	0	4	4
Semester-VII							
S No.	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**Hrs**	**Credits**
1	HDIE-711	Industrial Automation	3	1	0	4	4
Semester-VIII							
S No.	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**Hrs**	**Credits**
1	PHIE-721	Project Honors	0	0	8	8	4

SYLLABUS

Bachelor (Honors)
of
Instrumentation and Control Engineering

Subject Code: **HDIE-611**
Title of the course: **Sensors Technology**

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:

After successful completion of course, the students should be able to

CO1: explain the recent trends in sensor technology and its engineering applications.

CO2: compare various advanced sensing materials based on physical, electrical, chemical, and biological properties.

CO3: express knowledge on different concepts of smart sensors and systems, and their design methods.

CO4: choose the appropriate sensor, such as chemical, robotics, fiber optics sensors, and biosensors in different application areas.

CO5: classify the fabrication techniques (IC, MEMS/NEMS), data processing and coding methods.

Mapping COs/Bloom's Taxonomy Level (BLs)					
COs	CO1	CO2	CO3	CO4	CO5
BLs	BL1	BL4	BL2	BL3	BL4

CO/PO Mapping:(Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)														
COs	Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	1	2	2	2	2	1	2	3	2	-
CO2	3	3	3	2	1	2	1	2	1	1	1	2	3	1
CO3	3	2	-	1	1	2	1	3	1	2	-	3	3	-
CO4	3	3	3	2	1	2	1	2	1	2	1	2	3	1
CO5	3	2	-	1	1	2	1	3	1	2	-	3	3	1

Unit	Main Topics and Course Outline	Hour(s)
Unit-1	**Sensors:** Introduction, Importance of sensor/smart sensor in automation. Features of Advanced sensing techniques. Introduction of advanced sensing materials. Properties (physical, electrical, chemical, biological) of materials which makes it suitable for sensing in different domain standards for smart sensor interface, Design and modeling issue in advanced sensing technique.	08
	Latest trends in sensor technology: Introduction, film sensors, thick film sensors, thin film sensors, semiconductor IC technology-standard methods, thick film processes, thin film processes, thin film deposition methods, thin film characterization methods, thin film delineation technique, compatibility issues, Longmuir-Blodgett films for sensor materials, film forming apparatus, dipping-ion sensors-gas sensors. Applications of thin and thick film sensors.	08
	MEMS/NANO: Micro electromechanical systems (MEMS), Micromachining, Biomedical Applications, Nano-sensors, Carbon Nanotubes.	08
Unit-2	**Fiber optic sensors:** Fiber optic sensors for the measurement of temperature, pressure, displacement, turbidity, pollution.	06
	Chemical Sensors: Introduction, semiconductor gas detectors, Ion selective electrodes, conductometric sensors, Mass sensors, electro chemical sensors, potentiometric sensors, amperometry sensors, enhanced catalytic gas sensors	06

	Robotics sensors: Introduction, characteristics, types of sensors, touch or tactile sensors, binary and analog sensors, proximity sensors, types of proximity sensors, contact and non-contact proximity sensors, robotic vision.	06
	Biosensors: Enzyme sensors, Cell based biosensors using Microelectrodes, Biosensors in Food Analysis.	06

Reference Books:

1. Khazan AD, "Transducers and their Elements – Design and Applications," Prentice Hall.
2. Patranabis D, "Sensors and Transducers," Prentice Hall.
3. Middlehook S and Audet SA, "Silicon Sensors," Academic Press.
4. Dorf RC, "Sensors, Nanoscience, Biomedical engineering and instruments," CRC Press.
5. Zanger H and Zanger C, "Fiber optics Communication and other applications," Macmillan publishing.
6. Joshi RM, "Biosensors," ISHA Books.
7. Webster JG, "Medical Instrumentation, Application and Design," Wiley India.

Subject Code: **HDIE-612**
Title of the course: **Internet of Things**

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:

After successful completion of course, the students should be able to:

CO1: explain the fundamentals of internet of Things and role of hardware and software components in IoT.
CO2: illustrate the interface of I/O devices, like sensors, actuators& communication modules.
CO3: describe the role of various internet protocols used for communication in IoT.
CO4: articulate the various security aspects of IoT.
CO5: explain the real-time applications of IoT in agriculture, home automation and healthcare.

Mapping COs/Bloom's Taxonomy Level (BLs)					
COs	CO1	CO2	CO3	CO4	CO5
BLs	BL2	BL2	BL2	BL3	BL4

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)														
COs	**Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	3	1	1	2	3	3	1	3	-
CO2	3	3	3	2	3	3	-	2	1	2	2	1	3	-
CO3	3	2	2	2	2	1	1	2	2	2	-	-	3	1
CO4	2	2	2	2	2	-	-	1	-	2	1	1	2	2
CO5	2	2	3	2	3	-	1	1	2	2	3	2	3	2

Unit	Main Topics & Course Outline	Hour(s)
Unit-1	**Introduction to Internet of Things**: Overview of internet of things- the edge, cloud and the application development, anatomy of the thing, industrial internet of things (IoT - Industry 4.0), real time diagnostics, design and development for IoT, understanding system design for IoT, design model for IoT.	08
	Elements of IoT; hardware component: Hardware components, communication, sensing, actuation, I/O interfaces,CC3200 Launchpad for Rapid Internet Connectivity with Cloud Service Providers	10
	Understanding Internet Protocols: Simplified OSI model, network topologies, standards, types of internet networking – ethernet, WiFi, local networking, bluetooth, Bluetooth Low Energy (BLE), Zigbee. Programming API‟s for communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.	06
Unit-2	**Securing the Internet of Things (IoT):** Security requirements in IoT architecture - security in enabling technologies, security concerns in IoT applications. security architecture in the internet of things, security requirements in IoT – insufficient authentication/authorization - insecure access control - threats to access control.	12
	IoT applications: IoT applications for smart homes, smart cities, smart parking, agricultural and healthcare.	12

Recommended Books-

1. Lucas Darnell, "The Internet of Things (A Look at Real World Use Cases and Concerns)", Kindle Edition, 2016.

2. Joe Biron & Jonathan Follett, “Foundational Elements of an IoT Solution – The Edge, The Cloud and Application Development”, Oreilly, 1st Edition, 2016.
3. Vijay Madisetti, ArshdeepBahga, “Internet of Things, A Hands on Approach”, University Press
4. SRN Reddy, Rachit Thukral and Manasi Mishra, “Introduction to Internet of Things: A practical Approach”, ETI Labs.
5. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press
6. Jeeva Jose, “Internet of Things”, Khanna Publishing House, Delhi
7. Adrian McEwen, “Designing the Internet of Things”, Wiley
8. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill.

Subject Code: **HDIE-621**
Title of the course: **Wireless Sensor Networks**

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:

After successful completion of course, the students should be able to

CO1: explain wireless sensor networks for a given application.

CO2: **assess** emerging research areas in the field of sensor networks.

CO3: compare MAC protocols used for different communication standards used in WSN

CO4: discover the new protocols for WSN.

CO5: classify the operating system in this field.

Mapping COs/Bloom's Taxonomy Level (BLs)					
COs	CO1	CO2	CO3	CO4	CO5
BLs	BL2	BL5	BL4	BL3	BL2

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)														
COs	**Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	2	-	1	2	2	2	2	1	2	3	2	-
CO2	3	2	3	3	3	3	3	2	3	2	3	3	3	3
CO3	3	2	1	2	2	1	2	1	2	3	1	2	3	2
CO4	3	2	-	2	1	2	1	3	1	2	-	3	3	-
CO5	3	3	3	2	1	2	1	2	1	1	1	2	3	1

Unit	Main Topics & Course Outline	Hour(s)
Unit-1	Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks.	08
	Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.	08
	Routing protocols, MAC protocols: Classification of MAC Protocols, S- MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee.	08
Unit-2	Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.	08
	Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication	06
	Single-node architecture, Hardware components & design constraints.	06
	Operating systems and execution environments, introduction to TinyOS and nesC.	04

Recommended Books-

1. W Dargie and C Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley & Sons Publications, 2011.
2. S Soloman, "Sensors Handbook" by McGraw Hill publication 2009.
3. F Zhao and L Guibas, "Wireless Sensor Networks", Elsevier Publications, 2004.
4. K Sohrby and D Minoli, "Wireless Sensor Networks": Technology, Protocols and Applications, Wiley-Inter science.

Subject Code: **HDIE-711**
Title of the course: **Industrial Automation**

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:

After successful completion of course, the students should be able to

CO1: explain the importance of automation techniques in industries.
CO2: reproduce simple programs using PLC for industrial based applications.
CO3: compare different systems for industrial automation like PLC, DCS and SCADA.
CO4: analyze SCADA system, its hardware and software interfacing and applications.
CO5: give examples of the application of automation system in industry.

Mapping COs/Bloom's Taxonomy Level (BLs)					
COs	CO1	CO2	CO3	CO4	CO5
BLs	BL2	BL1	BL2	BL4	BL2

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)														
COs	**Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	2	-	1	2	2	2	2	1	2	3	2	-
CO2	3	2	2	1	2	3	1	2	2	-	2	3	1	3
CO3	3	3	3	-	1	2	1	2	1	1	1	2	3	1
CO4	3	3	3	2	1	2	1	2	1	1	1	2	3	1
CO5	3	-	1	-	1	2	2	2	-	2	1	3	3	-

Unit	Main Topics & Course Outline	Hour(s)
Unit-1	**Introduction:** Components of automation system, need and benefits of industrial automation, architecture of industrial automation, applications of automation in industries, different systems for industrial automation.	08
	Measurement Systems and Data Acquisition: Introduction to sensors and measurement systems, signal conditioning and processing, calibration.	08
	Programmable Logic Controller (PLC): Block diagram of PLC, Programming languages of PLC, Basic instruction sets, Design of alarm and interlocks, Networking of PLC, Overview of safety of PLC with case studies. Process Safety through use of PLCs, application of international standards in process safety control.	08
Unit-2	**Distributed control systems (DCS):** Introduction to DCS, PLC versus DCS, Block diagram and function of each component, control room for DCS, security and access control.	08
	Introduction to Supervisory Control and Data Acquisition (SCADA) system: Definition, elements: hardware and Software, communication, applications of IoT based SCADA systems.	08
	Communication systems: MAP/TOP protocol, types of bus: Field Bus, Rack Bus, PROFIBUS, FIPBUS, HART protocol its frame structure, programming, implementation advantages and limitation.	08

Recommended Books-

1. J.W. Webb and R.A. Reis, "Programmable Logic Controllers - Principles and Applications", Prentice Hall Inc., New Jersey, 5th Edition, 2002.
2. F. D. Petruzella, "Programmable Logic Controllers", McGraw Hill, New York, 4th Edition, 2010.

3. S. Bhanot, “Process Control—Principles and Applications”, Oxford University Press, 1st Edition, 2008.
4. P.B. Deshpande and R.H. Ash, “Elements of Process Control Applications”, ISA Press, New York, 1995.
5. C. D. Johnson, “Process Control Instrumentation Technology”, Prentice Hall, New Delhi, 8th Edition, 2005.
6. K. Kant, “Computer-based Industrial Control”, Prentice Hall, New Delhi, 2nd Edition, 2011.
7. G. Dunning, “Introduction to PLCs”, Tata McGraw Hill, 2005.

Subject Code: **PHIE-721**
Title of the course: **Project Honors**

L	T	P	Credits	Weekly Load
0	**0**	**8**	**4**	**8**

Course Outcomes:

After successful completion of course, the students should be able to

CO1: develop the project requiring individual and teamwork skills.
CO2: explain the recent advancements in industrial instrumentation.
CO3: compile the design calculations and implementations in the area of the project.
CO4: express their work effectively through writing and presentation.
CO5: show professional responsibilities and respect for ethics.

Mapping COs/Bloom's Taxonomy Level (BLs)					
COs	CO1	CO2	CO3	CO4	CO5
BLs	BL3	BL2	BL6	BL2	BL2

CO/PO Mapping:(Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)														
COs	**Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	2	1	2	1	1	3	1	2	3	1
CO2	3	2	3	3	3	3	3	2	3	2	3	3	3	3
CO3	3	2	1	2	2	1	2	1	2	3	1	2	3	2
CO4	3	3	3	3	3	3	3	3	3	2	3	3	3	3
CO5	3	2	3	3	3	3	3	2	3	2	3	3	3	3

The objective of Project Work is to enable the student to take up investigative study in the broad field of Electrical Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment normally includes:

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility.
4. Preparing a Written Report on the Study conducted for presentation to the Department.
5. Final Seminar, as oral Presentation before a Departmental Committee including external expert.