COURSE TITLE	**FUNDAMENTALS OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**
COURSE CODE	**01CT0120**
COURSE CREDITS	**4**

Objective:

1 To aware the students with fundamental knowledge of electronics engineering and principles of instrumentation. This information will enable students to apply these concepts in biological techniques. This knowledge will help students for various advance courses in biotechnology and bioinformatics.

Course Outcomes: After completion of this course, student will be able to:

1 Evaluate electronic circuits and diode–transistor-based signal processing techniques for solving healthcare biosignal problems.

2 Demonstrate the use of operational amplifiers in linear applications such as amplifiers, integrators, and differentiators.

3 Analyze the design and performance of active filters and waveform generators by constructing circuits based on oscillator principles, and evaluate their frequency response and signal characteristics.

4 Design and simulate basic combinational and sequential digital circuits;illustrate the role of microprocessors and microcontrollers.

Pre-requisite of course: No Pre-requisite

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction to Electronics:** Historical perspectives of electronics, Understand the components like resistors, capacitors, inductors etc., Basic electrical signals, biosignals	2
2	**Semiconductor Devices:** Intrinsic and extrinsic semiconductor, P-N junction diode and diode circuits, Diode applications as half wave and full wave rectifier, Fundamentals of Transistor, Transistor amplifier	6

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Contents : Unit	Topics	Contact Hours
3	**Linear Integrated circuits and applications:** Need of integrated circuits, Introduction to operational amplifier(op-amp) in integrated circuit form, Block diagram of op-amp, Characteristics of op-amp, open loop op-amp and closed loop op-amp, inverting and non-inverting op-amp, Applications of op-amp like summing, scaling and averaging amplifiers, Integrator and differentiator	10
4	**Introduction to active filters and Oscillators :** Need of active filters, low pass filter, high pass filter, band pass filter, band reject filter, Oscillators and its principles, Phase shift oscillator, Square wave generator, triangular wave generator, sawtooth generator, voltage controlled oscillator	6
5	**Concepts of Digital Electronics:** Digital logic, Various logic gates like AND gate, OR gate, NOT gate,EX-OR gate, EX-NOR gate, NAND and NOR gate as universal gate, Introduction to Boolean algebra, Introduction to combinational logic circuits and learn combinational circuits like half adder, full adder, decoder, multiplexer, encoder, demultiplexers etc., Introduction to sequential logic circuits and learn flip flops, registers, shift register, counters etc., Introduction to microprocessor and microcontroller with necessary block diagram	12
6	**Introduction to basic instrumentation:** Sensors and transducers, Signal conditioning circuits, Transducer bridge concept with instrumentation amplifier, Basic measurement system, Static and dynamic characteristics of an instrument	6
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment 1** To simulate and analyze dual power supply for bio-medical instruments.	1
2	**Experiment 2** To design and analyze an amplifier for weak biomedical signals such as ECG/EEG.	1
3	**Experiment 3** To perform and analyze the conversion of biomedical signals from analog to digital form.	2
4	**Experiment 4** To perform and analyze the regulated power supply to protect the earable Biosensor systems.	2
5	**Experiment 5** Design and analyze of Op-Amp as assuming amplifier for weighted combination of multiple bio-sensor inputs.	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
6	**Experiment 6** Perform and analyze Op-Amp as an integrator for analyzing cumulative biological responses.	2
7	**Experiment 7** Perform and analyze Op-Amp as a low-pass filter for removal of noise in biomedical signals.	2
8	**Experiment 8** Perform and analyze Op-Amp as a high-pass filter for extraction of high-frequency bio-signals.	2
9	**Experiment 9** To interface the glucose sensor and analyze acquired data for diabetic patient.	2
10	**Experiment 10** To interface temperature sensor and demonstrate data acquisition and logging.	2
11	**Experiment 11** To interface ECG sensor and monitor electrical characteristics of heart.	2
12	**Experiment 12** To design an IoT-Based Health Monitoring System Using Wi-Fi Enabled Microcontroller.	2
13	**Experiment 13** To compare and analyze bioinformatics instruments with respect to their functional specifications.	2
14	**Experiment 14** To study and analyze patient monitoring systems: Specifications, Channel Configurations, and Interface Ports.	2
15	**Experiment 15** To study, parse, and visualize various data formats used in biomedical devices.	2
Total Hours		**28**

Textbook :

1 Electronics Principles, Albert Malvino and David Bates , Tata McGraw-Hill, 7th Edition, , 2006

2 Electronic Devices and Circuit Theory , Robert Boylestad and Louis Nashelsky, Pearson Education, 10th Edition, 2009

References:

1 Electronic Instrumentation and Measurements , Electronic Instrumentation and Measurements , David A. Bell, , Oxford University Press, 2nd Edition, 2007

2 Transducers and Instrumentation , Transducers and Instrumentation , D.V.S Murty, PHI Learning Pvt. Ltd. 2nd Edition, 2010

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
0.00	0.00	35.00	35.00	30.00	0.00

Instructional Method:

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Supplementary Resources:

1. Basic Electronics https://nptel.ac.in/courses/108101091
2. Digital Electronic Circuits https://nptel.ac.in/courses/108105132
3. Electronics for Analog Signal Processing-I: https://nptel.ac.in/courses/117106087
4. Transducers for Instrumentation: https://nptel.ac.in/courses/108102191

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