COMMON POOL OF GENERIC ELECTIVES (GE) COURSES OFFERED BY THE DEPARTMENT

GENERIC ELECTIVES (GE-1)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Electronic Circuits and Interfacing ELGE-3A	4	3	0	1	-	NIL

Learning Objectives

The Learning Objectives of this course are as follows:

- To understand the basics of operational amplifier and it's linear and nonlinear applications.
- To familiarize IC 555 Timer and its application
- Understand the working of multivibrators
- To understand working of various types of transducers.
- To introduce concept of embedded systems using Arduino.

Learning outcomes

The Learning Outcomes of this course are as follows:

- Familiarize with design of the linear and non-linear applications of an op-amp.
- Understand the working of multivibrators
- Understand working of various types of transducers.
- Understand working of Arduino

SYLLABUS OF ELGE-3A Total Hours- Theory: 45 Hours, Practicals: 30 Hours

UNIT – I (12 Hours)

Basic Operational amplifiers: Block diagram, symbol, op- amp parameters (IC 741).

Op -Amp Circuits: Closed loop Inverting, Non-inverting, Summing and difference amplifier, Integrator, differentiator, Instrumentation Amplifier, Audio Amplifier (LM386) Voltage to current converter.

Comparators: Basic comparator, Schmitt Trigger.

UNIT – II (11 Hours)

Signal Conditioning Circuits: Active filters: First order Butterworth low pass and high pass filter, Wide Band -Pass filter, Wide Band-Reject filter, All-Pass filter (Designing with Circuit diagrams and formulas only for all filter)

Signal Generators: Phase shift oscillator, Wein Bridge oscillator (Designing with Circuit diagrams and formulas)

Multivibrators (IC 555): Block diagram, Astable and Monostable circuit. Applications of Astable and Monostable multivibrators.

UNIT – III (11 Hours)

Transducers (Basic Working): Displacement transducers - Resistive (Potentiometric, Strain Gauges – Types, Gauge Factor, bridge circuits, Semi-conductor strain gauge),Capacitive (diaphragm), Hall effect sensors, Microphone, Touch Switch, Piezoelectric sensors, light (photoconductive, photo emissive, photo voltaic, semiconductor, LDR), Temperature (electrical and non-electrical), Pressure sensor.

UNIT – IV (11 Hours)

A-D and D-A Conversion: D-A conversion: 4-bit binary weighted resistor type, circuit and working. Circuit of R-2R ladder- Basic concept. A-D conversion characteristics (Number of channels, resolution), successive approximation ADC. (Mention the relevant ICs for all).

Data Acquisition using Arduino: Arduino: Birth, Open-Source community, Functional Block Diagram, Functions of each Pin, Applications of Arduino, IDE, Basic Interfacing and I/O Concept, Interfacing LED, Switch,7seg LED.

Practical component (if any) – Electronic Circuits and Interfacing
(Hardware and Circuit Simulation Software)

Learning outcomes

The Learning Outcomes of this course are as follows:

- Design application-oriented circuits using Op-amp.
- Design application-oriented circuits using timer IC
- Familiarization with different specifications of arduino boards.
- Interfacing of various sensors with arduino.

LIST OF PRACTICALS (Total Practical Hours – 30 Hours)

1. Study of inverting and non-inverting amplifier.
2. Study of analog adder/ subtractor circuit.
3. Study of basic integrator circuit/ basic differentiator circuit.
4. Design of first order LPF / first order HPF.
5. Study of basic astable multivibrator / monostable multivibrator.
6. 555 Timer-Rain alarm /Motor control by PWM /LED flasher circuit.

7. To determine the Characteristics of resistance transducer - Strain Gauge (Measurement Strain using half and full bridge.)/ To determine the Characteristics of LVDT.
8. To determine the Characteristics of Thermistors and RTD.
9. Test the different Arduino Boards, Open-Source and Arduino Shields and install Arduino IDE and its development tool.
10. Develop a program to Blink LED for 1second when switch is pressed.

Note: Students shall sincerely work towards completing all the above listed practicals for this course. In any circumstance, the completed number of practicals shall not be less than eight.

Essential/recommended readings

1. Measurement Systems, 4/e, Doeblin McGraw Hill, New York, 1992.
2. Electrical Measurements & Electronic Measurements by A.K. Sawhney
3. Electronic Instrumentation by H.S Kalsi, McGraw Hill
4. R. A. Gayakwad, Op-Amps and Linear IC_s, Pearson Education (2003)
5. Electronic Sensor Circuits and Projects, III Volume, Forrest M Mims, Master Publishing Inc.
6. Beginning Arduino Programming, Brian Evans, Technology in Action

Suggestive readings

1. Instrumentation- Devices and Systems by Rangan, Sarma, and Mani, Tata-McGraw Hill
2. Instrumentation measurements and analysis by Nakra & Choudhary
3. Measurement & Instrumentation- DVS Murthy
4. Timer, Op Amp, and Optoelectronic Circuits & Projects, Forrest M Mims, Master Publishing Inc.
5. Exploring Arduino, Jeremy Blum, Wiley
6. Beginning Arduino, Michael McRobetrs, Technology in Action
7. Practical Arduino Engineering, Harold Timmis, Technology in Action
8. Practical Arduino: Cool Projects for open-source hardware, Jonathan Oxer, Hugh Blemings, Technology in Action

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

GENERIC ELECTIVES (GE-2)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Modelling and Simulation ELGE-3B	4	3	0	1	12th Pass	Basic Knowledge of Python language

Learning Objectives

The Learning Objectives of this course are as follows:
It covers modeling and simulation principles as applied to engineering and social sciences. It discusses the techniques for modeling a simple to slightly complex system and perform statistical analysis. It covers about the steps involved in developing models for static, continuous and discrete systems. It also offers the introduction to number of latest models and simulation tools being used in industry with a set of examples. Examples may include modeling and analysis of manufacturing systems, computer-communication networks, operating system and various utilities and logistic systems.

Learning outcomes

The Learning Outcomes of this course are as follows:

- Enable to perform simulations for developing models in order to solve problems in static and dynamic systems.
- Evaluate simulation models and do the analysis of a number of systems existing in real life.
- Synthesize queuing theory, random numbers generators and their application to modeling and simulation.

SYLLABUS OF ELGE-3B Total Hours- Theory: 45 Hours, Practicals: 30 Hours

UNIT – I (12 Hours)

Introduction to Modeling and Simulation: Introduction and historical development in Modeling and Simulation. System, Model and Simulation. Real system vs. Model of the system. Analytical solution vs. Simulation. Static vs. Dynamic Simulation Models. Continuous time vs. Discrete time modeling system. Hybrid systems, Feedback systems, Iterative systems Modeling. Random numbers in Simulation, random variables with discrete and continuous probability distribution. Deterministic and Stochastic Modeling System. Mathematical Modeling & Mathematical Tools.

UNIT – II (11 Hours)

Modeling Techniques and Design Steps: Discrete Event Simulation Models. System Models and Events. State variables, Entities and Attributes. Steps of Model Designs, Verification, validation and calibration of the Model.
Single server Queuing system, Database server as Queuing System.
Monte Carlo Method for static System.
Discrete and continuous Markov Models.

UNIT – III (11 Hours)
Simulation Techniques and Specifications: Advantages and disadvantages, Limitations, Steps in Simulation Study.
Differential Equation System Specification DESS, Discrete Event System Specification DEVS, Discrete Time System Specification DTSS.
Random numbers in Simulation. Random numbers generation and testing, Random variables with Discrete and continuous probability distribution. Simulation with Mathematical Models, Stochastic Models

UNIT – IV (11 Hours)
Modeling and Simulation Tools with Applications: System development, Project planning, System definition, Model formulation, input data collection and analysis, Model translation, verification and validation, experimentation and Analysis.
Different Applications domain of Modeling and Simulation.
Case Studies: Simulation of DEVS in a Bank, School, Hospital, or any such system. Modeling and analysis of a manufacturing systems, grocery store, computer-communication network or CPU scheduling.

Importance of different Modeling and Simulation softwares and their selection.
Brief overview and usefulness of Modeling and Simulation softwares- Scilab, SPICE, VHDL, Freemat, IMODELER, platform JModelica.org, Statistical Analysis Software SAS, MS- Excel.

Practical component (if any) – Modelling and Simulation
(Python or any Simulation Software)

Learning outcomes

The Learning Outcomes of this course are as follows:

- Program for implementation, testing of random numbers
- Simulation of gaming dice
- Different Models implementation- GPSS, DEVS
- Implementation of DESS, Monte Carlo Method, Markov Chain
- Simulation of real time problems

LIST OF PRACTICALS (Total Practical Hours- 30 Hours)

1. Implement different methods of random number generation
2. Simulating games of dice that generate discrete random variate, using random number generation

3. GPSS models - queue, storage, facility, multi-server queue, decision making problems
4. Perform an experiment on Testing of random numbers.
5. Write a simulator for any DEVS model that has scalar real values for its inputs, states and outputs.
6. Define a DEVS counter that counts the number of non-zero input events received since initialization and outputs this number when queried by a zero valued input.
7. Formulate a causal simulator for multi-component DESS.
8. Implementing an application of Monte Carlo methods.
9. Implement an application of Markov's chain.
10. Simulation of single queue server system.
11. Study of an implemented goal programming system and on decision making tools.
12. Study of a Game theory problem and solution.

Note: Students shall sincerely work towards completing all the above listed practicals for this course. In any circumstance, the completed number of practicals shall not be less than ten.

Essential/recommended readings

1. Bernard P. Zeigler, Alexandre Muzy, Ernesto Kofman, 3ed, Theory of Modeling and Simulation, Academic Press : Elsevier 1985.
2. Narsingh Deo, System Simulation with Digital Computers, Prentice Hall of India, 1979.
3. Geoffrey Gordon, System Simulation, 2ndEd., PHI, 1987
4. Averill M. Law and W. David Kelton, Simulation Modeling and Analysis, 3rdEd., Tata McGraw Hill, 2003

Suggestive readings

1. Raj Jain, Art of Computer Systems Performance Analysis, John Wiley and Sons, Inc,1991
2. Sheldon M. Ross, Simulation, 4thEd., Elsevier 2008
3. Jerry Banks and John S. Carson, Barry L Nelson, Discrete-Event System Simulation, 5thEd., Prentice Hall, 2010

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.