Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Name of Program: Bachelor of Technology in Electronics & Communication with Specialization in IOT

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTEC401	EC	Linear Integrated Circuits	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives(CEOs):
This course provides the foundation education in operational amplifier and other linear integrated circuits and also familiarizes students with applications of various ICs.

Course Outcomes(COs):
After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes. The student will be able to:

1. Inculcate the basic principles, configurations and practical limitations of op-amp.
2. Explain and design the linear and non-linear applications of an Op-Amp and special application ICs.
3. To analyze, design and explain the characteristics and applications of active filters.
4. Elucidate and compare the working of Multivibrators, Oscillators.
5. Illustrate the function of application specific ICs such as Voltage regulators, PLL and its application in communication.

Syllabus

UNIT I **10 Hrs.**

Op Amps: Block diagram of Op-Amp, Basic Differential amplifier using transistors and its operation, characteristics and equivalent circuits of an ideal op-amp, Power supply configurations for OPAMP applications, Voltage Transfer Curve, open loop op-amp configurations: inverting, non-inverting and differential amplifier configurations, Closed loop op-amps or feedback amplifiers.

Linear Applications of Op-Amp: Voltage follower, Summing amplifier, Scaling and averaging amplifier, Integrators and differentiators, Instrumentation amplifier, Differential input and differential output amplifier, Log/ Antilog amplifier, V-I and I-V converter, analog multiplier-MPY634.

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UNIT II **9 Hrs.**

The Practical Op-Amp: Introduction, Input offset voltage, offset current, Bias Current, thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, Slew rate and its Effect, PSRR and gain –bandwidth product, frequency limitations and compensations, interpretation of TL082 datasheet.

UNIT III **8 Hrs.**

Active Filters: Characteristics of filters, Classification of filters, Magnitude and frequency response, Design of Butterworth 1st and 2nd order Low pass, High pass filters, Band pass and Band reject filters, All pass filters.

UNIT IV **9 Hrs.**

Signal Generators and Waveform Shaping Circuits: Oscillator-Phase-shift oscillators, Wein bridge oscillator, Quadrature Oscillator, Monostable and Astable Multivibrator, Precision rectifiers, Square and Triangular wave generator, VCO. Comparator, Zero Crossing Detector, Schmitt Trigger, Voltage limiters, Clipper and clampers, Absolute value output circuit, Peak detector, Sample and hold Circuit.

UNIT V **9 Hrs.**

Advanced IC applications: Applications as Frequency Divider, PLL, AGC, AVC using op-AMP, simple OP-AMP Voltage regulator, Fixed and Adjustable Voltage Regulators, Dual Power supply, Basic Switching Regulator and characteristics of standard regulator ICs – TPS40200, TPS40210

Text Books:

1. Ramakanth A. Gayakwad, "Op-Amps & Linear ICS", PHI, 4th edition, 1987.
2. D. Roy Chowdhury, " Linear Integrated Circuits", New Age International (P) Ltd, 2nd Edition, 2003.

References:

1. R.F. Coughlin & Fredrick Driscoll, "Operational Amplifiers & Linear Integrated Circuits" , 6thEdition, PHI
2. David A. Bell, "Operational Amplifiers & Linear ICs", Oxford University Press, 2nd edition, 2010.
3. Sergio Franco, "Design with Operational Amplifiers & Analog Integrated Circuits" Mcgraw Hill, 1988.
4. C.G. Clayton , "Operational Amplifiers " , Butterworth & Company Publ. Ltd./Elsevier, 1971.
5. K. Lal Kishore, " Operational Amplifiers and Linear Integrated Circuits", Pearson
6. Education, 2007.
7. L. k. Maheshwari, M M S Anand , Analog Electronics, PHI
8. TL082:Data Sheet:http://www.ti.com/lit/ds/symlink/t1082.pdf
9. Application Note:http://www.ti.com/lit/an/sloa020a/sloa020a.pdf

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10. MYP634: Data Sheet:http://www.ti.com/lit/ds/symlink/mpy634.pdf
11. Application Note:http://www.ticom/lit/an/sbfa006/sbfa006.pdf

List of Experiments:

1. Introduction of ASLKv2010 starter-kit & Simulation software
2. Measurements of Op-Amp parameters- CMRR, slew rate ,open loop gain.
3. To develop an understanding of Inverting and non-inverting Op-Amp.
4. To Learn about AC electrical characteristic of Op-Amp.
5. To Learn about Integrator and Differentiator.
6. To Learn about Instrumentation Amplifier.
7. To learn about Analog low pass and high pass filter.
8. To learn about Astable Multivibrator.
9. To learn and study about frequency generation using VCO.
10. To learn and study ADC/DAC circuits.
11. Design a function generator capable of generating a square wave and a triangular wave of a known frequency f.
12. Perform an experiment to plot the Input Vs Output characteristics for the AGC/AVC.

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			END SEM University Exam	Two Term Exam	Teachers Assess-ment*	END SEM University Exam	Teachers Assess-ment*				
BTEC402	EC	**Digital Electronics**	60	20	20	30	20	2	1	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
*__Teacher Assessment__ shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives(CEOs):-
The objective of this course is to-
1. Use of Boolean algebra and Karnaugh Map to simplify logic function.
2. Describe the operation of different Combinational and Sequential Logic Circuits.

Course Outcomes(COs):-
After completion of this course the students will be able to-
1. Design an optimal digital logic circuit to meet the given specifications.
2. Evaluate the performance of the given digital logic circuit based on specific criteria for reliable system implementation.

Syllabus

UNIT 1 **9 Hrs.**
Logic Function Optimization and Arithmetic Circuits
Logic Function, Sum of Product and Product of Sum form, Karnaugh Map minimization, Incompletely specified functions. Arithmetic Circuits- Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel Adders/Subtractors- Ripple Carry Adder, Carry Look Ahead Adder, Serial Adders /Subtractors.

UNIT 2 **9 Hrs.**
Combinational Circuits
Multiplexers, Demultiplexers, Encoders- Binary Encoders, Priority Encoders, Decoders, Synthesis of logic functions using Multiplexers and Decoders. Structural modeling of higher order circuits using lower order circuits, Code converters.

UNIT 3
Sequential Design Elements **10 Hrs.**
S-R Latch, D- Latch, Flip Flops- Master Slave and Edge Triggered, S-R, D, J-K, T , State Table, State Equation, Timing Diagram, Excitation Table, Flip Flop Conversions, Setup and Hold Time. 555 Timer chip and its application in multivibrators.

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UNIT 4

Sequential Circuits **9 Hrs.**

Registers, Shift Registers, Counters- Synchronous and Asynchronous counters, Design Examples, Synchronous Sequential Circuits, State Machines, Mealy and Moore Model, State Diagram, State Table, State Assignment, State Minimization, Design Examples.

UNIT 5

Logic Families **8 Hrs.**

Characteristics of Digital ICs- Voltage Levels, Speed, Power, Noise Margin, Fan In, Fan Out. Logic Families- TTL, MOS- NMOS, PMOS, CMOS, ECL, IIL.

Text Books:

1. M. Morris Mano: Digital Logic Design, Pearson Education
2. Salivahanan and Ari Vahagan: Digital Circuits and Design,Vikas Publishing House

References:

1. Anand Kumar: Fundamentals of Digital Circuits, PHI.
2. Floyd and Jain: Digital Fundamentals, Pearson Education.
3. Roland J. Tocci, Widmer, Moss: Digital Systems Principles and Applications, Pearson Education.
4. Stephen Brown I Zvanko Vranesic: Fundamentals of Digital Logic Design, The Mc Graw Hill

List of experiments

1. Implementation of Adders and Subtractors.
2. Realization of multiplexers and demultiplexers.
3. Synthesis of logic function using multiplexer.
4. Design and analysis of Encoder and Decoders.
5. Analysis of various flip flops with Preset and Clear capability.
6. Design of Astable , Monostable and Bistable multivibrator using 555 Timer.
7. Design of various Shift registers.
8. Design of Johnson and Ring counter.
9. Design of synchronous and asynchronous up/down counters.
10. Design of logic functions using PLDs.
11. Design of some minor projects based on digital circuits to solve real life problems.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTEE503	EE	Control System Engineering	60	20	20	0	0	3	1	0	4

Legends: **Th** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

The course will provide understanding of open loop and closed loop systems. Students will understand the stability, time and frequency domain responses of first and second order system inputs.

Course Outcomes (COs):

After the successful completion of this course students will be able to

1. Demonstrate the understanding of basic elements and modeling of the control system.
2. Determine mathematical models of physical systems.
3. Analyze the stability in time domain and frequency domain.
4. Design the controllers and compensators for the system.

Syllabus:

UNIT I **8 Hours**

Introduction: Basic Elements of Control System, Open loop and Closed loop systems, Differential equation, Transfer function, Modeling of Electrical systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph, Constructional and working concept of ac servomotor.

UNIT II **10 Hours**

Time Domain Analysis: Standard test signals, Time response of first order systems, Characteristic Equation of Feedback control systems, Transient response of second order systems, Time domain specifications, Steady state response, Steady state errors and error constants. P, PI, PD and PID Compensation.

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UNIT III **10 Hours**

Stability Analysis and Root locus: The concept of stability – Routh's stability criterion: qualitative stability and conditional stability, limitations of Routh's stability. The root locus concept: construction of root loci, effects of adding poles and zeros to G(s) H(s) on the root loci.

UNIT IV **10 Hours**

Frequency domain Analysis: Frequency domain specifications: Bode diagrams, determination of Frequency domain specifications and Phase margin and Gain margin, Stability Analysis from Bode Plots, Polar Plots, Nyquist Plots Stability Analysis. Compensation techniques: Lag, Lead, Lead-Lag Controllers design in frequency Domain.

UNIT V **7 Hours**

State Space Analysis of Continuous Systems: Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations, State Transition Matrix and it's Properties, Concepts of Controllability and Observability.

Textbooks:

1. J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007.
2. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 2nd Edition, 2002.

References:

1. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition, 1995.
2. M.Gopal, "Digital Control and State Variable Methods", 2nd Edition, TMH, 2007. Schaum's Outline Series, "Feedback and Control Systems", Tata McGraw- Hill, 2007.
3. John J.D'azzo & Constantine H.Houpis, "Linear control system analysis and design", Tata McGrow-Hill, Inc., 1995.
4. Richard C. Dorf & Robert H. Bishop, "Modern Control Systems", Addidon – Wesley, 1999.

List of Practicals:

1. To generate step response of a transfer function.
2. To generate impulse response of a transfer function.
3. To generate ramp response of a transfer function.
4. To determine the torque speed characteristics and transfer function of a DC servomotor.
5. To analyze the characteristics of a small AC servomotor and determine its transfer function.
6. To determine the transient and frequency response of a second order system.

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7. To analyze the performance of various types of controllers used to control the temperature of an oven.
8. To analyze the stability using Nyquist plot from a transfer function.
9. To generate root locus from a transfer function.
10. To analyze the stability using Bode plot from a transfer function.
11. To analyze the performance characteristics of analog PID Controller using simulated system.
12. To design different cascade compensation network for a given system.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTECIOT 401	EC	Sensors and Signal Conditioning	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
*__Teacher Assessment__ shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives(CEOs):
1. Be able to identify the different sensors available for specific engineering applications
2. Be able to understand the construction and working of different types signal conditioning
3. Understand the various measurement techniques.
4. Understand the errors in measurements and their rectification.

Course Outcomes(COs):
Student will be able to
1. Understand the different types of Sensor.
2. Sense and analyze different physical parameter.
3. Identify and implement different signal conditioning circuit as per the physical requirement.

Syllabus

UNIT I **10 Hrs.**

Introduction to Sensor-Based Measurement Systems

Concepts and Terminology: Measurement systems, Transducers, sensors and actuators, Signal conditioning and display, Interfaces, data domains, and conversion, Sensor Classification, Interfering and modifying inputs, Compensation techniques.

Static Characteristics of Measurement Systems: accuracy, precision, sensitivity, Linearity and resolution, systematic and random errors.

UNIT II **9 Hrs.**

Primary Sensors

Temperature sensors: Bimetals, Pressure sensors, Flow velocity and Flow-rate sensors, Level sensors, Force and torque sensors, Acceleration and inclination sensors, Velocity sensors.

Materials for Sensor: Conductors, semiconductors, and dielectrics, Magnetic materials, Thick-Film technology, Thin-Film technology, Micromachining technologies.

UNIT III **10 Hrs.**

Resistive Sensors and its Signal Conditioning

Resistive Sensors: Potentiometers, Strain Gauges Fundamentals: Piezoresistive effect, types and

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applications. Resistive Temperature Detectors (RTDs), Thermistors: Models, Thermistor Types and Application, Magneto-resistors, Light-Dependent Resistors (LDRs), Resistive Hygrometers, Resistive Gas Sensors, Liquid Conductivity Sensors.

Signal Conditioning: Measurement of Resistance, Voltage Dividers, Wheatstone Bridge: Balance and Deflection Measurements, Sensitivity and linearity, linearization of resistive sensor bridges, Sensor bridge calibration and balance, Power supply of Wheatstone bridges, Detection methods of Wheatstone bridge, Differential and Instrumentation Amplifiers, Interference types and reduction.

UNIT IV **9 Hrs.**

Reactance Variation and Electromagnetic Sensors its signal Conditioning

Capacitive Sensors: variable and differential capacitor. Inductive Sensors: Variable Inductance, eddy current sensor, LVDT, Electromagnetic Sensor.

Signal Conditioning for Reactance Variation Sensors: problems and alternatives, AC Bridges: Sensitivity and linearity, Capacitive bridge analog linearization, ac amplifiers and power supply decoupling, Electrostatic shields and driven shields.

UNIT V **8 Hrs.**

Self-Generating Sensors and its Signal Conditioning

Thermoelectric Sensors: Thermocouples, Piezoelectric Sensors, Pyroelectric Sensors, Photovoltaic Sensor, Electrochemical Sensors.

Signal Conditioning: Chopper and Low-Drift Amplifiers, Electrometer and Trans-impedance amplifiers, Charge Amplifiers.

Text Books:

1. Ramón Pallás-Areny, John G. Webster, "Sensors and Signal Conditioning", 2nd Edition, John Wiley & Sons, 2012.
2. Walt Kester, "Practical Design Techniques for Sensor Signal Conditioning", Analog Devices, 1999.

References:

1. E.O. Doebelin, D.N. Manik, "Measurement systems", 6th Edition, Tata McGraw Hill, 2012.
2. R. Pallas-Areny and J. G. Webster, "Analog Signal Processing", John Wiley & Sons, 1999.

List of Experiment:

1. To study various Primary sensor.
2. To study RTD for Temperature measurement.
3. To study Strain Gauge for pressure measurement.
4. To study LDR and Photodiode for sensing light intensity.
5. To study Thermocouple for Temperature measurement.
6. To study Photovoltaic for sensing light parameter.
7. Case study on Temperature sensing.
8. Case study on light sensing.
9. Case study on Humidity sensing.
10. Case study on Distance measurement.

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCS403	CS	Data Structures & Algorithms	60	20	20	30	20	3	1	2	5

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Course Educational Objectives(CEOs):

1. To teach efficient storage mechanisms of data for an easy access.
2. To design and implementation of various basic and advanced data structures.
3. To introduce various techniques for representation of the data in the real world.
4. To develop application using data structures.
5. To teach the concept of protection and management of data.

Course Outcomes(COs):

Upon completion of the subject, students will be able to:

1. Get a good understanding of applications of Data Structures.
2. Develop application using data structures.
3. Handle operations like searching, insertion, deletion, traversing mechanism etc. on Various data structures.
4. Decide the appropriate data type and data structure for a given problem.
5. Select the best algorithm to solve a problem by considering various problem characteristics, such as the data size, the type of operations, etc.

Syllabus

UNIT I **10 Hrs.**

Introduction, Overview of Data structures, Types of data structures, Primitive and Non Primitive data structures and Operations, Algorithms. Characteristic of Array, One Dimensional Array, Operation with Array, Two Dimensional Arrays, Three or Multi-Dimensional Arrays. Strings, Array of Structures, Drawbacks of linear arrays, Pointer and Arrays, Pointers and Two Dimensional Arrays, Array of Pointers, Pointers and Strings.

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UNIT II **9 Hrs.**

The Stack as an ADT, Stack operation, Array Representation of Stack, Link Representation of Stack, Application of stack – Recursion, Polish Notation .

The Queue as an ADT, Queue operation, Array Representation of Queue, Linked Representation of Queue, Circular Queue, Priority Queue, & De-queue, Application of Queues.

UNIT III **9 Hrs.**

Linked List as an ADT, Linked List vs. Arrays, and Memory Allocation & De-allocation for a Linked List, Linked List operations, Types of Linked List, Implementation of Linked List, Application of Linked List polynomial.

UNIT IV **9 Hrs.**

Definitions and Concepts, Binary trees, operations on binary trees, Binary tree and tree traversal algorithms, operations on binary trees, List, representation of Tree. Graph Representation, Graph traversal (DFS & BFS).

UNIT V **9 Hrs.**

Sort Concept, Shell Sort, Radix sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, List Search, Linear Index Search, Index Sequential Search Hashed List Search, Hashing Methods, and Collision Resolution.

Text Books:

1. Ashok N. Kamthane, "Introduction to Data structures", Pearson Education India.
2. Tremblay & Sorenson, "Introduction to Data- Structure with applications", Tata Mc- Graw Hill.
3. Bhagat Singh & Thomas Naps, "Introduction to Data structure", Tata Mc- Graw Hill.
4. Robert Kruse, "Data Structures and Program Design", PHI.
5. Aaron M. Tanenbaum & Moshe J. Augenstein, "Data Structure using PASCAL", PHI.

References:

1. Rajesh K. Shukla, Data Structures Using C & C++, Wiley- India.
2. Data Structures Using C, ISRD Group, Second Edition, Tata McGraw-Hill.
3. Balagurusamy, Data Structure Using C.
4. Prof. P.S. Deshpande, Prof. O.G. Kakde, C & Data Structures, Dreamtech press.
5. Data Structures, Adapted by: GAV PAI, Schaum's Outlines.

List Of Experiments:

1. To develop a program to find an average of an array using AVG function.
2. To implement a program that can insert, delete and edit an element in array.
3. To develop an algorithm that implements push and pop stack operations and implement the same using array.
4. To perform an algorithm that can insert and delete elements in queue and implement the same using array.

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5. To implement an algorithm for insert and delete operations of circular queue and implement the same using array.
6. To develop an algorithm for binary tree operations and implement the same.
7. To design an algorithm for sequential search, implement and test it.
8. To develop an algorithm for binary search and perform the same.
9. To implement an algorithm for Insertion sort method.
10. To develop an algorithm that sorts number of elements using bubble sort method.
11. To design an algorithm for Merge sort method and implement the same.

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BTEC405	EC	Programming with Arduino	0	0	0	60	40	0	0	4	2

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
*__Teacher Assessment__ shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Syllabus

Study of Arduino and various programs based on Arduino.

Experiment List

E.N.	Aim
1.	Understanding Arduino IDE and Arduino board family.
2.	Understanding I/O access on ATMega328p
3.	Interfacing LED and Seven Segment.
4.	Interfacing Switch and Keypad.
5.	Program based on Timers.
6.	Experimenting data transfer using SPI Communication.
7.	Establishing i2c interface with ATMega328p
8.	Program based on Interrupts.
9.	Program based on Serial Communication.
10.	Interfacing GSM, RFID, Wi-Fi.

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