B.E, III Semester, Industrial Internet of Things

Semester: III		
Analysis and Design of Digital Circuits **(Theory and Practice)**		
Course Code:	**BIO302**	**CIE Marks:50**
L:T:P:	**3:0:2**	**SEE Marks: 50**
Credits:	**4**	**Total Marks: 100**
Hours:	**40 L+ 26 P**	**SEE Duration: 03 Hours**

Course Learning Objectives: The students will be able to

1	Familiarize with the simplification techniques & design various combinational digital circuits using logic gates.
2	Introduce the analysis and design procedures for synchronous and asynchronous sequential circuits.
3	Analysing & designing different applications of Combinational & Sequential Circuits
4	Analysing & designing sequential circuits using SR, JK, D, T flip-flops and Mealy & Moore machines
5	Know the importance of programmable devices used for designing digital circuits.

UNIT-I

Prerequisites: *Number systems, Boolean Algebra, Logic Gates, Comparison of Combinational & Sequential Circuits.* **Principles of combinational logic**: Introduction, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 variables, Incompletely specified functions (Don't care terms), Quine- McClusky techniques- 3 & 4 variables. **Laboratory Sessions/ Experimental learning**: 1. Study of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. 2. Design a 4-bit Binary to Gray code converter using logic gates. **Applications:** OR gate in detecting exceed of threshold values and producing command signal for the system and AND gate in frequency measurement. **Video link / Additional online information:**	**8 Hrs**

1. https://www.youtube.com/watch?v=FT03XrQ8Bi4	
UNIT-II	
Prerequisites*: *Decoder, Encoders, Multiplexers & Demultiplexer **Design and Analysis of combinational logic:** Full Adder & Subtractors, Parallel Adder and Subtractor, Look ahead carry Adder, Binary comparators, Decoders & Multiplexers as minterm/maxterm Generator. **Laboratory Sessions/ Experimental learning:** 1. Design a full adder with two half adders using logic gates. 2. Design an Adder cum Subtractor circuit which adds when input bit operation=1 or subtract if 0, using logic gates. 3. Design 4-bit comparator using IC7485. 4. Realize a Boolean expression using decoder IC74139. **Applications:** Communication systems, Speed synchronization of multiple motors in industries. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=RZQTTfU9TNA, 2. https://www.youtube.com/watch?v=36hCizOk4PA, 3. https://www.youtube.com/watch?v=397DDnkBm8A	**8 Hrs**
UNIT-III	
Prerequisites*: *SR, JK, D, T flipflops **Flip-Flops and its Applications:** Latches and Flip Flops, Master-slave JK flip-flop, Timing concerns in sequential circuits, Shift Registers – SISO, SIPO, PISO PIPO, Universal shift register, Counters – Synchronous and Asynchronous. **Laboratory Sessions/ Experimental learning:** 1. Develop SR, D, JK &T flip flop using logic gates 2. Design a 6-bit Register using D-Flipflop **Applications:** Frequency divider circuit, frequency counter. **Video link / Additional online information:** **1.** https://www.youtube.com/watch?v=Nxpei7Kp4Vs	**8 Hrs**
UNIT-IV	

Sequential Circuit Design: Characteristic equations, Design of a synchronous mod-n counter using clocked JK, D, T and SR flip-flops, Melay& Moore Models. **Laboratory Sessions/ Experimental learning:** 1. Design a Synchronous Counter for a given sequence- 0, 2, 4, 6, 0 2. Design a 4-bit Asynchronous up/down counter 3. Design a 4-bit binary Synchronous up/down **Applications:**Data synchronizer, Counter. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=O3If0Nr9to0	**8 Hrs**
UNIT-V	
Applications of Digital Circuits: Design of a Sequence Detector, Guidelines for construction of state graphs, Design Example – Code Converter, Design of Binary Multiplier, Design of Binary Divider. **Programmable Logic Devices:** PLA, PAL, FPGA. **Laboratory Sessions/ Experimental learning:** 1. Designing of sequence detector using necessary digital components. **Video link / Additional online information:** 1. https://nptel.ac.in/courses/117108040/	**8 Hrs**
LABORATORY EXPERIMENTS	
1. Verify a) The sum-of product expression using universal gates. b) The product-of-sum expression using universal gates. 2. Design and implement (a) Full Adder using basic logic gates. (b) Full subtractor using basic logic gates. 3. Design and implement 4-bitParallelAdder/ Subtractor using IC 7483. 4. Design and implement BCD to Excess-3 code conversion and vice-versa using IC 7483. 5. Realize	

(i) Adder & Subtractors using IC 74153

6. Realize 4-variable function using IC 74151(8:1MUX)

7. Realize the following flip-flops using NAND Gates.

(a) Clocked SR Flip-Flop

(b) JK Flip-Flop

8. Design and implement the following flip-flops using NAND Gates

(a) D-Flip-Flop

(b) T-Flip-Flop

9. Realize the following shift registers using IC7474

(a)SISO (b) SIPO (c) PISO (d) PIPO

10 Realize the following shift registers using IC7474

(a) Ring Counter (b) Johnson Counter.

11. Realize

(a) Mod-N Counter using IC7490

Virtual Lab Links: http://vlabs.iitkgp.ernet.in/dec/

Course outcomes:	
CO1	Illustrate simplification of Algebraic equations using K-map & Quine-McCluskey Technique.
CO2	Design the combinational logic circuits.
CO3	Analyse& design different applications of Combinational & Sequential Circuits to meet desired need within realistic constraints.
CO4	Design the sequential circuits using SR, JK, D, T flip-flops and Mealy & Moore machines
CO5	Know the importance of programmable devices used for designing digital circuits.
Reference Books:	
1.	John M Yarbrough, “Digital Logic Applications and Design”, Thomson Learning, 2001.
2.	Donald D. Givone, “Digital Principles and Design”, McGraw Hill, 2002.
3.	Charles H Roth Jr., Larry L. Kinney –Fundamentals of Logic Design, CengageLearning, 7th Edi
4.	. Morris Mano, –Digital Design‖, Prentice Hall of India, Third Edition.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three qquizzes are onducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. aculty may adopt innovative methods for conducting quizzes eeffectively. The number of quizzes ıay be more than three (conduct additional quizzes aand take best three). The three tests are onducted for 50 marks each and the average of aall the tests are calculated for 50. The marks for the elf -study are 20 (2 presentations are b held for 10 marks each). The marks obtained in test, quiz and elf -studies are added to gget marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO Mapping:

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO2	**1**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO3	**1**	**2**	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO4	**1**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO5	**1**	**1**	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

High-3, Medium-2, Low-1

Semester: III		
Analog Electronic Circuits (Theory and Lab)		
Course Code:	**BIO303**	**CIE Marks:50**
L:T:P	**3:0:2**	**SEE Marks: 50**
Credits:	**4**	**Total :100**
Hours:	**40 L+ 26 P**	**SEE Duration: 03+03 Hours**
Course Learning Objectives: The students will be able to		
1	To know low frequency response for various configurations of BJT and FET amplifier.	
2	Understand the different topologies of feedback amplifiers and oscillators.	
3	Analyse the Power amplifier circuits in different modes of operation	
4	Sketch and explain typical Frequency Response graphs for each of the Filter circuits and switching circuits of Op-Amps and analyse its operations.	
5	Differentiate between various types of DACs and ADCs, Timer IC's and evaluate the performance of each with neat circuit diagrams.	

Module -I	
Prerequisites: *Operation of Transistor* **Transistor Biasing:** Fixed bias circuits, Emitter stabilized biased circuits, Voltage divider biased circuits. **Transistor at Low Frequencies:** BJT transistor modeling, CE Fixed bias configuration, Voltage divider bias, Emitter follower, Analysis of circuits re model. **Laboratory Sessions/ Experimental learning:** 1. 8Plot the transfer and drain characteristics of a BJT and calculate its drain resistance, mutual conductance and amplification factor. **Applications:** Analog switches, Phase shift oscillator, chopper, and current limiter. **Video link/ Additional online information:** http://www.nptelvideos.in/2012/12/electronics.html	**8 Hrs**
Module -II	
Prerequisites: *Working of JFET* FET Amplifiers: JFET small signal model, Fixed bias configuration, Voltage divider configuration, Common Gate configuration,	**8 Hrs**

Feedback Amplifier: The Four Basic Feedback Topologies, The series-shunt, series-series, shunt-shunt and shunt-series amplifiers. **Laboratory Sessions/ Experimental learning:** 1. Design and test the voltage-shunt feedback amplifier and calculate the parameters using with and without feedback. **Applications:** Radios, Televisions, Communication systems, Computers, Industrial controlled applications. **Video link/ Additional online information:** https://www.youtube.com/watch?v=xHNDrbB-iWY	
Module -III	
Oscillators: Oscillator operation, FET based Phase shift oscillator, Wien bridge oscillator, LC and Crystal Oscillators. **Output Stages and Power Amplifiers:** Introduction, Classification of output stages, Class A output stage, Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage, Class C tuned Amplifier. **Laboratory Sessions/ Experimental learning:** 1. Plot the frequency response using any class of power amplifier **Applications:** Audio power amplifiers, Switching type power amplifiers, and Wireless Communication **Video link/ Additional online information:** http://www.nptelvideos.in/2012/12/electronics.html	**8 Hrs**
Module -IV	
OP-Amps as DC Amplifiers: Direct coupled voltage followers, Non-inverting amplifiers, inverting amplifiers. **Op-Amps as AC Amplifiers:** Capacitor coupled voltage follower, Capacitor coupled non inverting amplifiers, Capacitor coupled inverting amplifiers, Capacitor coupled difference amplifier. **Application:** Summing, Scaling and Averaging Amplifiers, Instrumentation amplifier, Zero Crossing Detector, Schmitt trigger. **Laboratory Sessions/ Experimental learning:** 1. Design and find the gain of a Differential Amplifier.	**8 Hrs**

Applications: Industrial areas (Temperature Indicator, Light Intensity Meter, Temperature Controller) **Video link / Additional online information:** https://www.youtube.com/watch?v=GjG8oshYNLQ	
Module -V	
Op-Amp Circuits: DAC - Weighted resistor and R-2R ladder, ADC- Successive approximation type, Active Filters, First and second order low-pass and high-pass Butterworth filters, Band-pass filters, Band reject filters. **555 Timer and its applications:** Mono-stable and Astable Multivibrators. **Laboratory Sessions/ Experimental learning:** 1. Demonstrate a simple light circuit that uses a decade counter to drive two traffic lights and uses 555 timer chips as clock. **Applications:** PWM (Pulse Width Modulation) & PPM (Pulse Position Modulation), Analog frequency meters, Digital logic probes. **Video link / Additional online information**: https://www.youtube.com/watch?v=-KMAQxc3J3g	**8 Hrs**

Laboratory Experiments

1. Design and set up the RC coupled Single stage BJT amplifier and determine the gain-frequency response, input and output impedances

2.Design an oscillator with tank circuit having two inductances and one capacitance and compare the practical frequency with theoretical frequency.

3.Design an oscillator with tank circuit having two capacitance and one inductance and compare the practical frequency with theoretical frequency.

4. Design an Oscillator using FET whose tank circuit produces a total phase shit of 180 and calculate the frequency of output waveform.

5. Design an oscillator whose frequency is 2MHZ and compare with the theoretical frequency.

6. Find a suitable power amplifier that removes the cross over distortion and calculate the

efficiency

7. Design active second order Butterworth low pass filters.

8. Test a comparator circuit and design a Schmitt trigger for the given UTP and LTP

values and obtain the hysteresis.

9.Design 4 bit R – 2R Op-Amp Digital to Analog Converter (i) using 4 bit binary input

from toggle switches and (ii) by generating digital inputs using mod-16 counter.

10. Design Astable Multivibrator using 555 Timer.

11. Design Monostable Multivibrator using 555 Timer.

12. To set up and study a triangular waveform generator using Op-amp for 1kHz frequency .

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyse the DC biasing & frequency response of BJT Amplifier and FET amplifier
CO2	Design various Feedback amplifiers.
CO3	Evaluate the efficiency of power amplifiers and working of oscillator.
CO4	Describe DC amplifier, AC Amplifiers and its application.
CO5	Acquire knowledge about Active Filters, DAC, ADC and Timer.

Reference Books	
1.	Robert L.Boylestad and louis Nashelsky, “Electronic Devices and circuit Theory”, PHI/Pearson Education,11 TH Edition.
2.	Adel S Sedra, Kenneth C Smith “Microelectronic Circuits, Theory and Applications”, 6th Edition, Oxford, 2015.ISBN:978-0-19-808913-1.
3.	Behzad Razavi, “Fundamentals of Microelectronics”, John Weily ISBN 2013 978-81-265-2307-8,2nd Edition, 2013.
4.	K.A.Navas, “Electronics Lab Manual”, Volume I, PHI, 5th Edition, 2015, ISBN: 9788120351424.
5	“Operational Amplifiers and Linear IC‟s”, David A. Bell, 2nd edition, PHI/Pearson,

	2004. ISBN 978-81-203-2359-9.
6	"Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain, 4th edition, Reprint 2006, New Age International ISBN 978-81-224-3098-1.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**
CO3	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**

CO4	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**
CO5	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**

High-3, Medium-2, Low-1

Semester: III		
NETWORK ANALYSIS		
Course Code:	**BIO304**	**CIE Marks: 50**
L: T:P	**2:0:2**	**SEE Marks: 50**
Credits:	**3**	**Total : 100**
Hours:	**40L**	**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Describe basic network concepts emphasizing source transformation source shifting, mesh and nodal techniques to solve for resistance/impedance, voltage, current and power.	
2	Explain network Thevenin‘s, Millman‘s, Superposition, Reciprocity, Maximum Power transfer and Norton‘s Theorems and apply them in solving the problems related to Electrical Circuits.	
3	Describe Series and Parallel Combination of Passive Components as resonating circuits, related parameters and to analyze frequency response.	
4	Explain the behavior of networks subjected to transient conditions. Use applications of Laplace transform to solve network problems.	
5	Study two port network parameters like Z, Y, T and h and their inter-relationships.	

UNIT-I

Prerequisites: *Ohm's law, Kirchhoff's laws* **Basic Concepts:** Introduction, Practical sources, Source transformations, Star – Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC networks, Concepts of super node and super mesh. **Laboratory Sessions/ Experimental learning:** 1. Find the current through and voltage across the load in the given circuit. **Applications:** Simplification and analysis of analog circuits, microwave circuit analysis **Video link / Additional online information :** **1.** https://www.youtube.com/watch?v=UMhBgyK8F0U	**8 Hrs**
UNIT-II	
Graph Theory and Network equations: Graph of a network, Trees, Co-trees and Loops, Incidence Matrix, Cut-set Matrix, Tie-set Matrix and loop currents, Number of possible trees of a graph, Analysis of networks, Duality. **Laboratory Sessions/ Experimental learning:** NA **Applications:** Simplification and analysis of analog circuits, microwave circuit analysis **Video link / Additional online information:** https://www.youtube.com/watch?v=F8qiM3o0Jc0	**8 Hrs**
UNIT-III	
Network Theorems: Superposition Theorem, Millman's theorem, Thevenin's and Norton's theorems, Reciprocity theorem, Maximum Power transfer theorem. **Laboratory Sessions/ Experimental learning**: 1. Verify superposition theorem for a given circuit. **Applications:** Simplification and analysis of analog circuits, microwave circuit analysis. **Video link / Additional online information:** https://www.youtube.com/watch?v=bnjiLg4xfh8	**8 Hrs**

UNIT-IV	
Prerequisites: *Laplace Transforms, Properties of Laplace Transform and Inverse Laplace Transform using partial fraction method.* **Transient behaviour and initial conditions:** Behaviour of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for DC excitations, Applications of Laplace Transforms in circuit analysis. **Laboratory Sessions/ Experimental learning:** 1. Plot the response of a series RLC circuit. **Applications:** In the analysis of transmission lines and waveguides. **Video link / Additional online information :** https://www.youtube.com/watch?v=g-CGI7oUSCA	**8 Hrs**
UNIT-V	
Two port network parameters: Introduction, open circuit impedance parameter, short circuit admittance parameter, hybrid parameters, transmission parameter, relationship between parameters. **Laboratory Sessions/ Experimental learning:** 1. Plot the frequency response characteristics for a series RL, RC circuit. 2. Plot the frequency response characteristics for a parallel RL circuit. 3. Measure two port parameters for a given network **Applications:** For analysis of communication systems and antennas. **Video link / Additional online information:** https://www.youtube.com/watch?v=YLGrugmDvc0	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Determine currents and voltages in a circuit using network simplification techniques.
CO2	To solve the network problems using graphical methods.
CO3	To simplify the complex circuits using network theorems.
CO4	To analyze simple DC circuits and applies the concepts to transient conditions.
CO5	Solve the given network using specified two port network parameters like Z or Y

	or T or h and Evaluate frequency response related parameters through the RLC elements, in resonant circuits.

Reference Books	
1.	M.E. Van Valkenberg (2000), "Network analysis", Prentice Hall of India, 3rd edition, 2000, ISBN: 9780136110958.
2.	Roy Choudhury, "Networks and systems", 2nd edition, New Age International Publications, 2006, ISBN: 9788122427677.
3.	Hayt, Kemmerly and Durbin –Engineering Circuit Analysis", TMH 7th Edition, 2010.
4.	J. David Irwin /R. Mark Nelms, "Basic Engineering Circuit Analysis", John Wiley, 8th edition, 2006.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**
CO3	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**
CO4	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**
CO5	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**

High-3, Medium-2, Low-1

Semester: III		
Analog and Digital Electronics Laboratory		
Course Code:	**BIOL305**	**CIE Marks: 50**
L:T:P	**0:0:2**	**SEE Marks: 50**
Credits:	**1**	**Total:100**
Hours:	**20**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Demonstrate various circuits using PSPICE and verify functionality.	
2	To be exposed to the operation and application of electronic devices and their circuits.	
3	To analyze circuit characteristics with signal analysis using Op-amp ICs.	
4	Familiarize with Modern EDA tool such as Verilog.	
5	Acquire knowledge on different types of description in Verilog.	

PART A	
Simulation using EDA software (EDWinXP, PSpice, MultiSim, Proteus, CircuitLab or any other equivalent tool can be used) 1. Monos table Multivibrator using 555 Timer. 2. Astable Multivibrator using 555 Timer. 3. RC Phase shift oscillator. 4. Inverting Schmitt Trigger. 5. Narrow Band-pass Filter and Narrow band-reject filter	

6. Precision full-wave rectifier.	

PART B

Simulate the following using Verilog Code

1. Write a Verilog program for 2 to 4 decoder.
2. Write a Verilog program for 8 to 3 encoder (without priority & with priority)
3. Write Verilog code to convert 4 bit binary to gray code.
4. Write a Verilog code for 8 to 1 multiplexer
5. Write Verilog code of Comparator

Course outcomes:

CO1	Demonstrate various circuits using PSPICE and verify functionality.
CO2	Design and test of analog circuits using OPAMPs
CO3	Design and implement basic circuits using IC (OPAMP and 555 timers).
CO4	Use the modern engineering tool such as Verilog necessary for engineering practice.
CO5	Write code and verify functionality of digital circuit/system

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO2	**1**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO3	**1**	**2**	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO4	**1**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO5	**1**	**1**	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

High-3, Medium-2, Low-1

Engineering Science Course:

Semester: III		
Digital System Design using Verilog		
Course Code:	**BIO306A**	**CIE Marks:50**
L: T:P:	**3:0:0**	**SEE Marks: 50**
Credits:	**3**	**Total :100**
Hours:	**40L**	**SEE Duration: 03 Hours**
Course Learning Objectives: The students will be able to		
1	Understand the concepts of Verilog Language	
2	Study of verilog data flow descriptions.	
3	Study of design and operation of behavioral programming using verilog	
4	Understand the concepts of Verilog Structural Language	
5	Design and diagnosis of verilog circuits using synthesis module.	

UNIT 1	
Introduction to Verilog: Structure of verilog Module, Operators, Data types, Units and ports, Verilog constructs. **Laboratory Sessions/ Experimental learning:**	**8Hrs.**

1. Develop a mini project to demonstrate the concept of de morgan's theorem. **Applications:** 1. Conversion from one form of expression to another **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=FT03XrQ8Bi4	
UNIT 2	
Data-Flow Description: Highlights Of Data-Flow Description, Signal Declaration And Assignment Statement , Constant Declaration and Constant Assignment Statements , Assigning a Delay Time to the Signal-Assignment Statement **Laboratory Sessions/ Experimental learning:** 1. Develop an algorithm using data flow description **Applications:** 1. Programs for simple mathematical calculations **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=RZQTTfU9TNA, 2. https://www.youtube.com/watch?v=36hCizOk4PA, 3. https://www.youtube.com/watch?v=397DDnkBm8A	**8Hrs.**
UNIT 3	
Behavioral Description: Behavioral Description Highlights, Structure of the Verilog Behavioral Description , Sequential Statements: IF Statement , The case Statement , Verilog casex and casez , The wait-for Statement , The Loop Statement: For-Loop, While-Loop , Verilog repeat , Verilog forever **Laboratory Sessions/ Experimental learning:** 1. Develop an algorithm using behavioural description **Applications:** 1. Comparators using behavioural description. 2. Multiplexers using behavioural description. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=Nxpei7Kp4Vs	**8Hrs.**
UNIT 4	
Structural Description: Highlights of Structural Description, Organization of Structural	**8Hrs.**

Description , Half adder and full adder design using structural description, Half subtractor and full subtractor design using structural description, generate and parameter (Verilog) , Exercises **Laboratory Sessions/ Experimental learning:** 1. Code converters using behavioural description. **Applications:** 1. Decoders using Structural description. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=O3If0Nr9to0	
UNIT 5	
Synthesis Basics: Highlights of Synthesis, Synthesis Information From Module , Mapping Always in the Hardware Domain ,Mapping the Signal-Assignment Statement to Gate Level, Mapping Logical Operators, Mapping the IF Statement, Mapping the case Statement , Mapping the Loop Statement **Laboratory Sessions/ Experimental learning:** 1. Weather analysis of a weak using synthesis module 2. synthesis verilog code for state machine **Video link / Additional online information:** 1. https://nptel.ac.in/courses/117108040/	**8Hrs.**

Course Outcomes: After completing the course, the students will be able to

CO1	Understand verilog programming basics
CO2	Describe how dataflow description of verilog code works and write simple programs using dataflow description.
CO3	Describe how Behavioural description of verilog code works and write simple programs using dataflow description.
CO4	Design simple circuits using verilog structural description.
CO5	Synthesize different assign statements and simple applications using verilog.

Text Books:

1.	HDL WITH DIGITAL DESIGN VHDL AND VERILOG, Nazeih Botros, MERCURY LEARNING INFORMATION Dulles, Virginia Boston, Massachusetts New Delhi, 2015.

Reference Books:	
1.	Samir Palnitkar "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, Sec Edition
2.	Charles H Roth Jr., Larry L. Kinney "Fundamentals of Logic Design", Cengage Learning, 7th Editio

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksis executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	1	-	-	1	-	-	1
CO2	3	3	2	2	-	1	-	-	1	-	-	1

CO3	**3**	**3**	**2**	**2**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**
CO4	**3**	**3**	**2**	**2**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**
CO5	**3**	**3**	**2**	**2**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**

High-3, Medium-2, Low-1

Semester: III		
SENSORS AND INSTRUMENTATION **(Theory)**		
Course Code:	**BIO306B**	**CIE Marks:50**
L:T:P:	**3:0:0**	**SEE Marks: 50**
Credits:	**3**	**Total:100**
Hours:	**40 L**	**SEE Duration: 03 Hours**
Course Learning Objectives: The students will be able to		
1	To understand the basic concepts of transducers.	
2	To identify the mathematical model of transducer and its response for various inputs.	
3	To understand the construction and working principle of resistive type transducers.	
4	To impart knowledge on capacitive type and inductive type transducer.	
5	To understand the construction and working principle of sensors and its real time applications.	

UNIT-I	
Prerequisites: *knowledge of basic of sensors* General block diagram of measurements systems – Methods of measurements – Classification and selection of transducers – Error analysis – Statistical methods – Odds and uncertainty, classification of instruments, applications of measurement systems. **Laboratory Sessions/ Experimental learning:** Displacement versus output voltage characteristics of a potentiometer transducer. **Applications:** Selection of appropriate sensors for different industrial applications. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=pFM9K9JrsU4&list=PLm_MSClsnwm9HsQaejlrxvkNPWbvxgwWs 2. https://www.youtube.com/watch?v=Z6evuxYjYMs&list=PLSGws_74K019wiWyVU3CnVMMqAcF3_sxz	**8 Hrs**
UNIT-II	
Static characteristics – Accuracy, precision, resolution, sensitivity, linearity – Dynamic characteristics – Mathematical model of transducer – Zero, first and second order transducers – Response for impulse, step, ramp and sinusoidal inputs **Laboratory Sessions/ Experimental learning:** 1. Characteristics of Strain gauge. 2. Characteristics of Load cell. **Applications:** Platform Weighing **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=78NpGnA1sX4	**8 Hrs**
UNIT-III	
Principle of operation – Construction details – Characteristics and application of resistance potentiometer – Strain gauge – Resistance thermometer – Thermistor – Hot-wire anemometer – Humidity sensor – Induction potentiometer – Variable reluctance transducers – LVDT. **Laboratory Sessions/ Experimental learning:** 1. Characteristics of thermocouple. 2. Characteristic of LDR and thermistor.	**8 Hrs**

3. Step response characteristics of RTD. **Applications:** Air conditioning Heating and Ventilation Devices. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=lUjBmV4wMtA 2. https://www.youtube.com/watch?v=kb3W-1_deLc	
UNIT-IV	
Capacitive transducer and types – Capacitor microphone – Frequency response – Piezoelectric transducer – Hall effect transducer – Magnetostrictive – Digital transducers – Fiber optic sensors – Thick and thin film sensors (Bio sensor and chemical sensor) **Laboratory Sessions/ Experimental learning:** 1. Characteristics of LVDT. 2. Characteristics of Hall effect transducer. **Applications:** Power turbines, hydraulics, automation, aircraft, satellites, nuclear reactors, current transformers, Position sensing. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=emtskVpbtyY 2. https://www.youtube.com/watch?v=E0NMM_Pq0IY	**8 Hrs**
UNIT-V	
Environmental monitoring sensors (Water quality and air pollution) – Photo electric transducer – Vibration sensor – Ultrasonic based sensors – Introduction to MEMS and Nanotechnology – Applications – Robotics – Home appliance. **Laboratory Sessions/ Experimental learning:** Study of smart transducers. **Applications:** Smart city developments with latest technological sensors. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=hyHcnZsgbRU 2. https://www.youtube.com/watch?v=jQF4_hO_2qw	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Choose appropriate sensors for the measurement of various physical parameters.

CO2	Obtain the mathematical model of the transducer and its response for various inputs.
CO3	Choose appropriate resistive type transducer for the measurement of various physical parameters.
CO4	Select capacitive and inductive type transducers for the measurement of various physical parameters.
CO5	Select the suitable type of sensors for real time applications.

Reference Books	
1.	"A Course in Electrical and Electronics Measurements and Instrumentation", Sawhney A K, Dhanpat Rai and Sons, New Delhi, 2013
2.	"Sensors and Transducers", Patranabis D, Prentice Hall of India, Second Edition, 2010
3.	"Transducers and Instrumentation", Murthy D V S, Prentice Hall of India, New Delhi, Second Edition, 2010.

Continuous Internal Evaluation (CIE):

Theory for 100 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 100 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**3**	**3**	**2**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**2**
CO3	**3**	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**1**
CO4	**3**	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**1**
CO5	**3**	**2**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**1**

Semester: III		
COMPUTER ORGANIZATION & ARCHITECTURE (Theory)		
Course Code:	**BIO306C**	**CIE Marks:50**
L:T:P:	**3:0:0**	**SEE Marks: 50**
Credits:	**3**	**Total :100**
Hours:	**40L**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Explain the basic sub systems of a computer, their organization, structure and Operation.	
2	Illustrate the concept of programs as sequences of machine instructions.	
3	To understand the different ways of communicating with I/O devices and to introduce memory types including cache memories.	
4	Describe memory hierarchy and concept of virtual memory.	
5	To analyse concepts of Pipelining and other computing systems.	

UNIT 1	
Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance – Processor Clock, Basic Performance Equation. **Machine Instructions and Programs:** Numbers, Arithmetic Operations and Characters, IEEE standard for Floating point Numbers, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing. **Laboratory Sessions/ Experimental learning:** 1. Understanding various parts of CPU of a PC. 2. Study of Microprocessor and understanding of its various instruction **Applications:** Understand the functionality of the various units of computer. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=K7fnDf-P6_c#action=share 2. https://www.youtube.com/watch?v=9-9z32T-5WU#action=share 3. https://www.youtube.com/watch?v=Szn_lwHal04#action=share	**8Hrs.**
UNIT 2	
Prerequisite :*Number system* **Addressing Modes:** Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions. **Laboratory Sessions/ Experimental learning:** 1. Write an ALP to find the sum of two numbers and verify if the sum is an even or odd number and simulate the output. 2. Write an ALP to transfer a block of data from one location to other and simulate the output. **Applications:** Project based on microprocessor. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=s4cVdsK3XiQ#action=share 2. https://www.youtube.com/watch?v=xKTNgA_ee58	**8Hrs.**
UNIT 3	
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware,	**8Hrs.**

Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access, and Buses. **Laboratory Sessions/ Experimental learning:** Study any one input/output device and examine its various input output ports details. **Applications:** Interfacing of Peripheral devices **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=Y17TLZCSe4M#action=share 2. https://www.youtube.com/watch?v=Zw79moR2gFs	
UNIT 4	
Memory System: Basic Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Cash Memories, Mapping Functions, Replacement Algorithm, Virtual Memories, Secondary Storage-Magnetic Hard Disks. **Laboratory Sessions/ Experimental learning:** Implement and simulate a simple memory unit which is capable of reading and writing data within a single clock cycle. **Applications:** Understanding the various memories **Video link / Additional online information :** 2. https://www.youtube.com/watch?v=lpVyGPNyjEs#action= 3. https://www.youtube.com/watch?v=NhyIUpOj5V8#action=share 4. https://www.youtube.com/watch?v=xXk3WiPGux8#action=share 5. https://www.youtube.com/watch?v=aeDyDIo-G44#action=share	**8Hrs.**
UNIT 5	
Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Micro programmed Control ,Pipelining ,Basic concepts, Role of Cache memory, Pipeline Performance **Laboratory Sessions/ Experimental learning:** Evaluate the possible control sequence for implementing a multiplication instruction using registers for a single bus organization **Applications:** Microprocessor **Video link / Additional online information:** 2. https://www.youtube.com/watch?v=R41DfN3NpIM#action=share	**8Hrs.**

3. https://www.youtube.com/watch?v=b5thcNYBrQc	

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify the functional units of the processor and the factors affecting the performance of a computer
CO2	Demonstrate the ability to classify the addressing modes, instructions sets and design programs.
CO3	Understand the different ways of accessing an input / output device including interrupts.
CO4	Illustrate the organization of different types of semiconductor and other secondary storage memories.
CO5	Illustrate the simple processor organization based on hardwired control and micro programmed control.

Reference Books:	
1.	Carl Hamacher, ZvonkoVranesic, SafwatZaky: "Computer Organization", 6th Edition, Tata McGraw Hill, 2011.
2.	Andrew S. Tanenbaum, Todd Austin, "Structured Computer Organization", 6th Edition, Pearson, 2013.
3.	David A. Patterson, John L. Hennessy: "Computer Organization and Design – The Hardware / Software Interface ARM Edition", 4th Edition, Elsevier, 2009.
4.	William Stallings: "Computer Organization & Architecture", 7th Edition, PHI, 2006.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**2**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**
CO2	**3**	**3**	**2**	**2**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**
CO3	**3**	**3**	**2**	**2**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**
CO4	**3**	**3**	**2**	**2**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**
CO5	**3**	**3**	**2**	**2**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**

High-3, Medium-2, Low-1

B.E, IV Semester, Industrial Internet of Things

Semester: IV		
Engineering Electromagnetics		
Course Code:	**BIO401**	**CIE Marks:50**
L:T:P:	**2:0:0**	**SEE Marks: 50**
Credits:	**3**	**Total :100**
Hours:	**30L**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Understand the applications of Coulomb's law and Gauss law to different charge Distributions.	
2	Understand the physical significance of Biot-Savart's Law, Amperes' Circuital Law and Stokes' theorem for different current distributions.	
3	Know the physical interpretation of Maxwell's equations and its applications in plane waves.	
4	Understand the concepts of Smith Chart for impedance matching.	
5	Acquire knowledge on different types of transmission lines.	

UNIT 1	
Prerequisites: *Vector Algebra, Coordinate systems (Rectangular Coordinate System, Cylindrical Coordinate System and Spherical Coordinate System), gradient, divergence and curl* **Electrostatics: Coulomb's Law, Electric Field Intensity, Flux density and potential:** Coulomb's law , Electric field intensity, Field due to line charge, Field due to Sheet of charge, Field due to continuous volume charge distribution, Electric flux, Electric flux density, Electric potential, Potential difference, relation between Electric field intensity (E) & potential (V), potential gradient, Electric dipole, Energy density in electrostatic fields. **Laboratory Sessions/ Experimental learning:** 1. Determine the electric field intensity at a point due to uniform linear charge (ρ L) and point charges using MATLAB. 2. Determine the electric field intensity at a point due to surface charge using MATLAB. 3. Determine the potential difference between two points on a ring having linear	**6Hrs.**

charge density, ρ L using MALAB. **Applications:** The Van de Graaff generator, Xerography, Ink Jet Printers and Electrostatic Painting, Smoke Precipitators and Electrostatic Air Cleaning **Video link / Additional online information:** 1. https://youtu.be/ckAVB3_NP2Q 2. https://youtu.be/IH2fFNaR9YM 3. https://youtu.be/JhTT-wew-OE	
UNIT 2	
Gauss' law, Divergence, Poisson's and Laplace's Equations: Gauss law, Maxwell's First equation, Application of Gauss' law, Divergence theorem, Current, Current density, Conductor, The continuity equation, Boundary conditions (dielectric-dielectric, conductor-dielectric, conductor-free space), Poisson's and Laplace's Equations, Uniqueness theorem. **Laboratory Sessions/ Experimental learning:** 1. Evaluate the current flowing through a given surface using MATLAB. 2. Verify the Divergence theorem using MATLAB. **Applications:** Used for calculation electrical field for a symmetrical distribution of charges **Video link / Additional online information:** 1. https://youtu.be/N_jUbFnlqEg 2. https://youtu.be/XtH2WAhvYIM 3. https://youtu.be/gu934FBac6g	**6Hrs.**
UNIT 3	
Magnetostatics: Steady Magnetic Field-Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Gauss's law for magnetic fields, Magnetic flux and Magnetic flux density, Maxwell's equations for static fields, Magnetic Scalar and Vector Potentials. **Magnetic Forces and magnetic materials:** Force on a moving charge and differential current element, Force between differential current elements, Magnetization, magnetic susceptibility, permeability, Magnetic boundary conditions, Inductances, magnetic energy, magnetic circuit. **Laboratory Sessions/ Experimental learning:** Determine the magnetic field intensity at a point due to magnetic field using MATLAB. **Applications:** Motors, Generators, Loudspeakers, MRI	**6Hrs.**

Video link / Additional online information : 1. https://youtu.be/ebGM_q19gY0 2. https://youtu.be/uXQbYJVzlQ0 3. https://youtu.be/aYRBXI63Oqk	
UNIT 4	
Time varying Fields and Electromagnetic wave propagation: Time varying fields & Maxwell's equations, Faraday's law, Transformer and Motional Electro - Motive Forces, Displacement current, Maxwell's equation in differential and integral form, Time varying potentials. **Electromagnetic wave propagation:** Derivation of wave equations from Maxwell's equations, Relation between E and H, Wave propagation in - lossy dielectrics, lossless dielectrics, free space and good conductor, skin-effect, Poynting theorem. **Laboratory Sessions/ Experimental learning:** Determine the parameters of wave using MATLAB. **Applications:** Optoelectronics **Video link / Additional online information :** 1. https://youtu.be/xxIb9Qv6t7E 2. https://youtu.be/_X061_y9Lqw 3. https://youtu.be/OoQS1ex4kJA	**6Hrs.**
UNIT 5	
Transmission line: Introduction, Transmission line parameters, Transmission line equations, input impedance, standing wave ratio and power, Smith Chart basic fundamentals, types of transmission lines - coaxial line, strip line, micro strip line. **Applications of transmission line**: Impedance matching and tuning: single stub tuning, double stub tuning, and the quarter wave transformer. **Laboratory Sessions/ Experimental learning:** Simulation of micro strip transmission line using FEKO software. **Applications:** Telephone, Cable TV, Broadband network **Video link / Additional online information:** 1. https://youtu.be/z9GbnMPDCVA 2. https://youtu.be/yk1Mu9fQ6mA	**6Hrs.**

3. https://youtu.be/PO5ExHOKIJM	

Course Outcomes: After completing the course, the students will be able to	
CO1	Evaluate problems on electrostatic force, electric field due to point, linear, surface charge and volume charges.
CO2	Apply Gauss law to evaluate Electric fields due to different charge distributions by using Divergence Theorem. Determine potential and capacitance using Laplace equation and Poisson equation.
CO3	Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations.
CO4	Apply Maxwell's equations for time varying fields and evaluate power associated with EM waves using Poynting theorem.
CO5	Determine the parameters of transmission lines and use Smith chart for determining the impedance and admittance.

Reference Books:	
1.	Matthew N. O. Sadiku, "Elements of Electromagnetics", Oxford University Press, Edition VII, 2018.
2.	David M Pozar, "Microwave Engineering", John Wiley & Sons, Inc., 4th edition, 2014.
3.	W.H. Hayt. J.A. Buck & M Jaleel Akhtar, "Engineering Electromagnetics", Tata McGraw – Hill, Edition VIII, 2014.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
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CO2	3	3	3	2	2	1	-	-	-	-	-	1
CO3	3	3	3	2	2	1	-	-	-	-	-	1
CO4	3	3	3	2	2	1	-	-	-	-	-	1
CO5	3	3	3	2	2	1	-	-	-	-	-	1

High-3, Medium-2, Low-1

Semester: IV		
Principles of Communication Systems(Theory and Lab)		
Course Code:	**BIO402**	**CIE Marks:50**
L:T:P:	**3:0:2**	**SEE Marks: 50**
Credits:	**4**	**Total : 100**
Hours:	**40 L+ 26 P**	**SEE Duration: 03Hours**
Course Learning Objectives: The students will be able to		
1	Understand the concepts of Analog Modulation schemes viz; AM, FM.	
2	Interpret the different types of noise in communication system.	
3	Learn the concepts of digitization of signals viz; sampling, quantizing, and encoding.	
4	Analyze the Base Band data transmission system.	
5	Realize the basic concepts of coherent and non-coherent digital modulation techniques and understand the basics of spread spectrum modulation.	

UNIT 1	
Prerequisites: *Modulation, Need for Modulation, and types of Modulation.* **Amplitude Modulation:** Introduction to AM, Time-Domain description, Frequency-Domain description, Generation of AM wave: Square Law Modulator, Switching modulator,Detection of AM waves: Envelop detector. **Double side band suppressed carrier modulation (DSBSC):** Time-Domain description, Frequency-Domain representation, Generation of DSBSC waves: Ring modulator. Coherentdetection of DSBSC modulated waves. Costas loop. **Single Side-Band Modulation (SSB):** Single side-band modulation, Time-Domain description, Frequency-Domain description of SSB wave, Phase discrimination method for generating an SSB modulated wave. **Laboratory Sessions/ Experimental learning:** 1. Generation of AM signal using MATLAB	**8Hrs.**

2. Generation of DSBSC signal using transistor **Applications:** Broadcast transmissions, Air band radio, Quadrature amplitude modulation **Video link / Additional online information :** 1. https://nptel.ac.in/courses/117/105/117105143/ 2. https://youtu.be/00ZbuhPruJw	
UNIT 2	
Frequency Modulation: Basic definitions, FM, narrow band FM, wide band FM, transmission bandwidth of FM waves, and generation of FM waves: indirect FM and direct FM. **Demodulation of FM waves:** Phase-locked loop, Nonlinear model of the phase – lockedloop, Linear model of the phase – locked loop, Nonlinear effects in FM systems. **Noise:** Introduction, Types of noise, Noise Figure, Equivalent noise temperature, Noise inAM receivers, Noise in FM receivers, Superheterodyne receivers. **Laboratory Sessions/ Experimental learning:** 1. Generation of FM signal using MATLAB 2. Design of mixer **Applications:** FM radio broadcasting, telemetry, radar, seismic prospecting, and monitoring new-born for seizures via EEG, two-way radio systems, sound synthesis, magnetic tape- recording systems and some video-transmission systems. **Video link / Additional online information :** 1. https://nptel.ac.in/courses/117/105/117105143/	**8Hrs.**
UNIT 3	
NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth. NOISE IN ANALOG MODULATION: Introduction, Receiver Model, Noise in DSB-SC receivers. Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis, and De-emphasis in FM **Laboratory Sessions/ Experimental learning:** ASK modulation and demodulation. **Applications:** Biomedical engineering, communication system **Video link / Additional online information:**	**8Hrs.**

1. https://nptel.ac.in/courses/117/105/117105077/ 2. https://nptel.ac.in/courses/117/101/117101051/	
UNIT 4	
Inter-symbol Interference & Signal Space representation: Base band transmission: Discrete PAM Signals, Power spectra of Discrete PAM Signals, Inter Symbol Interference, Nyquist criterion for Distortion less Base band Binary Transmission, Eye diagram, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Optimum receivers for coherent detection: Correlation Receivers and Matched Filter receiver. **Laboratory Sessions/ Experimental learning:** 1. Eye diagram using MATLAB **Applications:** Ethernet, RFID marker localization signals, Radar Systems **Video link / Additional online information:** 1. https://nptel.ac.in/courses/117/105/117105077/ **2.** https://nptel.ac.in/courses/117/101/117101051/	**8Hrs.**
UNIT 5	
Prerequisites: *Probability & Random Process* **Pass band transmission:** Digital modulation techniques: Phase shift Keying techniques using Coherent detection: Generation, Detection and Error probabilities of BPSK and QPSK, QAM, Frequency shift keying techniques using Coherent detection: BFSK generation, detection, and error probability. **Non-coherent orthogonal modulation techniques:** BFSK, DPSK Symbol representation, Block diagrams of Transmitter and Receiver, Probability of error (without derivation of probability of error equation) **Principles of Spread Spectrum Communication Systems:** Model of a Spread Spectrum, Digital Communication System, Direct Sequence Spread Spectrum Systems (DSSS),Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum (FHSS). **Laboratory Sessions/ Experimental learning:** 1. Analyze constellation of 16-QAM Using MATLAB	**8Hrs.**

Applications: CDMA, WiMAX (16d, 16e), telemetry, caller ID, garage door openers, wireless communication, mobile communication and Satellite Communication, LANs, Bluetooth, RFID, GPS, Wi-Fi, etc., **Video link / Additional online information :** 1. https://nptel.ac.in/courses/117/105/117105077/ 2. https://nptel.ac.in/courses/117/101/117101051/ 3. https://nptel.ac.in/courses/117/105/117105136/	

Lab Experiments

Hardware Experiments

1. Amplitude Modulation and Demodulation using transistor
2. DSB SC Modulation.
3. Frequency modulation and FSK using IC 8038/2206
4. Pre-emphasis & de-emphasis
5. Demonstrate sampling and reconstruction Pulse Amplitude Modulation and Detection
6. Generation of PWM/PPM signal
7. Generation and detection of ASK Waveform
8. FSK Generation and detection.
9. TDM of two band limited signals.

Course outcomes:	
CO1	Examine the concepts of analog modulation techniques such as amplitude, modulations andits variations like DSB-SC and SSB-SC.
CO2	Analyze frequency modulation and compute performance of different types of noise.
CO3	Apply the concepts of noise in analog modulation and analysis of pre-emphasis and deemphasis circuit.
CO4	Analyze the signal space representation of digital signals.
CO5	Evaluate the performance of a baseband and pass band digital communication system. and spread spectrum techniques.

Reference Books:	
1.	Simon Haykins& Moher, Communication Systems, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN 978 – 81 – 265 – 2151 – 7.

2.	Simon Haykins, "An Introduction to Analog and Digital Communication", John Wiley, 2003.
3.	John G Proakis and MasoudSalehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.
4	B P Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University Press., 4th edition, 2010, ISBN: 97801980738002.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. The test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in tests, quizzes and assignment are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the timetable and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marksfor the laboratory are 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three subdivisions. Each unit will have an

internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**
CO3	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**
CO4	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**
CO5	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**

High-3, Medium-2, Low-1

Semester: IV		
Modern Control systems		
Course Code:	**BIO403**	**CIE Marks:50**
L:T:P:	**4:0:0**	**SEE Marks: 50**
Credits:	**4**	**Total : 100**
Hours:	**50L**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Formulate the mathematical modelling of systems and understand the concepts of transfer function	
2	Obtain transfer function using block diagram reduction and signal flow graph techniques.	
3	Analyse the response of first and second order systems using standard test signals and analyse steady state error.	
4	Analyse stability of systems using RH criteria, Root Locus, Nyquist, Bode plot and polar plot.	
5	Obtain state variable model for electrical systems.	

UNIT 1	
Introduction to Control Systems: open loop and closed loop systems, Types of feedback, Differential equation of Physical Systems – Mechanical Systems, Electrical Systems, Analogous Systems. **Block diagrams and signal flow graphs:** Transfer functions, Block diagram algebra and Signal Flow graphs. **Laboratory Sessions/ Experimental learning:** 1. Determine and plot poles and zeros from the transfer function using MATLAB. **Applications:** Electric Hand Drier, Automatic Washing Machine, DC motor,Automatic Electric Iron, Voltage Stabilizer **Video link / Additional online information :** 1. https://youtu.be/R0E3uKSKdME 2. https://youtu.be/zXMklO-jxIo	**10Hrs.**
UNIT 2	
Time Response of feedback control systems: Standard test signals, Unit step response of	**10Hrs.**

First and Second order Systems. Time response specifications, Time response specifications of second order systems for underdamped system, steady state errors and error constants. **Introduction to Controllers:** P, PI, PD and PID Controllers. **Laboratory Sessions/ Experimental learning:** 1. Obtain step and impulse response of a unity feedback first order system for a given forward path transfer function using MATLAB. 2. Obtain step and impulse response of a unity feedback second order system for a given forward path transfer function using MATLAB. **Applications:** Industrial Control systems **Video link / Additional online information :** 1. https://youtu.be/ziu1OTwUrbw https://youtu.be/YuZ3iwA-47I	
UNIT 3	
Stability analysis using RH Criteria and root locus: Concepts of stability, Necessary conditions for stability, Routh Hurwitz stability criterion, Relative stability analysis, Introduction to Root-Locus Techniques, the root locus concepts, Construction of root loci. **Laboratory Sessions/ Experimental learning:** 1. Obtain Root Locus Plot of the system for a given forward path transfer function using MATLAB. **Applications:**Used to determine the dynamic response of a s system **Video link / Additional online information:** 1. https://youtu.be/cez4InLZ7Pw 2. https://youtu.be/sUDoTw_LIbk 3. https://youtu.be/Irxppc_LCUk	**10Hrs.**
UNIT 4	
Stability analysis using Nyquist criteria and Bode plots: Polar plot, Nyquist Stability criterion, Nyquist plots, Bode plots, Gain and phase margin. **Laboratory Sessions/ Experimental learning:** 1. Obtain Bode Plot of the system for a given forward path transfer function using MATLAB. 2. Obtain Nyquist Plot of the system for a given forward path transfer function using	**10Hrs.**

MATLAB. **Applications:** To determine a stability of a system **Video link / Additional online information:** 1. https://youtu.be/QzTCRk4nkDg https://youtu.be/Wi6xt7IyjA0	
UNIT 5	
Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations, State transition matrix and its properties.Lag, lead and lag lead compensation. **Laboratory Sessions/ Experimental learning:** 1. Determining the solution of state equations using MATLAB. **Applications:** State variables are used to describe the future response of a dynamic response **Video link / Additional online information:** https://youtu.be/xajgSUci9zs	**10Hrs.**

Course Outcomes: After completing the course, the students will be able to	
CO1	Write the mathematical model for electrical systems and find the transfer function using block diagram reduction technique and signal flow graph.
CO2	Analyze transient and steady state response of second order systems using standard test signals and analyze steady state error.
CO3	Analyze the stability of the systems by applying RH criteria and root locus techniques.
CO4	Analyze the stability of the system using frequency domain techniques such as Nyquist and Bode plots.
CO5	Write state space equations and solutions of a given electrical system.

Reference Books:	
1.	Nagarath and M.Gopal, – Control Systems Engineering‖, New Age International (P) Limited, Publishers, Fifth edition-2005, ISBN: 81-224-2008-
2.	Modern Control Engineering, K.Ogata, Pearson Education Asia/PHI, 4th Edition, 2002. ISBN 978-81-203-4010-7.
3.	Automatic Control Systems‖, Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**1**	**-**	-	-	-	-	-	-	-
CO2	**3**	**2**	**2**	**1**	**-**	-	-	-	-	-	-	-
CO3	**3**	**2**	**2**	**2**	**-**	-	-	-	-	-	-	-
CO4	**3**	**2**	**2**	**2**	-	-	-	-	-	-	-	-
CO5	**3**	**2**	**2**	**1**	-	-	-	-	-	-	-	-

High-3, Medium-2, Low-1

Semester: IV		
Communication laboratory		
Course Code:	**BIOL404**	**CIEMarks:50**
L:T:P:	**0:0:2**	**SEE Marks: 50**
Credits:	**1**	**Total : 100**
Hours:	**26P**	**SEEDuration:03Hours**

Course Learning Objectives: The students will be able to	
1	To visualize the effects of sampling and TDM
2	To Implement AM & FM modulation and demodulation
3	To implement PCM & DM
4	To simulate Digital Modulation schemes

	EXPERIMENTS
1	Signal Sampling and reconstruction
2	Time Division Multiplexing
3	AM Modulator and Demodulator
4	FM Modulator and Demodulator
5	Pulse Code Modulation and Demodulation
6	Delta Modulation and Demodulation
7	Line coding schemes
8	Simulation of ASK, FSK, and BPSK generation schemes
9	Simulation of DPSK, QPSK and QAM generation schemes
10	Simulation of signal constellations of BPSK, QPSK and QAM
11	Simulation of ASK, FSK and BPSK detection schemes
12	Simulation of Linear Block and Cyclic error control coding schemes
13	Simulation of Convolutional coding scheme
14	Communication link simulation

Course Outcomes: After completing the course, the students will be able to	
CO1	Simulate & validate the various functional modules of a communication system.
CO2	Demonstrate their knowledge in base band signaling schemes through Implementation of digital modulation schemes.
CO3	Apply various channel coding schemes & demonstrate their capabilities.
CO4	Towards the improvement of the noise performance of communication system

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1	1	-	-	-	-	-	1
CO2	3	3	3	2	1	1	-	-	-	-	-	1
CO3	3	3	3	2	1	1	-	-	-	-	-	1
CO4	3	3	3	2	1	1	-	-	-	-	-	1
CO5	3	3	3	2	1	1	-	-	-	-	-	1

High-3, Medium-2, Low-1

Semester: IV		
8051 Microcontroller		
Course Code:	**BIO405A**	**CIE Marks: 50**
L:T:P:	**3:0:0**	**SEE Marks: 50**
Credits:	**3**	**Total : 100**
Hours:	**40L**	**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller.	
2	Write 8051 Assembly level programs using 8051 instruction set	
3	Explain the Interrupt system, operation of Timers/Counters and Serial port of 8051.	
4	Interfacing of 8051 to external memory.	
5	Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O ports.	

UNIT I	
8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing. **Laboratory Sessions/ Experimental learning: NA** **Applications**: Embedded Systems, Consumer Electronics Products **Video link / Additional online information :** 1. https://www.youtube.com/watch?v=QGg5jZEdT7A&list=PLgwJf8NK-2e49i6neo70aGtFLvKeZ3IQD 2. https://www.youtube.com/watch?v=2-geyR_aM28&pp=ygUVODA1MSBtaWNyb2NvbnRyb2xsZXIg	**8Hrs.**
UNIT 2	

8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions. **Laboratory Sessions/ Experimental learning:** Assembly language programs to perform arithmetic and logical operations. **Applications**: Speedometer, Auto-breaking system **Video link / Additional online information :** 1. https://www.youtube.com/watch?v=I1xMNR1q7Ds&pp=ygU0ODA1MSBtaWNyb2NvbnRyb2xsZXIgaW5zdHJ1Y3Rpb24gc2V0IGFuZCBwcm9ncmFtbWluZw%3D%3D. **2.** https://www.youtube.com/watch?v=g7Gypl9zNz8&list=PLL6Ah8JHS-GCY36NO5-rU6Ifg1UZ5CSto	**8Hrs.**
UNIT 3	
8051 Stack, I/O Port Interfacing and Programming:8051 Stack, Stack and Subroutine instructions. Assembly language program examples on subroutine and involving loops. Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status. **Laboratory Sessions/ Experimental learning:** Assembly language program to turn on/off LEDs **Applications**: Light sensing & controlling devices. **Video link / Additional online information :** 1. https://www.youtube.com/watch?v=AIME92jvANQ&pp=ygUfODA1MSBzdGFjayxpL28gcG9ydCBpbnRlcmZhY2luZw%3D%3D	**8Hrs.**
UNIT 4	
8051 Timers and Serial Port: 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to	**8Hrs.**

receive data serially. **Laboratory Sessions/ Experimental learning: Assembly language program for serial communication in 8051.** • **Applications:** Medical Instruments, Fax, Printers **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=1mJ3k_GxwQI&pp=ygUcODA1MSBzZXJpYWwgcG9ydCBwcm9ncmFtbWluZw%3D%3D	
UNIT 5	
8051 Interrupts and Interfacing Applications: 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly language interfacing programming. **Laboratory Sessions/ Experimental learning:** Assembly language program to Interface 8051 with ADC,DAC,LCD etc **Applications**: Temperature sensing and controlling devices **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=x4eBYZ52Vgo&pp=ygUPODA1MSBpbnRlcnJ1cHRz	**8Hrs.**

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and Instruction set of 8051.
CO2	Write 8051 Assembly level programs using 8051 instruction set.
CO3	Write 8051 Assembly language program to generate timings and waveforms using 8051 timers, to send & receive serial data using 8051 serial port and to generate an external interrupt using a switch.
CO4	Write 8051 Assembly language programs to generate square wave on 8051 I/O port pin using interrupt and C Program to send & receive serial data using 8051 serial port.
CO5	Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using

	8051 I/O ports.

Reference Books:	
1.	The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2.	"The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson/Cengage Learning.
3	"The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2 ISBN: 978-93-329-0125-4.
4.	"Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	-	-	1	1
CO2	3	3	2	3	3	-	-	-	-	-	3	2
CO3	3	3	2	3	3	-	-	-	-	-	3	1
CO4	3	3	2	2	3	-	-	-	-	-	3	1
CO5	3	2	2	3	3	-	-	-	-	-	3	2

High-3, Medium-2, Low-1

Semester: IV		
Data Structures and Algorithms using Python		
Course Code:	**BIO405B**	**CIE Marks:50**
L:T:P:	**3:0:0**	**SEE Marks: 50**
Credits:	**3**	**Total : 100**
Hours:	**40L**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Understand the fundamentals of data structures and their applications in logic building and project assessment.	
2	Understand the concept of linked lists and sorting techniques.	
3	Acquire the knowledge of algorithms of queues and stacks.	
4	Analyze the concepts of Binary trees.	
5	To Understand Graphs and its algorithms.	

UNIT 1	
Python Primer: Python Overview, Objects in Python, Expressions, Operators, Control Flow, Functions, Simple i/p and o/p, Modules. **Basic Concepts of Data Structures and Algorithms:** Introduction- Variables, Datatypes, Data Structures, ADT, what is an algorithm, How to compare algorithms, Rate growth, Types of analysis, Asymptotic Notation, Performance Analysis: Space complexity, Time complexity, Guidelines for asymptotic analysis. **Searching Techniques:** Linear Search and Binary Search Applications: developing computational tools and bioinformatics software, Mathematics. **Video link / Additional online information (related to module if any):** 1. http://www.nptelvideos.com/video.php?id=1442 2 2. https://nptel.ac.in/courses/106105085/ **Laboratory Sessions/ Experimental learning**: 1. Develop a mini project to demonstrate the concept Binary Search. **Applications:** 1. Conversion from one form of expression to another 2. Mathematical calculation for expression evaluation	8Hrs.

UNIT 2	
Prerequisites: Programming using the concept of Arrays and pointers **Linked Lists:** Definition, Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists and its operations, Circular linked lists and its operations. **Sorting Techniques:** Bubble Sort, Insertion Sort, Selection Sort, Quick Sort and Merge Sort. **Laboratory Sessions/ Experimental learning:** Develop an algorithm to demonstrate the concept of Linked lists. **Applications:** 1. Programs for Departmental store bills 2. Programs for Railway booking **Video link / Additional online information:** 1. https://nptel.ac.in/courses/106/102/106102064/ 2. https://drive.google.com/file/d/0BzTQ7doC5eGSQTBicHo1UDgtOVU/view	8Hrs.
UNIT 3	
Stacks: Definition, Stack Implementation using arrays/lists and linked lists, Stack ADT, Stack Operations (Insertion and Deletion), Array Representation of Stacks, Stack Applications: Infix to postfix conversion, Tower of Hanoi. **Queues:** Definition, Array Representation, Queue Implementation using arrays/lists and linked lists, Queue ADT, Operations on queues (Insertion and Deletion), Circular Queues and its operations, Priority Queues and its operations. **Laboratory Sessions/ Experimental learning:** 1. Implementation of Towers of Hanoi using Stacks. **Applications:** 1. Towers of Hanoi. 2. Parenthesis matching in an expression **Video link / Additional online information:** 1. https://nptel.ac.in/courses/106/106/106106127/ 2. https://www.youtube.com/playlist?list=PL0gIV7t6l2iIsR55zsSgeiOw9Bd_IUTbY	8Hrs.
UNIT 4	
Trees: Terminology, Binary Trees, Types of Binary trees, Properties of Binary trees, Array Representation of Binary Trees, Binary Tree Traversals – Inorder, Postorder, Preorder.	8Hrs.

Binary Search Trees – Definition, Insertion, Deletion, Searching, Implementation of Binary tree, Heaps and Heap Sort, Construction of Expression Trees, AVL Trees. Laboratory Sessions/ Experimental learning: 1. Solve Parenthesis Matching problem using binary search trees. Applications: 1. Can be used for Memory Management. 2. In solving backtracking problems. Video link / Additional online information: 1. https://nptel.ac.in/courses/106/106/106106127/ 4. https://nptel.ac.in/courses/106/105/106105225/	
UNIT 5	
Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search, DAG, Minimum Spanning Trees: Prim – Kruskal algorithm, Single Source Shortest Path: Weighted graphs, Dijkstra algorithm. Laboratory Sessions/ Experimental learning: 1. Print all the nodes of graph using DFS and BFS. 2. Apply various algorithms on a graph and analyse it. Video link / Additional online information: 1. https://nptel.ac.in/courses/106/106/106106133/ 2. https://nptel.ac.in/courses/106/105/106105225/ 1. https://nptel.ac.in/courses/106/102/106102064/	8Hrs.

Course Outcomes: After completing the course, the students will be able to

CO1	Acquire knowledge of Python fundamentals and data structures.
CO2	Analyse and design of algorithms for Linked lists and sorting techniques.
CO3	Apply the concepts of Stacks and queues.
CO4	Utilize the operations of search trees and their applications.
CO5	Understand the concepts of Graphical algorithms.

Reference Books:

1.	Rance D Necaise “Data Structures and Algorithms using Python”, Wiley, John Wiley and Sons
2.	Michael T. Goodrich, R. Tamassia and Michael H Goldwasser “Data structures and Algorithms in python”, Wiley student edition, John Wiley and Sons.
3.	Narasimha Karumanchi “Data Structures and Algorithmic Thinking with Python”, CareerMonk Publications.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksis executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom’s taxonomy level.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	1	-	-	1	-	-	1
CO2	3	3	2	2	-	1	-	-	1	-	-	1
CO3	3	3	2	2	-	1	-	-	1	-	-	1
CO4	3	3	2	2	-	1	-	-	1	-	-	1
CO5	3	3	2	2	-	1	-	-	1	-	-	1

High-3, Medium-2, Low-1

Semester: IV		
Operating System		
Course Code:	**BIO405C**	**CIE Marks:50**
L:T:P:	**3:0:0**	**SEE Marks: 50**
Credits:	**3**	**Total : 100**
Hours:	**40L**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Understand the services provided by an operating system.	
2	Learn how processes are synchronized and scheduled.	
3	Identify different approaches of memory management and virtual memory management.	
4	Study the structure and organization of the file system	
5	Understand inter process communication and deadlock situations.	

UNIT 1	
Prerequisites: *Computer Organization and Architecture* **Introduction to Operating Systems:** OS, Goals of an OS, Operation of an OS, Program's, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes of operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time , distributed and modern Operating Systems. **Laboratory Sessions/ Experimental learning:** 1. Case study: Basics of LINUX OS. **Applications:** • Controls the backing store and peripherals such as scanners and printers. • Maintains security and access rights of users. • Spooling (Simultaneous Peripheral Operation on Line) **Video link / Additional online information :** 1. https://nptel.ac.in/courses/106/105/106105214/ 2. https://www.youtube.com/watch?v=qJ_bXhrUOkc&t=12s	8Hrs.
UNIT 2	
Process Management: OS View of Processes, PCB, Process States and Transitions, Threads,	8Hrs.

Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Long term, medium term and short term scheduling in a time sharing system. **Laboratory Sessions/ Experimental learning:** 1. Case study on Processes and threads in Linux/ Windows/ UNIX Scheduling Algorithms **Applications:** • Organizes the use of memory between programs. • Organizes processing time between programs and users. • Install Operating Systems - Ubuntu Linux. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=Lf3xYcIzgeQ	
UNIT 3	
Memory Management: Static and Dynamic memory allocation, Contiguous Memory allocation, Non-Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, Paging Hardware, VM handler, Page replacement policies - FIFO, LRU. **Laboratory Sessions/ Experimental learning:** 1. Case Study on Linux/ UNIX Memory Management. **Applications:** • Memory Management deals with the transfer of programs in and out of memory. • Dynamically allocate portions of memory to programs at their request, and free it for reuse when no longer needed. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=MLbdsuxYAF4 2. https://www.youtube.com/watch?v=WqnwrWODLKs	8Hrs.
UNIT 4	
File Systems: File systems and IOCS, Files and File Operations, Fundamental File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of diskspace, Implementing file access, and File sharing schematics.	8Hrs.

Laboratory Sessions/ Experimental learning: 1. Case Study on UNIX/ Windows/ Linux File System. **Applications:** • Understand file handling operations (read, write, and append). • Basic understanding of how pointers are used **Video link / Additional online information :** 1. https://www.youtube.com/watch?v=Fjz3PKJGe5s 2.https://www.youtube.com/watch?v=E3PshX16WEY	
UNIT 5	
Message Passing and Deadlocks: Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Handling Deadlocks, Deadlock detection algorithm, Deadlock Prevention, Deadlock avoidance-Bankers algorithm. **Laboratory Sessions/ Experimental learning:** 1. Simulate Bankers Algorithm for Dead Lock Avoidance. **Applications:** Email management **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=rCHnS-ZX7PE 2. https://www.youtube.com/watch?v=vOfKOg0rFg4	8Hrs.

Course Outcomes: After completing the course, the students will be able to

CO1	Summarize the goals, structure, operation and types of operating systems.
CO2	Apply scheduling techniques to find performance factors.
CO3	Apply suitable techniques for contiguous and non-contiguous memory allocation.
CO4	Interpret the organization of file systems and IOCS.
CO5	Describe message passing, deadlock detection and prevention methods.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct

additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**1**	**-**	**-**	**1**
CO2	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**1**	**-**	**-**	**1**
CO3	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**1**	**-**	**-**	**1**
CO4	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**1**	**-**	**-**	**1**
CO5	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**1**	**-**	**-**	**1**

High-3, Medium-2, Low-1