Semester | 7

VII Semester

PLC, DCS and SCADA in Process Automation			Semester	VII
Course and Course Code	IPCC	**BEI701**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0		SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots		Total Marks	100
Credits	04		Exam Hours	3
Examination nature (SEE)	Theory with Practical			

Course objectives:
After completion of the course, the students will be able to

- Understand basic concepts of PLC, I/Os and its Instructions set.
- Understand Programming techniques of PLC's timer/ Counter Instructions and Data handling instructions.
- Understand basic concepts of Distribution Control System and its Architecture/ Applications.
- Understand concepts of Supervisory Control and Data Acquisition system (SCADA) and its applications.
- Understand modelling and simulation for plant automation and usage of modern tools for plant automation.

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Always start every class hour with preamble of what was covered in previous class and what would be discussed in the present class.
- Encourage group discussions and arrange debates on selected topics.
- Try to arrange some industrial visits to understand various process automation techniques.
- Give exhaustive assignments on all topics so that students will be able to practice answering any questions in the University examinations that would come from nook and corner of the syllabus.
- Arrange seminars by the students on certain intriguing topics relevant to syllabus by the students.

MODULE – 1

Introduction to Programmable Logic Controllers (PLC): The digital concept, the input status file, the output status file, input and output status file, sixteen point I/O modules with Decimal addressing, PLC memory.
Input modules: Discrete input modules, Discrete AC and DC input modules
Output modules: Discrete output modules, solid-state output module switching, relay output modules

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 2

PLC Instructions: What is logic? PLC programming languages, ladder programming- Conventional ladder Vs PLC ladder, series and parallel function of AND, OR, NOT, XOR logic, Analysis of rung, the basic relay instructions: Normally open and normally closed, output and latching instructions, understanding relay instructions and the PLC input modules - interfacing start stop pushbutton and motor to PLC, developing ladder diagrams with analytical problems.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 3	
Timers and Counter Instructions: Timer addressing, On delay, off delay and retentive timer instructions and associated status bits. Counter addressing, PLC counter up and down instructions and associated status bits. **Data Handling Instructions**: Data handling instructions-MOVE, Masked Move, COPY. Sequencer instructions: Programming sequence output instructions, developing ladder diagram with analytical problems.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 4	
Distributed Digital Control: Introduction, History, Functional requirements of Distributed Process Control System, System Architecture, Distributed Control Systems, Field bus System. Text 2: Ch.7; 7.1,7.2,7.3,7.4,7.5 and 7.8	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Supervisory Control and Data Acquisition System: Basic Functions: Channel Scanning, conversion to Engineering units, Data Processing, Remote Terminal Unit. **Modelling and Simulation for Plant Automation**: Introduction, Overview of Process Models, Model Based Automatic Control, System Modelling, uses of systems simulation, how to build the mathematical model of a plant, Model evaluation & improvement. Text 2: Ch.3; 3.6,3.7 and Ch.11; 11.1,11.2,11.3,11.5,11.6,11.7 & 11.8.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

PRACTICAL COMPONENT OF IPCC*(May cover all / major modules)*

Sl. No	List of experiments to be performed
1	Realize a binary to Gray converter and vice versa using ladder logic on a PLC.
2	Develop a ladder diagram program to implement the Interfacing of a simple Switch to the PLC and displaying its status through the LED connected to the PLC.
3	Realization of basic gate functions using PLC. The logic should be solved using ladder diagram. (hardware experiment using PLC module)
4	Realization of Bottle Filling Process using PLC. The logic should be solved using ladder diagram.
5	Realization of Lift/Elevator System using PLC. The logic should be solved usingladder diagram.
6	Develop a ladder logic diagram to control the lamp output as per the given logic. Make use of On-Delay timers for this problem. Lamp 1 – 2 sec, Lamp 2 – 4sec, All off -6sec.
7	Realize a n-bit counter (up/down) with suitable delay using PLC (counter output to be displayed on the LEDs interfaced to the PLC). The logic should be solved using ladder diagram.
8	Develop a ladder diagram to implement a Traffic light controller system using PLC.
	Can be Demo experiments for CIE Conduct the following experiments using suitable software tools such as Wonderware In Touch for SCADA.
9	Develop a SCADA model for Simple conveyor object moving system.

10	Develop a SCADA model for Seven segment Display.
11	Develop a SCADA model for tank level alarm indicator.
12	Develop a SCADA model for Bottle filling system.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Describe the architecture, functioning and applications of PLC in automation.
- Develop ladder diagram programs for automation systems using different PLC instruction sets
- Analyze the basics of distributed control system and communication protocols used in automation industries.
- Develop process automation system using SCADA and DCS and also develop models of process automation using modern tools.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks - 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

1) Introduction to Programmable Logic Controllers, Garry Dunning, 3rdedition, Centage Learning. (Modules: 1, 2 & 3).
2) Computer based Industrial Control, Krishna Kant, 2nd edition, PHI, 2017 (Modules: 4 & 5).
3) Programmable Logic Controllers, F.D. Petruzella, Tata Mc-Graw Hill, Third edition, 2010.
4) Programmable Controllers, T.A. Hughes, Fourth edition, ISA press, 2005.
5) Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems, Gordon Clarke, Deon Reynders, Edwin Wright, Newnes, 1st Edition, 2004.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes,
- Assignments,
- Seminars

VLSI Design			Semester	VII
Course and Course Code	IPCC	**BEI702**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0		SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots		Total Marks	100
Credits	4		Exam Hours	3
Examination nature (SEE)	Theory with Practical			

Course objectives:
After completion of the course, the students will be able to

- Gain knowledge of mass transistors theory and CMOS technology.
- Understand the basic electrical properties of mass and BICMOS circuits.
- Cultivate the concept of subsystem design and layout processes.
- Understand the concept of design process computational elements

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Always start every class hour with preamble of what was covered in previous class and what would be discussed in the present class.
- Encourage group discussions and arrange debates on selected topics.
- Show video/ animation films to explain the functioning of various techniques.
- Give exhaustive assignments on all topics so that students will be able to practice answering any questions in the University examinations that would come from nook and corner of the syllabus.
- Arrange seminars by the students on certain intriguing topics relevant to syllabus by the students.

MODULE – 1

Moore's law, speed power performance, nMOS fabrication, CMOS fabrication: n-well, p-well processes, BiCMOS, Comparison of bipolar and CMOS.
Basic Electrical Properties of MOS And BiCMOS Circuits: Drain to source current versus voltage characteristics ,threshold voltage, transconductance.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Basic Electrical Properties of MOS And BiCMOS Circuits: nMOS inverter, Determination of pull up to pull down ratio, nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, BiCMOS inverters, latch up.
Basic Circuit Concepts: Sheet resistance, area capacitance calculation, Delay unit, inverter delay, estimation of CMOS inverter delay, driving of large capacitance loads, super buffers, BiCMOS drivers.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

MOS and BiCMOS Circuit Design Processes: MOS layers, stick diagrams, nMOS design style, CMOS design style, design rules and layout, λ - based design.
Scaling of MOS Circuits: scaling factors for device parameters, limitations of scaling.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 4	
Subsystem Design and Layout-1: Switch logic pass transistor, Gate logic inverter, NAND gates, NOR gates, pseudo nMOS, Dynamic CMOS, example of structured design, Parity generator, Bus arbitration, multiplexers, logic function block, code converter. **Subsystem Design and Layout-2**: Clocked sequential circuits, dynamic shift registers, bus lines, subsystem design processes, General considerations, 4-bit arithmetic processes, 4x4 cross bar switch, 4-bit barrel shifter.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Design Process-Computational Elements: Regularity, design of ALU subsystem, ALU using adders, carry look ahead adders, serial parallel multipliers. **Memory, Register and Aspects of Timing**: Three Transistor Dynamic RAM cell, Dynamic memory cell, Pseudo- Static RAM, JK Flipflop, DFlip-flop circuits, RAM arrays, practical aspects and testability: Some thoughts of performance, optimization and CAD tools for design and simulation.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
PRACTICAL COMPONENT OF IPCC*(May cover all / major modules)*	
Sl. No	**List of experiments to be performed**
1	Write the Verilog Code and Verify the Functionality using Test-bench of a 4-Bit Adder.
2	Write the Verilog Code and Verify the Functionality using Test-bench of a 4-Bit Booth Multiplier.
3	Write the Verilog Code and Verify the Functionality using Test-bench of a 32-Bit ALU Supporting 4-Logical and 4-Arithmetic operations, using case and if statement for ALU BehavioralModeling.
4	Write the Verilog Code and Verify the Functionality using Test-bench of a Latch and Flip-flop (D, JK, T).
5	a) Capture the schematic of CMOS inverter with load capacitance of 0.1pF and set the widths of Inverter with Wn = Wp, Wn=2Wp, Wn = Wp/2 and length at selected technology. Carry out the following: i. Set the input signal to a pulse with rise time,fall time of 1ns and pulse width of 10ns and the time period of 20ns and plot the input voltage and output voltage of designed inverter? ii. From the simulation result compute tpHL, tpLH and td for all three geometrical settings of width? iii. Tabulate the results of delay and find the best geometry for minimum delay for CMOS inverter? b) Draw layout of inverter with Wp/Wn = 40/20, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.
6	a) Capture the schematic of 2-input CMOS NAND gate having similar delay as that of CMOS inverter computed in experiment above. Verify the functionality of NAND gate and also find out the delay td for all four possible combinations of input vectors. Table the results. Increase

	the drive strength to 2X and 4X and tabulate the results. b) Draw the layout of NAND with Wp/Wn = 40/20, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.
7	a) Capture the schematic of 2-input CMOS NOR gate having similar delay as that of CMOS inverter computed in experiment above. Verify the functionality of NOR gate and also find out the delay td for all four possible combinations of input vectors. Table the results. Increase the drive strength to 2X and 4X and tabulate the results. b) Draw the layout of NOR with Wp/Wn=40/20, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.
8	a) Capture the schematic of 2-input CMOS XOR gate having similar delay as that of CMOS inverter computed in experiment above. Verify the functionality of XOR gate and also find out the delay td for all four possible combinations of input vectors. Table the results. Increase the drive strength to 2X and 4X and tabulate the results. b) Draw the layout of XOR with Wp/Wn=40/20, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.
	Can be Demo experiments for CIE only
9	a)Capture schematics of two-stage operational amplifier and measure the following: i. UGB ii. dB Bandwidth iii. Gain Margin and phase margin with and without coupling capacitance iv. Use the op-amp in the inverting and non-inverting configuration and verify its functionality. v. Study the UGB, 3dB bandwidth, gain and power requirement in op-amp by varying the stage wise transistor geometries and record the observations. b) Draw layout of two-stage operational amplifier with minimum transistor width set to 300 (in180/90/45 nm technology), choose appropriate transistor geometries as per the results obtained in part a. Use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.
10	UART i. Write Verilog Code ii. Verify the Functionality using Test-bench iii. Synthesize the design targeting suitable library and by setting area and timing constraints iv. Tabulate the Area, Power and Delay for the Synthesized netlist, Identify Critical path
11	For synthesized netlist carry out the following: i. Floor planning ii. Placement and Routing iii. Record the parameters such as no. of metal layers used for routing, flip method for placement of standard cells iv. Physical Verification and record the DRC and LVS reports v. Generate GDSII
12	Design and characterize 6T binary SRAM cell and measure the following: i. Read Time, Write Time, SNM, Power

	ii. Draw Layout of 6T SRAM, use optimum layout methods. Verify for DRC & LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1. Identify the CMOS layout levels, and the design layers used in the process sequence.
2. Describe the general steps required for processing of CMOS integrated circuits.
3. Design static CMOS combinational and sequential logic at the transistor level.
4. Demonstrate different logic styles such as complementary CMOS logic, pass-transistor Logic, dynamic logic, etc.
5. Interpret the need for testability and testing methods in VLSI.

Course outcomes (Course Skill Set) of the lab component:

On the completion of this laboratory course, the students will be able to:

1. Design and simulate combinational and sequential digital circuits using Verilog HDL.
2. Understand the synthesis process of digital circuits using EDA tool.
3. Perform ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level netlist.
4. Design and simulate basic CMOS circuits like inverter, differential amplifier, SRAM.
5. Perform RTL_GDSII flow and understand the stages in ASIC design.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks - 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of

all experiments' write-ups are added and scaled down to **15 marks**.

- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

6) Basic VLSI Design, Douglas A Pucknell, Kamran Eshraghian, 3rdEdition, Prentice Hall of Indiapublication, 2005.
7) CMOS Digital Integrated Circuits, Analysis And Design, Sung – Mo (Steve) Kang, Yusuf Leblebici,3rdEdition, Tata McGraw Hill, 2003.
8) VLSI Technology - S.M. Sze, 2ndedition Tata McGraw Hill, 2003.

Web links and Video Lectures (e-Resources):

- VTU e-shikshana programme
- https://nptel.ac.in/courses/117101058

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes,
- Assignments,
- Seminars

Lasers and Optical Instrumentation			Semester	VII
Course and Course Code	PCC	**BEI703**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	4:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	4		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:
After completion of the course, the students will be able to

- Understand the basic concepts of Lasers.
- Understand and analyze the classification of Lasers and their energy level diagram.
- Understand and analyze the key elements of Optical Fiber systems.
- Understand the Optical amplifiers and its applications.

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Always start every class hour with preamble of what was covered in previous class and what would be discussed in the present class.
- Encourage group discussions and arrange debates on selected topics.
- Give exhaustive assignments on all topics so that students will be able to practice answering any questions in the University examinations that would come from nook and corner of the syllabus.
- Arrange seminars by the students on certain intriguing topics relevant to syllabus by the students.

MODULE – 1

Lasers -I: Introduction, Emission and absorption of radiation, Einstein relation, population inversion, thresholdconditions, Line shape function, population inversion and pumping threshold conditions.
Lasers -II: Classes of LASER: Doped insulator LASERs, semiconductor LASERs, Gas LASERs, Liquid dye LASERs.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Generation of Lasers: Single mode operation, frequency stabilization, Q-switching and mode locking.
Applications of Laser: Properties of lasers, Measurement of distance: Interferometric methods, Beam modulation telemetry, Pulseecho techniques; Holography & its Applications.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Overview of Optical Fiber Communications: Motivations for light wave communications, optical spectral bands, Decibel units, Network information rates, WDM concepts, Key elements of optical fiber systems, standards for optical fiber communications.
Structures, Wave guiding, and Fabrication I: The nature of light, basic optical laws and definitions, optical fiber modes and configurations, Single mode fibers.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 4	
Structures, Wave guiding, and Fabrication II: Graded index fiber structure, Fiber materials, Photonic crystal fibers, Fiber fabrication, Mechanical properties of fibers, Fiber optic cables. **Optical Amplifiers**: Basic applications and Types of optical amplifiers, Semiconductor optical amplifiers (Only principle of operation and construction), Erbium doped fiber amplifiers (amplification mechanism and architecture), Optical SNR, Raman amplifiers, wideband optical amplifiers.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Applications of Fiber Optic Laser Systems in Medicine: Introduction, Fiberoptic laser systems in cardiovascular disease-Endoscopic laser systems in cardiology, Fiber-optic laser therapy-angioplasty, Endoscopic Nd:YAG Lasertherapy in gastroenterology, Laparoscopic laser surgery, photodynamic therapy inoncology, ophthalmological applications of laser-fiber systems, arthroscopic surgery in orthopaedics, laser lithotripsy, flowchart diagrams forclinical applications of laser-fiber systems-advances. Textbook 3: Unit 9.1, 9.2, 9.2.1, 9.2.2, 9.2.5, 9.3.4, 9.5.2.3, 9.7.3, 9.8.2, 9.9.2, 9.11.4.3	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1) Explain the principle and working of Laser system.
2) Discuss the engineering applications of laser systems.
3) Discuss the fundamentals of optical fiber communications.
4) Evaluate the design of optical fibers and optical amplifiers.
5) Apply fiber optic laser systems in medical systems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1) 'Optoelectronics- An Introduction', Wilson & Hawkes, Prentice Hall of India.
2) 'Optical fiber communications', GerdKeiser, McGraw Hill education (India) private limited, Fifth edition.
3) 'Lasers and Optical Fibers in Medicine', Abraham Katzir, Academic Press, 1998.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of optical sensors and instruments.
- Quizzes,
- Assignments,
- Seminars

Professional Elective Course

Unit Operations & Industrial Process Instrumentation			Semester	VII
Course and Course Code	PEC	**BEI714A**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:
After completion of the course, the students will be able to

- Be familiar with the various unit operations used in Industrial Process Control.
- Study and understand various control strategy involved in Boilers control, Furnace controls, Dryer controls, Evaporators controls, Crystallizers controls and Heat Exchangers controls.
- Understand various unit operations used in industrial plant such as cement plant, Thermal power plant, Water treatment plant and steel plant.

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Always start every class hour with preamble of what was covered in previous class and what would be discussed in the present class.
- Encourage group discussions and arrange debates on selected topics.
- Give exhaustive assignments on all topics so that students will be able to practice answering any questions in the University examinations that would come from nook and corner of the syllabus.
- Arrange seminars by the students on certain intriguing topics relevant to syllabus by the students.
- Try to arrange some industrial visit to understand various process automation techniques.

MODULE – 1

Boiler Control: Boiler -pressure controls, Fuel controls, Fuel -Air ratio controls and feed water controls
Furnace Controls: Control system functions, Combustion Air requirements, control system and Instrumentationfor Start-up heaters, Fired Re-boilers, Process heaters and Vaporizers.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 2

Dryers Controls: Drying of Solids, Dryer types, control of batch dryers, control of continues dryers, turbo dryers and spray dryers.
Evaporators controls: Evaporators terminology, Types of evaporators, Control systems for evaporators such asFeedback control, Case cade control, Selective control and Feed-Forward control.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 3

Crystallizers Controls: Crystallization process, Control of Evaporators crystallizers, Cooling crystallizers and Vacuum crystallizers.
Heat Exchanger Controls: Control of Liquid-to-Liquid Heat exchangers, Steam Heaters and condensers controls.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 4

Industrial Control Applications: **Cement Plant**: Objectives of Automation system, Raw mill automation, Kiln automation and DCS for Cement plant.

Thermal Power Plant: Block schematic, Control Equipment and applications in Power plant automation, Diagnosticfunction and protection.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 5

Industrial Control Applications: Water Treatment plant: Block schematic, Pre-chlorination control, Ratio Control, Sludge level control and Post-chlorination control.

Steel plant: Main zones in a steel plant, Automation Strategy, Iron zone controls, Blast furnace controls and Steel zone controls.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Understand basic concepts of various unit operations enlisted in the syllabus.
- Thoroughly understand the process involved in various industrial process such as cement plant, Thermal power plant, Water treatment plant and steel plant.
- Relate to various control strategy involved in Boilers control, Furnace controls, Dryer controls, Evaporators controls, Crystallizers controls and Heat Exchangers controls.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1) Process control by Bela G Liptak, Instrument Engineers and book, 3rdedition.
2) Computer based Industrial control by Krishnakanth PHI. New Delhi.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/103103155

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes,
- Assignments,
- Seminars

Artificial Intelligence and Machine Learning			Semester	VII
Course and Course Code	PEC	**BEI714B**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:

After completion of the course, the students will be able to

- Understand the basics of Artificial intelligence and concepts of natural language processing.
- Learn the working of Parallel, Distributed and connectionist models of AI.
- Relate to the fundamentals of Genetic algorithms.
- Understand the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised learning.
- Explore the associated parameters of the Machine Learning algorithms viz., dimensionality reduction, classification, etc.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Always start every class hour with preamble of what was covered in previous class and what would be discussed in the present class.
- Encourage group discussions and arrange debates on selected topics.
- Give exhaustive assignments on all topics so that students will be able to practice answering any questions in the University examinations that would come from nook and corner of the syllabus.
- Arrange seminars by the students on certain intriguing topics relevant to syllabus by the students.

MODULE – 1

Artificial Intelligence: The AI Problems, the underlying Assumption, what is an AI technique? (Text 1- 1.1,1.2,1.3) Natural Language Processing: Introduction, Steps in the Process. (Text 1- 15.1,15.1.1)

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Parallel and Distributed AI: Psychological Modeling, Parallelism in Reasoning Systems, Distributed Reasoning Systems: Coordination and Cooperation. (Text1-16.1,16.2,16.3,16.3.1)

Connectionist Models: Introduction Hopfield Networks, Connectionist AI and Symbolic AI. (Text 1-18.1,18.6)

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Genetic Algorithms (Gas): Learning: Generalization of an Input-Output table, Significance of the Genetic operators, Ant Algorithms. (Text 1- 23.2,23.2.2,23.3,23.8)

Multilayer Perceptrons: The Perceptron, multilayer Perceptrons, Learning time – Time delay networks, Recurrent networks, Deep Learning. (Text 2-11.1.2,11.2,11.5,11.12,11.13)

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 4	
Machine Learning: Introduction, Examples of Machine learning Applications. **Supervised Learning:** Learning a class from examples, Noise, Learning Multiple classes, Regression, Model selection and Generalization, Dimensions of a supervised Machine learning Algorithm. (Text 2- 1.1,1.2,2.1,2.4,2.5,2.6,2.7,2.8)	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Dimensionality Reduction: Introduction, Subset selection, Principal Component analysis. **Kernel Machines:** Introduction, Optimal separating hyper plane (SVM). (Text 2- 6.1,6.2,6.3,13.1,13.2)	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1) Appraise the basics of Artificial intelligence and concepts of natural language processing.
2) Illustrate the working of Parallel, Distributed and connectionist models of AI.
3) Discuss the fundamentals of Genetic algorithms.
4) Escalate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised learning.
5) Explore the associated parameters of the Machine Learning algorithms viz., dimensionality

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1) Artificial Intelligence – Elaine Rich, Kevin Knight, Shivashankar B Nair, McGraw Hill Education, 3rd Edition, 2016, ISBN 978-0-07-008770-5.
2) Introduction to Machine Learning – Ethem Alpaydin, PHI Learning, 3rd Edition, 2018, ISBN 978-81-203-5078-6.
3) Introduction to Artificial Intelligence – Eugene Charnik, Drew McDermott, Pearson Education India, 1st Edition, ISBN - 978-8131703069

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- To implement Artificial Intelligence and Machine Learning algorithms using recent tools.
- Quizzes,
- Assignments,
- Seminars

Neural Network and Fuzzy Logic Systems			Semester	VII
Course and Course Code	PEC	**BEI714C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	03		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:

After completion of the course, the students will be able to

- **Preparation**: To prepare students with fundamental knowledge and comprehensive understanding of artificial neural networks and Fuzzy Logic systems.
- **Core Competence**: To equip students to develop and configure ANNs with different types of learning algorithms and to understand the basics of Fuzzy logic operations and systems for real world problems.
- **Professionalism & Learning Environment**: To inculcate an engineering student an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Always start every class hour with preamble of what was covered in previous class and what would be discussed in the present class.
- Encourage group discussions and arrange debates on selected topics.
- Give exhaustive assignments on all topics so that students will be able to practice answering any questions in the University examinations that would come from nook and corner of the syllabus.
- Arrange seminars by the students on certain intriguing topics relevant to syllabus by the students.
- Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.

MODULE – 1

Introduction: Neural Networks, Application Scope of Neural Networks, Fuzzy Logic, Genetic Algorithm, Hybrid Systems, Soft Computing.

Artificial Neural Network: **An Introduction -** Fundamental Concept, Evolution of Neural Networks, Basic models of Artificial Neural Networks (ANN), Important Technologies of ANNs, McCulloch-Pitts Neuron, Linear Separability.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Supervised Learning Network – Introduction **–**Perceptron Networks, Adaptive Linear Neuron (Adaline), Multiple Adaptive Linear Neurons, Hebb Network and simple problems.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Back –Propagation Network: Theory, Architecture, Flowchart for training process, Training Algorithm, Learning Factors of Back-Propagation Network, Testing Algorithm of Back-Propagation Network. Radial

Basis Function Network, Time Delay Neural Network, Functional Link Networks, Tree Neural Networks, wavelet neural network.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 4	
Introduction to Fuzzy Logic, Classical sets and Fuzzy sets: Introduction to Fuzzy Logic, Classical sets (crisp sets) - Operations on Classical sets, Properties of Classical sets, Function of Mapping of Classical sets. Fuzzy sets – Fuzzy set operations, Properties of fuzzy sets. Simple Problems **Classical Relations and Fuzzy Relations**: Introduction, Cartesian Product of Relation, Classical Relation, Fuzzy Relation, Tolerance and Equivalence Relations, Simple Problems.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Membership Functions: Introduction, Features of the Membership functions, Fuzzification, Simple Problems. **Defuzzification**: Introduction, Lamba-cuts for Fuzzy sets (Alpha-Cuts), Lamba-Cuts for Fuzzy Relation, Defuzzification Methods. **Fuzzy Logic Control Systems:** Introduction, Control System Design, Architecture and Operation of FLC system, FLC system Models, Application of FLC systems.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1) Compare and contrast the biological neural network and ANN.
2) Discuss the ANN for pattern classification.
3) Develop and configure ANN's with different types of functions and learning algorithms.
4) Apply ANN for real world problems.
5) Discuss the fundamentals of fuzzy logic, implementation and their functions.
6) Apply fuzzy logic concepts in building automated systems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books

1) S. N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", 2nd Edition, Wiley India Pvt. Ltd.-2014.
2) Timothy J Ross, "Fuzzy logic with engineering applications", McGraw Hill International Edition, 1997

Reference Books

1) Simon Haykin, "Neural Networks: A comprehensive foundation", 2nd Edition, PHI, 1998.

Web links and Video Lectures (e-Resources):

- http://www.nptel.ac.in/courses/106105152/
- https://nptel.ac.in/courses/106/106/106106139

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Numerical problems, Programming Assignments / Mini Projects can be given to improve programming skills
- Quizzes,
- Assignments,
- Seminars

MEMS and Micro Electronics			Semester	VII
Course and Course Code	PEC	**BEI714D**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:
After completion of the course, the students will be able to

- **Preparation**: To prepare students with fundamental knowledge/ overview in the field of Micro Electro Mechanical Systems.
- **Core Competence**: To equip students with a basic foundation in electronic engineering, mechanical engineering, electrical engineering, chemistry, physics and mathematics fundamentals required for comprehending the operation and application of MEMS circuits, design.
- **Professionalism & Learning Environment**: To inculcate in students an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Always start every class hour with preamble of what was covered in previous class and what would be discussed in the present class.
- Encourage group discussions and arrange debates on selected topics.
- Give exhaustive assignments on all topics so that students will be able to practice answering any questions in the University examinations that would come from nook and corner of the syllabus.
- Arrange seminars by the students on certain intriguing topics relevant to syllabus by the students.

MODULE – 1

OVERVIEW OF MEMS AND MICROSYSTEMS: MEMS & Microsystems, Typical MEMS and Micro system Products, Evolution of Micro fabrication, Microsystems and Microelectronics. The Multidisciplinary nature of Microsystem, Design and Manufacture, Microsystem and Miniaturization, Applications of Microsystems in the Automotive Industry and in other industries.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Working Principles of Microsystems: Introduction, Micro sensors, Micro actuation, MEMS with Micro actuators, Micro accelerometers Micro fluids.
Engineering Science for Microsystems Design and Fabrication: Introduction, Atomic Structure of Matter, Ions and Ionization Molecular Theory of Matter and Intermolecular Forces, Plasma Physics, Electrochemistry.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Engineering Mechanics for Microsystems Design: Introduction, Static Bending of Thin Plates, Mechanical Vibration, Thermo mechanics, Fracture Mechanics, Thin Film Mechanics,

Materials for MEMS and microsystems: Introduction, Substrates and wafers, Active Substrate materials, silicon as a substrate material, silicon compounds and silicon piezo resistors.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 4	
Microsystems Fabrication Process: Introduction, Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition, Physical Vapour deposition, Deposition by Epitaxy, Etching. **Microsystems Design**: Introduction, Design considerations, Process Design, Design of a silicon Die for a Micropressure sensor, Design of Micro fluidic network systems.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Microsystems Packaging: Introduction, Overview of Mechanical Packaging of Microelectronics, Micro system Packaging, Interfaces in Micro system Packaging, Essential Packaging Technologies, Three-dimensional Packaging, Assembly of Microsystems, Selection of Packaging Materials, Signal Mapping and Transduction, Design Case: Pressure Sensor Packaging.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1) Understand the technologies related to Micro Electro Mechanical Systems.
2) Understand design and fabrication processes involved with MEMS devices.
3) Analyse the MEMS devices and develop suitable mathematical models
4) Know various application areas for MEMS device.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1) MEMS & Microsystems Design and Manufacture **–** Tai Ran Hsu, TMH 2002.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/117105082
- https://nptel.ac.in/courses/108108113
- https://www.acsce.edu.in/acsce/wp-content/uploads/2020/03/BIOMEMS-MODULE1.pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Develop mini projects and Final year projects using MEMS components to address the real world problems
- Quizzes,
- Assignments,
- Seminars

Open Elective Course

Smart Sensors			Semester	VII
Course and Course Code	OEC	**BEI755A**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:
After completion of the course, the students will be able to

- Learn the principle of smart sensors and process of micromachining in development of smart sensors.
- Learn intelligent systems by interfacing the smart sensors to MCUs and DSPs.
- Analyse the use of smart sensors in communication, MEMS and automation.
- Evaluate the standards of smart sensors by the assessment of reliability testing and packaging.
- Understand the applications of smart sensors in different fields and recent development.
- Design the simple models of intelligent instrumentation.

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Always start every class hour with preamble of what was covered in previous class and what would be discussed in the present class.
- Encourage group discussions and arrange debates on selected topics.
- Give exhaustive assignments on all topics so that students will be able to practice answering any questions in the University examinations that would come from nook and corner of the syllabus.
- Arrange seminars by the students on certain intriguing topics relevant to syllabus by the students.

MODULE – 1

Basics of smart sensors and micromachining: Introduction, Mechanical-Electronic transitions in sensing, nature of sensors, overview of smart sensing and control systems, integration of micromachining and microelectronics, introduction to micromachining, bulk micromachining, wafer bonding, surface micromachining, other micromachining techniques.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

MCUs and DSPs for sensor: Introduction, MCU control, MCUs for sensor interface, DSP control, Software, tools and support, sensor integration.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Sensor Communication and MEMS: Wireless zone sensing, surface acoustical wave devices, intelligent transportation system, RF-ID, Micro optics, micro-grippers, micro-probes, micro-mirrors, FEDs, communications for smart sensors - sources and standards, automotive protocols, industrial networks, office and building automation, home automation, protocols in silicon, other aspects of network communications.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 4	
Packaging, Testing and Reliability of Smart Sensors: Introduction, Semiconductor packaging applied to sensors, hybrid packaging, packaging for monolithic sensors, reliability implications, testing smart sensors. Unit Standards for Smart Sensors: Introduction, setting the standards for smart sensors and systems , IEEE 1451.1, IEEE 1451.2,IEEE P1451.3, IEEE 1451.4, extending the systems to network.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Implications of Smart Sensor Standards and Recent Trends: Introduction, sensor plug-and-play, communicating sensor data via existing wiring, automated/remote sensing and web, process control over the internet, alternative standards, HVAC sensor chip, MCU with integrated pressure sensors, alternative views of smart sensing, smart loop.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1) Describe the principle of smart sensors and process of micromachining in development of smart sensors.
2) Develop intelligent systems by interfacing the smart sensors to MCUs and DSPs.
3) Analyze the use of smart sensors in communication, MEMS and automation.
4) Evaluate the standards of smart sensors by the assessment of reliability testing and packaging.
5) Discuss the applications of smart sensors in different fields and recent development.
6) 6. Develop/sketch the simple models of intelligent instrumentation.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.

2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

4) Understanding Smart Sensors- Randy Frank, 2nd Edition. Artech House Publications, 2013.
5) Micro and Smart Systems: Technology and modeling, G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat, V. K. Aatre, Wiley Publications,2012.

Web links and Video Lectures (e-Resources):

- MEMS :https://www.youtube.com/watch?v=CNmk-SeM0ZI
- MEMS ACCELEROMETER : https://www.youtube.com/watch?v=eqZgxR6eRjo
- MICROMACHINING OVERVIEW: https://www.youtube.com/watch?v=EALXTht-stg
- Chip Manufacturing - How are Microchips made?
- https://www.youtube.com/watch?v=bor0qLifjz4
- HOW SENSORS ARE ENABLING INDUCSTRY 4.0:https://www.youtube.com/watch?v=wKXe-0ocyiQ

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes,
- Assignments,
- Seminars
- Recent tools to simulate MEMS and other sensors

Industrial Electronics			Semester	VII
Course and Course Code	OEC	**BEI755B**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:

After completion of the course, the students will be able to

- Relate to the fundamentals of industrial electronics covering the basic idea about the various signals and circuits and its processing like analog and digital signal processing
- Understand the evolvement of the Control and mechatronics in industrial control
- Have knowledge of the Industrial communication systems and intelligent systems in various industrial applications.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Always start every class hour with preamble of what was covered in previous class and what would be discussed in the present class.
- Encourage group discussions and arrange debates on selected topics.
- Give exhaustive assignments on all topics so that students will be able to practice answering any questions in the University examinations that would come from nook and corner of the syllabus.
- Arrange seminars by the students on certain intriguing topics relevant to syllabus by the students.

MODULE – 1

Historical development of control systems, current trends in computer control of process plants,

Transducers – Present and Future: Classification, Technology trend, Intelligent sensors, MEMS sensors, Bio sensors, Nano sensors,

Building blocks of automation system: LAN, SCADA, RTU

Text 1: 0.3, 0.4, 2.5, 2.6, 2.12 – 2.15, 3.4, 3.6, 3.7

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Direct Digital Control: DDC Structure, DDC Software

Distributed Digital Control: History, Functional requirements of Process control system, System architecture, Distributed control systems, Fieldbus system.

Text 1: Chapter 6, 7.1 – 7.5, 7.8

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Modeling and Simulation for Plant Automation Industrial Control Applications: Cement Plants, Thermal Power Plants

Text 1: Chapter 11, 12.2, 12.3

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 4	
Industrial Control Applications: Water Treatment Plant, Irrigation canal automation, Steel plant Text 1: 12.4 – 12.7	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Intelligent Controllers: Model based controllers, Predictive control, AI based system, Expert controller, ANN, Neural controllers. Text 1: 13.1 – 13.5, 13.9, 13.10	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1) Understand the evolvement of control systems, transducers and automation systems.
2) Recognize the direct and distributed control architecture and software.
3) Present the advanced control techniques of modelling and simulating plant automation.
4) Relate to the process intricacies and control strategies in various industrial control applications.
5) Comprehend the different intelligent controllers used in modern control.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each full question is set for **20 marks**.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to **50 marks**

Suggested Learning Resources:

1) Computer Based Industrial Control by Krishna Kant, 2/e. India, Prentice Hall India Pvt., Limited, 2011.ISBN:9788120339880
2) Instrument Engineers Hand Book, third edition "Process Control" by B.G.Liptak – Chiltan book company Radnor Pennsylvania,1995.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes,
- Assignments,
- Seminars

Avionics and Aircraft Instrumentation			Semester	VII
Course and Course Code	OEC	**BEI755C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:
After completion of the course, the students will be able to

- Understand and analyze the basic concepts of Aircraft Instruments.
- Understand and analyze the Air data Instruments.
- Realize the concepts of Altimeters and gyroscopic flight instruments.
- Relate to the concepts of Aircraft engine Instruments.

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Always start every class hour with preamble of what was covered in previous class and what would be discussed in the present class.
- Encourage group discussions and arrange debates on selected topics.
- Give exhaustive assignments on all topics so that students will be able to practice answering any questions in the University examinations that would come from nook and corner of the syllabus.
- Arrange seminars by the students on certain intriguing topics relevant to syllabus by the students.
- Try to arrange some industrial visit to understand various Aircraft Instruments.

MODULE – 1

Aircraft Instruments: Introduction-Qualitative and quantitative displays, basic T grouping of instruments, basics of Altitude Director Indicator (ADI) &Horizontal Situation Indicator.
Air Data Instruments: Pneumatic type and air data computers, International Standard Atmosphere (ISA), combined pitot-static probe, separate static probe, air speed indicator, instantaneous vertical speed indicator

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Air Data Warning System: Altimeters**,** machmeters**,** Mach warning system, altitude alerts system, airspeed warning system.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Directional Systems: Earth's total magnetic field, horizontal and vertical components of total field direct reading compass and its limitations, fluxgate detector units. gyro stabilized direction indicating systems.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 4

Gyroscopic Flight Instruments: types of gyros-mechanical, ring laser gyros, fiber optic gyros and their limitations, basic mechanical gyro and its properties namely rigidity and precision, gyro horizon, direction

indicator, turn and bank indicator, Gyroscopic levelling system.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 5

Engine Instruments: pressure measurement (EPR), Temperature measurement (EGT), capacitance type volumetric fuel quantity indicator, densitometer, fuel quantity indicator by weight. Engine speed measurement ,torque measurement, integrated impellor type flow meter.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1) Outline the scope and extent of avionics and identify the types of flight instruments and display panels.
2) Describe the fundaments of flight, basics of aircraft structures, propulsion and materials used in the development of an aircraft.
3) Comprehend the complexities involved during development of flight vehicles.
4) Recognize the fundamental applications of gyroscopic flight instruments in aircraft and analyses the performance of aircraft control system and interpret the results.
5) Evaluate the performance characteristics of engine instruments of aircraft and give better view and ways to improve efficiency.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.

2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books

1) Aircraft Instruments and Integrated Systems- EHJ Pallet, Longman Scientific & Technical, 1992.
2) Aircraft Instrumentation and Systems -S. Nagabhushana & L.K. Sudha, IK International
3) Aircraft Systems: Mechanical, electrical, and avionics subsystems integration - Ian Moir and Allan Seabridge, Third Edition, John Wiley & Sons, Ltd., 2008

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/101104071
- https://nptel.ac.in/courses/101101079

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes,
- Assignments,
- Seminars

Advanced Control Systems			Semester	VII
Course and Course Code	OEC	**BEI755D**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	03		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:
After completion of the course, the students will be able to

- Prepare for the advanced concepts in control theory
- Represent discrete time control systems using state space analysis
- Apply Z-transformation techniques to digital control systems
- Understand optimal and adaptive control systems

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Always start every class hour with preamble of what was covered in previous class and what would be discussed in the present class.
- Encourage group discussions and arrange debates on selected topics.
- Give exhaustive assignments on all topics so that students will be able to practice answering any questions in the University examinations that would come from nook and corner of the syllabus.
- Arrange seminars by the students on certain intriguing topics relevant to syllabus by the students.

MODULE – 1

NONLINEAR SYSTEMS: Introduction, Common physical nonlinearities. Phase plane Method: Basic concepts singular points, Stability of non –linear system, Construction of phase trajectories, System - analysis by phase-plane method.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Non–Linear System Analysis using Describing Function Method: Describing function Method: Basic Concepts, Derivation of describing function, stability analysis by describing function method, Jump resonance, Lyapunov's stability criteria, Popov's stability criteria**.**

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

State-Space Analysis of Control Systems: State- space representation of discrete **–** timesystems, Solving time variant state equation, Transfer Function, State Transition matrix.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 4

Sampled Data Control Systems: Introduction, Spectrum, Analysis of sampling process, Signal reconstruction, Difference Equations, Z- transform, Z- transfer function (pulse transfer function). Stability analysis in Z **–** plane, Jury's Stability Test, Bi **–** Linear Transformation.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 5

Optimal and Adaptive Control Systems: Optimal control system based on quadratic performance index. Adaptive controller (block diagram description only) and model reference adaptive control (block diagram description only).

Compensation Techniques: Lead, Lag, Lead-lag network and compensator.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1) Understand and apply the phase plane method in design of non-linear systems
2) Relate and apply the describing function method in analysis of non-linear systems
3) Apply state space analysis techniques to discrete time control systems
4) Apply Z-transformation techniques to digital control systems
5) Understand optimal and adaptive control systems

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1) Control Systems Engineering – J Nagarath& M Gopal, New Age Int. Pvt. Ltd. Publishers, 5thEdn 2008.
2) Advanced Control Theory – A Nagoor Kani, 2nd Edition, RBA Publications, 1999
3) Discrete Time Control Systems – K Ogata, Pearson, 2015.
4) Modern Control Engineering – Kogata, Prentice Hall of India.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc21_ee50
- https://archive.nptel.ac.in/courses/108/103/108103008/

Activity Based Learning (Suggested Activities in Class)/ Practical Based Learning

- Quizzes,
- Assignments,
- Seminars

Semester | 8

Professional Elective Course

Electric Vehicle			Semester	VIII
Course and Course Code	PEC	**BEI801A**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:
After completion of the course, the students will be able to

- To Understand the fundamental laws and vehicle mechanics.
- To Understand the working of Electric Vehicles and recent trends.
- Ability to analyze different power converter topologies used for electric vehicle applications.
- Ability to develop the electric propulsion unit and its control for the application of electric vehicles.

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecturer method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
- Use of Video/Animation to explain the functioning of various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask at least three HOT (Higher Order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem-Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.
- Introduce Topics in manifold representations.
- Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

MODULE – 1

Vehicle Mechanics: Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Non- constant FTR, General Acceleration, Propulsion System Design.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Electric and Hybrid Electric Vehicles: Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 3

Energy storage for EV and HEV: Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Supercapacitors.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 4

Electric Propulsion: EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 5

Design of Electric and Hybrid Electric Vehicles: Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine /generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1) Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design.
2) Explain the working of electric vehicles and hybrid electric vehicles in recent trends.
3) Model batteries, Fuel cells, PEMFC and super capacitors.
4) Analyze DC and AC drive topologies used for electric vehicle application.
5) Develop the electric propulsion unit and its control for application of electric vehicles.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of

assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books

1) Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Husain, CRC Press, 2003.
2) Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, M. Ehsani, Y. Gao, S.Gay and Ali Emadi, CRC Press, 2005.

Reference Books

1) Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Sheldon S. Williamson, Springer, 2013.
2) Modern Electric Vehicle Technology, C.C. Chan and K.T. Chau, Oxford University, 2001.
3) Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Chris Mi, M. Abul Masrur, David Wenzhong Gao, Wiley Publication, 2011.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration by videos
- Mini projects
- Quizzes
- Assignments
- Seminars

Petroleum Refinery Engineering			Semester	VIII
Course and Course Code	PEC	**BEI801B**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:
After completion of the course, the students will be able to

- To provide the concept of petroleum refining and explain the different methods of petrochemical reactions and their applications
- To provide the importance of various refining processes and their applications
- To explain the significance petrochemicals productions

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- An appeal is made to the teachers to use alternative effective teaching methodology to inculcate an interest in the subject and its applications to solve societal & industrial problems.
- Efforts may be made to use MOOC's, videos, recorded contents, presentations to induce curiosity, better understanding and also higher levels of learning.
- Activities to promote interest may be incorporated wherever possible

MODULE – 1

Indian Petroleum Industry: Prospects & Future. Major companies. World production, Markets, Offshore and onshore, Oil well technology.
Composition of Crude: Classification. Evaluation of petroleum. UOP-k factor. TBP analysis. EFV analysis. Average boiling point. ASTM curves. Thermal properties of petroleum fractions.
Product Properties and Test Methods: Gas. Various types of gas and LPG. Reid vapour pressure analysis. Gasoline and naptha. Octane No. Oxidation stability. Additives for gasoline. Kerosene.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Crude Pre-treatment: Pumping of crude oils. Dehydration of crude by chemical, gravity, centrifugal, electrical de-salter and comparison of each. Heating of crude- heater, different types of pipe still heaters including box type, cylindrical etc. Crude distillation, arrangement of towers for various types of reflux. Design aspects for atmospheric and vacuum column. Atmospheric distillation unit: internals and operational.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Treatment Techniques: Types of impurities present and various desulfurisation processes. Production and treatment of LPG. LNG technology. Sweetening operations for gases including merox, ethanolamine, copper chloride, stertford etc. Catalytic de sulphonisation. Treatment of kerosene, De-aromatisation and merox. Treatment of diesel, naptha: desulpurisation by hydrogen and catalysts. Treatment of lubes: sulphuric acid, clay treatment, solvent treatment- phenol, furfural.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 4

Thermal Processes: Thermal cracking reactions- theory of thermal cracking. Properties of cracked materials and factors influencing the properties of cracked materials. Vis breaking, dubbs two coil cracking process. Catalytic Reforming: Theory of reforming. Factors influencing reforming, reforming catalysts, feedstock requirements. Plat-forming, hondi forming, flexi forming.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 5

Catalytic Cracking: Comparison of thermal and catalytic cracking. Carbonium ion chemistry. Feedback requirements. Cracking conditions. Commercial cracking analysis. Various catalytic cracking processes. Fixed bed crackers. Moving bed crackers. Fluid catalytic cracking-flexi cracking-ortho-flow reactor. Theory of coking: various types of coking processes.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1) Comprehend introductory information about petroleum and refinery. (Understand the history of refinery development and composition of petroleum, learn the refinery products, test methods andpetroleum properties).
2) Recognize the characteristics of petroleum refinery process(Recognize the distillation processes. solvent treating and extraction processes. Related fluid mechanics. combustion, vaporization and condensation. fractionation and towers.)
3) Assimilate information about thermal cracking(Understand heat transfer and exchangers, thermal cracking, catalytic cracking, and reforming, Perform typical design calculation and economics of design.)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1) Petroleum Refinery Engineering, Nelson, 4thedn McGraw Hill, 14th Reprint, 1982.
2) Modern Petroleum Refining Processes, Bhaskara Rao, 3rdedn, Oxford & IBH Publication, Reprint, 1999.
3) Petroleum Refining Technology, Ram Prasad, 1stedn, Khanna Publishers, 2000
4) Challenges in Crude Oil Evaluation, Nagnal J.M., Gate, McGraw Hill, 1996.
5) Petroleum Processing, Bland W.F. and Davidson R.L. McGraw Hill, 1967.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Petroleum industries visit
- Quizzes,
- Assignments,
- Seminars

Aeronautical Instrumentation			Semester	VIII
Course and Course Code	PEC	**BEI801C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	03		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:
After completion of the course, the students will be able to

- Understand and analyze the basic concept of Aircraft Instruments.
- Understand and analyze the Air data Instruments.
- Understand and analyze the concept of Altimeters and gyroscopic flight instruments.
- Understand and analyze the concept of Aircraft engine Instruments.

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecturer method (L) does not mean only the traditional lecturer method, but a different type of teaching method may be adopted to develop the outcomes.
- Show video/ animation films to explain the functioning of various techniques.
- Encourage group learning in the class.
- Try to arrange some industrial visit to understand various Aircraft Instruments.
- Give assignments on all topics so that the students will be able to practice any question in the University examination
- Arrange seminars by the students on certain topics relevant to syllabus.

MODULE – 1

Aircraft Instruments: Introduction-Qualitative and quantitative displays, basic T grouping of instruments, basics of Altitude Director Indicator (ADI) & Horizontal Situation Indicator.
Air Data Instruments: Pneumatic type and air data computers, International Standard Atmosphere (ISA),
combined pitot-static probe, separate static probe, air speed indicator, instantaneous vertical speed indicator.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 2

Air Data Warning System: Altimeters, Mach warning system, altitude alerts system, airspeed warning system.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 3

Directional Systems: Earth's total magnetic field, horizontal and vertical components of total field direct reading compass and its limitations, fluxgate detector units. gyro stabilized direction indicating systems.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 4	
Gyroscopic Flight Instruments: types of gyros-mechanical, ring laser gyros, fiber optic gyros and their limitations, basic mechanical gyro and its properties namely rigidity and precision, gyro horizon, direction indicator, turn and bank indicator.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Engine Instruments: pressure measurement (EPR), Temperature measurement (EGT), capacitance type volumetric fuel quantity indicator, densitometer, fuel quantity indicator by weight. Engine speed measurement, torque measurement, integrated impellor type flow meter.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Outline the scope and extent of avionics and identify the types of flight instruments and display panels.
- Describe the fundaments of flight, basics of aircraft structures, propulsion and materials used in the development of an aircraft.
- Comprehend the complexities involved during development of flight vehicles.
- Recognize the fundamental applications of gyroscopic flight instruments in aircraft and analyses the performance of aircraft control system and interpret the results.
- Evaluate the performance characteristics of engine instruments of aircraft and give better view and ways to improve efficiency.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question

papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1) Aircraft Instruments and Integrated Systems- EHJ Pallet, Longman Scientific & Technical, 1992.
2) Aircraft Instrumentation and Systems -S. Nagabhushana & L.K. Sudha, IK International
3) Aircraft Systems: Mechanical, electrical, and avionics subsystems integration - Ian Moir and Allan Seabridge, Third Edition, John Wiley & Sons, Ltd., 2008.

Web links and Video Lectures (e-Resources):

- VTU e-shikshana programme
- VTU Edu-sat programmes
- https://nptel.ac.in/courses/101104071
- https://nptel.ac.in/courses/101101079

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes,
- Assignments,
- Seminars

DSP Algorithms & Architecture			Semester	VIII
Course and Course Code	PEC	**BEI801D**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:1		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:
After completion of the course, the students will be able to

- Understand the concepts of digital signal processing techniques.
- Understand the computational building blocks of DSP processors and its speed issues.
- Understand the various addressing modes, peripherals, interrupts and pipelining structure of then TMS320C54xx processor.
- Learn how to interface the external devices to the TMS320C54xx processor in various modes.
- Understand DSP algorithms and applications with their implementation using TMS320C54xx processor.

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
- Show Video/animation films to explain the functioning of various techniques.
- Encourage collaborative (Group) Learning in the class
- Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in multiple representations.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

MODULE – 1

Introduction to Digital Signal Processing: Introduction, A Digital Signal – Processing system, Major features of programmable Digital signal processors, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.
Section 1.3, 2.1 to 2.8 of Text 1

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 2

Architectures for Programmable Digital Signal Processing Devices: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features

for External Interfacing. Section 4.1 to 4.9 of Text 1	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 3	
Programmable Digital Signal Processors: Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS32OC54XX, Memory Space of TMS32OC54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming, On–Chip Peripherals, Interrupts of TMS32OC54xx Processors, Pipeline Operation of TMS32OC54xx Processor. Section 5.1 to 5.10 of Text 1	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 4	
Implementation of Basic DSP Algorithms: Introduction, The Q–notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case). **Implementation of FFT Algorithms:** Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit – Reversed Index. Generation & Implementation on the TMS32OC54xx. Section 7.1 to 7.6 and 8.1 to 8.6 of Text 1	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I/O Direct Memory Access (DMA). **Interfacing and Applications of DSP Processors:** Introduction, Synchronous Serial Interface, A CODEC Interface Circuit, DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System. Section 9.1 to 9.8, 10.1 to 10.5 and11.1 to 11.5 of Text 1	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
Course outcomes (Course Skill Set): At the end of the course, the student will be able to: 1) Comprehend the knowledge & concepts of digital signal processing techniques. 2) Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor. 3) Develop assembly language programs to implement FIR, IIR filters and FFT algorithms. 4) Build the Applications on Programmable DSP devices.	
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.	

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books

1) "Digital Signal Processing", Avatar Singh and S Srinivasan, Thomson Learning, 2004

Reference Books

1) "Digital Signal Processing: A practical approach", Ifeachor E C, Jervis B**.** W Pearson-Education, PHI, 2002.
2) "Digital Signal Processors", B Venkataramani and M Bhaskar, TMH, 2nd Ed**.**, 2010
3) "Architectures for Digital Signal Processing", Peter Pirsch, John Wiley.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes,
- Assignments,
- Seminars

Open Elective Course

E-Waste Management			Semester	VIII
Course and Course Code	OEC	**BEI802A**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:
After completion of the course, the students will be able to

- **Current Status:** According to a report on e-waste presented by the United Nations (UN) in World Economic Forum on January 24, 2019, the waste stream reached 48.5 MT in 2018. With such a large quantity of e-waste being generated each year, the future of e-waste recycling in India looks pretty bright. The E-waste (Management) Rules, 2016, enacted on October 1, 2017, added over 21 products (Schedule-I) under the purview of the rule.
- **Purview:** This course covers an extensive review of e-waste management in India. With a focus on the evolution of legal frameworks in India and the world, it presents impacts and outcomes; challenges and opportunities; and management strategies and practices to deal with e-waste. It also includes a survey of pan-India initiatives and trajectories of law-driven initiatives for effective E-waste management along with responses from industries and producers.
- **Scope:** There is a considerable scope for e-waste recycling in India. It is not only a solution to help mitigate E-waste management issues, but it also helps to generate employment. With the rise in E-waste recycling plants, the demand for employees with all levels of qualification and skills also increases.

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
- Show Video/animation films to explain the functioning of various techniques.
- Encourage collaborative (Group) Learning in the class
- Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in multiple representations.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps to improve the students' understanding.
- Arrange visits to nearby industries to give industry exposure.

MODULE – 1

Sustainable development and e-waste management: Importance of electrical and electronic equipment in a nation's development, and e-waste as toxic companion of digital era, I: Let's understand e-waste, II: E-waste statistics: quantities, collection and recycling, E-waste categories and harmonising statistics, III: An overview on status of e-waste related legislation across the globe; IV: UN initiatives for e-waste management: creating partnerships and achieving Agenda 2030; V: Indian scenario: e-waste generation, collection and recycling.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2

MODULE – 2

Extended producer responsibility: a mainstay for e-waste management: Evolution of concept of 'extended producer responsibility', EPR applied for waste management and extended for e-waste management, EPR: goals, implementation, and challenges for e-waste management, EPR implemented for e-waste management under the existing regulatory frameworks in different countries, Role of a PRO prescribed in regulatory framework, Considerations for successful implementation of EPR, Challenges in implementation of EPR for e-waste management, Impact of EPR, EPR and e-waste management in India.

Toxicity and impacts on environment and human health: Toxicity, recycling, and regulations, I: Environmental concerns, II: Human health concerns.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 3

Treating e-waste, resource efficiency, and circular economy: Safe environment, resource use, and circular economy, Circular economy: recycling, resource recovery, and resource efficiency, Potentials of urban mining in circular economy, Recycling and resource efficiency related challenges to the circular economy, Urban mining, recycling, resource use, resource efficiency, and circular economy in India.

E-waste management through legislations in India: I: Historical backdrop of regulatory regime for e-waste in India, II: E-waste (management) Rules, 2016 and E-waste (management) Amendment Rules, 2018, III: Analysing performance of EPR and CPCB as regulatory mechanisms, IV: Legal cases and judicial directives.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 4

Strategies and initiatives for dealing with e-waste in India: I: Overview of pan-India initiatives for dealing with e-waste during 2000 and 2012, II: Law-driven e-waste management – initiatives by the government, non-government agencies, and judiciary.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

MODULE – 5

Moving towards horizons: I: Legal and judicial domain, II: Economic concerns, III: Environment concerns, IV: Recycling culture/recycling society.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Understand the existing discourse on e-waste and its management, statistics across the world, opportunities, and challenges w.r.t. regulatory framework, SDGs, CE, and LCIA (Life Cycle Impact Assessment) and MFA (Material Flow Analysis), Indian scenario.
- Describe EPR, a regulatory framework for achieving specified goals across different countries and impacts on environment and human health.
- Explain themes in the context of resource use and sustainable development. Urban mining, informal sector operations and need for resource use policy, financial support for recycling infrastructure building, etc. in Indian context and also explain to what extent – different aspects of e-waste

management have been incorporated in the existing regulatory framework in comparison with international legislatures.

- Identify and infer pan-Indian initiatives dealing with e- waste management, ranging from building knowledge base through research and social action by different stakeholders to technological and legal advancements, and industrial initiatives. Analyse roadmap for the Agenda 2030.
- Use opportunities and challenges around four domains: legal and judicial domain; economic concerns; recycling culture/society; and environment concerns.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1) Varsha Bhagat Gangulay, 'E-Waste Management', Taylor and Francis, 2022**.**

Web links and Video Lectures (e-Resources):

- https://link.springer.com/book/10.1007/978-3-030-14184-4
- https://rajyasabha.nic.in/rsnew/publication_electronic/E-Waste_in_india.pdf
- https://greene.gov.in/wp-content/uploads/2018/01/E-waste-Vol-II-E-waste-Management-Manual.pdf
- https://nptel.ac.in/courses/105105169

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Groups can be made to conduct a survey on the present scenario of India and top 5 countries facing E-waste management challenges.
- Industry visits to give an exposure of the e-waste management process and also business.
- Case studies to develop e-waste management models.
- Survey of few e-waste management companies can be carried out and submit report.

Smart Sensors and Intelligent Instrumentation			Semester	VIII
Course and Course Code	OEC	**BEI802B**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:

After completion of the course, the students will be able to

- To learn the principle of smart sensors and process of micromachining in development of smart sensors.
- To learn intelligent systems by interfacing the smart sensors to MCUs and DSPs.
- To analyze the use of smart sensors in communication, MEMS and automation.
- To evaluate the standards of smart sensors by the assessment of reliability testing and packaging.
- To understand the applications of smart sensors in different fields and recent development.
- To design the simple models of intelligent instrumentation.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so
- that the delivered lessons shall develop student's theoretical and programming skills**.**
- State the need for learning Programming with real-life examples.
- Support and guide the students for self**–**study.
- You will also be responsible for assigning homework, grading assignments and quizzes, and documenting
- students' progress.
- Encourage the students for group learning to improve their creative and analytical skills.
- Show short related video lectures in the following ways:
  - ✓ As an introduction to new topics (pre-lecture activity).
  - ✓ As a revision of topics (post-lecture activity).
  - ✓ As additional examples (post-lecture activity).
  - ✓ As an additional material of challenging topics (pre-and post-lecture activity).
  - ✓ As a model solution of some exercises (post-lecture activity).

MODULE – 1

Basics of smart sensors and micromachining: Introduction, Mechanical-Electronic transitions in sensing, nature of sensors, overview of smart sensing and control systems, integration of micromachining and microelectronics, introduction to micromachining, bulk micromachining, wafer bonding, surface micromachining, other micromachining techniques.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

MCUs and DSPs for sensor: Introduction, MCU control, MCUs for sensor interface, DSP control, Software, tools and support, sensor integration

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 3	
Sensor Communication and MEMS: Wireless zone sensing, surface acoustical wave devices, intelligent transportation system, RF-ID, Micro optics, micro-grippers, micro-probes, micro- mirrors, FEDs, communications for smart sensors - sources and standards, automotive protocols, industrial networks, office and building automation, home automation, protocols in silicon, other aspects of network communications.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 4	
Packaging, Testing and Reliability of Smart Sensors: Introduction, Semiconductor packaging applied to sensors, hybrid packaging, packaging for monolithic sensors, reliability implications, testing smart sensors. Unit Standards for Smart Sensors: Introduction, setting the standards for smart sensors and systems , IEEE 1451.1, IEEE 1451.2, IEEE P1451.3, IEEE 1451.4, extending the systems to network.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Implications of Smart Sensor Standards and Recent Trends: Introduction, sensor plug-and-play, communicating sensor data via existing wiring, automated/remote sensing and web, process control over the internet, alternative standards, HVAC sensor chip, MCU with integrated pressure sensors, alternative views of smart sensing, smart loop.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1) Describe the principle of smart sensors and process of micromachining in development of smart sensors.
2) Develop intelligent systems by interfacing the smart sensors to MCUs and DSPs.
3) Analyze the use of smart sensors in communication, MEMS and automation.
4) Evaluate the standards of smart sensors by the assessment of reliability testing and packaging.
5) Discuss the applications of smart sensors in different fields and recent development.
6) Develop/sketch the simple models of intelligent instrumentation.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.

- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1) Understanding Smart Sensors- Randy Frank, 2nd Edition. Artech House Publications, 2013.
2) G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat, V. K. Aatre, Micro and Smart Systems: Technology and modeling, Willey Publications, 2012.

Web links and Video Lectures (e-Resources):

- Introduction to Microscale Sensors or MEMS: https://www.youtube.com/watch?v=gG5a_zIiiV0
- MEMS :https://www.youtube.com/watch?v=CNmk-SeM0ZI
- MEMS ACCELEROMETER : https://www.youtube.com/watch?v=eqZgxR6eRjo
- MICROMACHINING OVERVIEW: https://www.youtube.com/watch?v=EALXTht-stg
- Chip Manufacturing - How are Microchips made?
- https://www.youtube.com/watch?v=bor0qLifjz4
- HOW SENSORS ARE ENABLING INDUCSTRY 4.0:https://www.youtube.com/watch?v=wKXe-0ocyiQ

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- To learn recent tools to simulate MEMS and other sensors
- Quizzes,
- Assignments,
- Seminars

Automotive Electronics			Semester	VIII
Course and Course Code	OEC	**BEI802C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:
After completion of the course, the students will be able to

- To Gain knowledge of Ignition, Transmission, Brakes System in Automobile
- To Understand the basic concepts and various Operation using Sensor and Actuators Used Automobile.
- To diagnosis the problem related types of, Data Acquisition System and Communication Networks (Bus Systems) Control system using Standard Technology.
- To Understand the basic of Vehicle Cruise control and Collision Avoidance Radar warning Systems.
- To Gain knowledge of Electric Vehicle, Hybrid Electric vehicle, Electric Hybrid Vehicle,Vehicle components

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecturer method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
- Use of Video/Animation to explain functioning of various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.
- Introduce Topics in manifold representations.
- Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

MODULE – 1

Automotive Fundamentals Overview: Four Stroke Cycle, Engine Control, Ignition System, Spark plug, Spark pulse generation, Ignition Timing, Drive Train, Transmission, Brakes, Steering System, Battery, Starting System. Air/Fuel Systems Fuel handling. Air/ Fuel Management.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Sensors and actuators: Sensors – Oxygen (02/EGO) Sensors, Throttle Position Sensor (TPS), Engine Crankshaft Angular Position (CKP)Sensors, Hall effect Position Sensor, Shielded Field Sensor, Optical

Crankshaft Position Sensor, Manifold Absolute Pressure (MAP) Sensor– Strain gauge and Capacitor capsule, Engine Coolant Temperature (ECT) Sensor, Intake Air Temperature(IAT)Sensor, Knock Sensor, Air flow rate sensor, Throttle angle Sensor. Actuators: Fuel Metering Actuator, Fuel Injector, Ignition Actuator. Exhaust After-Treatment Systems – AIR, Catalytic Converter, Exhaust Gas Recirculation(EGR), Evaporative Emission Systems.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Automotive Instrumentation and Communication: Sampling, Measurement & Signal Conversion of various parameters (Speed, fuel, pressure). Serial Data, Communication Systems, Protection, Body and Chassis is Electrical Systems, Remote Keyless Entry, GPS

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 4

Vehicle Motion Control: Cruise control, Chassis, Power Brakes, Antilock Brake System (ABS), Electronic Steering Control, Power Steering, Traction Control, electronically controlled suspension. Automotive Diagnostics –Timing Light, Engine Analyzer, On- board diagnostics, Off-board diagnostics, Expert Systems. Future Automotive Electronics Systems: Alternative Fuel Engines, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Radio navigation, Advance Driver Information System.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 5

Introduction to Alternative Vehicles: Electric Vehicle, Hybrid Electric vehicle, Electric Hybrid Vehicle, Vehicle components, Electric and Hybrid history EV/CEV Comparison. Alternative Vehicle Architecture: Electric Vehicles, Hybrid Electric Vehicles, Plug-in Hybrid Electric Vehicles, Power Train component Sizing, Mass Analysis & Packaging, Vehicle Simulation.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1) Understanding of Engine Parameters and a critical awareness of current problems within the automotive electronics domain using Various Measurement Technology.
2) Apply the fundamental Concepts of automotive electronics on various Engine parts, Sensor, Actuator, Communication and Measurement System.
3) Determine the extent and nature of electronic circuitry in automotive systems including monitoring and control circuits for engines, transmissions, brakes, steering, suspension
4) Analyze climate control, instrumentation and radios and accessories involved in Automotive Industry.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1) Willliam B. Ribbens: Understanding Automotive Electronics, 6th Edition, SAMS/Elsevier Publishing Iqbal Husain "Electric and Hybrid Vehicles: Design fundamentals". CRC Press,2011.
2) Robert Bosch GmbH: Automotive Electronics Systems and Components, 5th Edition, John Wiley & Sons Ltd., 2007
3) James Laminie and John Lowry. "Electric Vehicle Technology – Explained', CRC Press2010. Society of Automobile Engineers, "Hybrid Electric vehicles", CRC Press,2011.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration by videos
- Group activity
- Quizzes
- Assignments
- Seminars

Instrumentation Buses and Industrial Data Networks			Semester	VIII
Course and Course Code	OEC	**BEI802D**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		Total Marks	100
Credits	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:
After completion of the course, the students will be able to

- Explain basic concepts of Industrial Data communication.
- Apply network data communication protocols.
- Solve the problems of industrial data communication systems including Modbus, Fiber optics, Industrial Ethernet etc
- Evaluate appropriateness of different industrial data networks.

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
- Show Video/animation films to explain the functioning of various techniques.
- Encourage collaborative (Group) Learning in the class
- Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in multiple representations.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

MODULE – 1

Introduction to industrial data communications: Introduction, Modern instrumentation &control systems, Open system interconnection (OSI) model, protocols, standards-EIA-232interface standard, EIA-485 interface standard, fibre optics, Data Highway plus/DH485, foundation field bus.
Overall methodology: Common problems & solutions, General comments on trouble shooting, A specific methodology, Grounding/shielding and noise.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Fiber Optics Overview: Introduction, Fiber optic cable components, Fiber optic cable parameters, Basic cable types, connecting fibers, splicing trace/organizers and termination cabinets, troubleshooting.
Data Highway Plus/DH485 Overview : Allen Bradley Data Highway (plus) protocol, troubleshooting.

Teaching-Learning Process	Chalk and talk method, You Tube Videos, Power Point Presentation.
RBT Levels	L1, L2, L3

MODULE – 3	
Modbus overview : Modbus protocol structure, function codes, Trouble shooting ,Profibus PA/DP/FMS overview, Profibus Protocol stack, Profibus communication model, relationship between application process and communication, communication objects, system operation, Trouble shooting. **Modbus Plus Protocol Overview:** General Overview, Trouble shooting.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 4	
HART overview : Introduction to HART and smart instrumentation, HART protocol, physical layer, Data link layer, Application layer, Trouble shooting. **TCP/IP overview :** Introduction, Internet layer protocols, Host-to-host layer, Troubleshooting.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Foundation Fieldbus Overview: Introduction, The Physical layer and wiring rules, The Data link layer, The application layer, The User layer, Error Detection and diagnostics, HSE, Good wiring and installation practice with Fieldbus, Trouble shooting **Industrial Ethernet overview :** Introduction10Mbps Ethernet, 100 Mbp's Ethernet, Radio and wireless communication: Introduction, components of radio link, The radio spectrum and frequency allocation, Radio Modems.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1) Understand the basic concepts of Industrial communication system.
2) Describe the main features of fiber optic cabling & Data Highway Plus.
3) List the main Modbus structure and frames used and fixing the problems by using ProfiBus.
4) Describe the operation of HART and TCP/IP.
5) Develop the various communication networks for industries.

Assessment Details (both CIE and SEE)

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- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of

assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

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1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books

1) Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, 'Practical Industrial Data Networks Design, Installation and Troubleshooting', Newnes publication, Elsevier First edition, 2004

Reference Books

1) Andrew S. Tanenbaum, Modern Operating Systems, Prentice Hall of India Pvt. LTD, 2003
2) Stallings, W., "wireless Communication and networks", 2nd Edition, Prentice Hall of India, 2005
3) Process Software and Digital Networks", B.G. Liptak, CRC Press ISA- The Instrumentation, Systems, and Automation Society.
4) Theodore S. Rappaport, 'Wireless communication: Principles & Practice',2nd Edition,2001, Prentice Hall of India.

Web links and Video Lectures (e-Resources):

- VTU e-shikshana programme
- VTU Edu-sat programmes
- http://www.interfacebus.com/Design_Connector_Field_Buses.html
- https://www.chemicalprocessing.com/assets/Media/MediaManager/texasinstruments_fielbus.pdf
- https://www.ti.com/applications/industrial/industrial-communications.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to modern industries
- Quizzes,
- Assignments,
- Seminars

Common Subjects

BSCK307 – Social Connect & Responsibility 2022 Scheme & syllabus for 3rd sem		Semester	3rd
Course Code	BSCK307	CIE Marks	100
Teaching Hours/Week (L:T:P: S)	0:0:3:1	SEE Marks	------
Total Hours of Pedagogy	40 hour Practical Session +15 hour Planning	Total Marks	100
Examination nature (No SEE – Only CIE)	For CIE Assessment - Activities Report Evaluation by College NSS Officer / HOD / Sports Dept / Any Dept.		
Credits	01 - Credit		

Course objectives: The course will enable the students to:

1. Provide a formal platform for students to communicate and connect to the surrounding.
2. create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

General Instructions - Pedagogy :

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

Contents :

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.

The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.

In the following a set of activities planned for the course have been listed:

Social Connect & Responsibility - Contents

Part I:

Plantation and adoption of a tree:

Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE)

They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.

Part II :

Heritage walk and crafts corner:

Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives,Visit, case study, report, outcomes.

Part III :

Organic farming and waste management:

Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus –

Objectives,Visit, case study, report, outcomes.

Part IV:

Water conservation:

Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.

Part V :

Food walk:

City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1: Communicate and connect to the surrounding.

CO2: Create a responsible connection with the society.

CO3: Involve in the community in general in which they work.

CO4: Notice the needs and problems of the community and involve them in problem –solving.

CO5: Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.

CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

Activities:

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY:

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersionwith NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

Duration :

A total of 40 - 50 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic ,and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines of scheme & syllabus.

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE):

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall

be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information/Data collected during the social connect Analysis of the information/data and report writing Considering all above points allotting the marks as mentioned below

Excellent : 80 to 100
Good : 60 to 79
Satisfactory : 40 to 59
Unsatisfactory and fail : <39

Special Note :

NO SEE – Semester End Exam – Completely Practical and activities based evaluation

Pedagogy – Guidelines :

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	**Plantation and adoption of a tree:**	May be individual or team	Farmers land/ parks / Villages / roadside/ community area / College campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
2.	**Heritage walk and crafts corner:**	May be individual or team	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
3.	**Organic farming and waste management:**	May be individual or team	Farmers land / parks / Villages visits / roadside/ community area / College campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
4.	**Water conservation:** & conservation techniques	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers / campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
5.	**Food walk: Practices in society**	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty

Plan of Action (Execution of Activities)

Sl.NO	Practice Session Description
1	**Lecture session in field to start activities**
2	**Students Presentation on Ideas**
3	**Commencement of activity and its progress**
4	**Execution of Activity**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
8	**Case study based Assessment, Individual performance**
9	**Sector/ Team wise study and its consolidation**
10	**Video based seminar for 10 minutes by each student At the end of semester with Report.**

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**	• Implementation strategies of the project (NSS work). • The last report should be signed by NSS Officer, the HOD and principal. • At last report should be evaluated by the NSS officer of the institute. • Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Field Visit, Plan, Discussion	10 Marks	
Commencement of activities and its progress	20 Marks	
Case study based Assessment Individual performance with report	20 Marks	
Sector wise study & its consolidation 5*5 = 25	25 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report. **Activities 1 to 5, 5*5 = 25**	25 Marks	
Total marks for the course in each semester	**100 Marks**	

For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.

Yoga for a Better Life		Semester	III – VI sem
Course Code	**BYOK459**	CIE Marks	100/sem
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	000
Total Hours of Pedagogy per semester	24 - 28 hours (Theory + practical)	Total Marks	100/sem
Examination nature (SEE)	**Objective type Theory / Practical / Viva-Voce**		

Course objectives:

1) To enable the student to have good health.
2) To practice mental hygiene.
3) To possess emotional stability.
4) To integrate moral values.
5) To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical
    1. Improved body flexibility and balance
    2. Improved cardiovascular endurance (stronger heart)
    3. Improved digestion
    4. Improved abdominal strength
    5. Enhanced overall muscular strength
    6. Relaxation of muscular strains
    7. Weight control
    8. Increased energy levels
    9. Enhanced immune system
- Mental
    1. Relief of stress resulting from the control of emotions
    2. Prevention and relief from stress-related disorders
    3. Intellectual enhancement, leading to improved decision-making skills
- Spiritual
    1. Life with meaning, purpose, and direction
    2. Inner peace and tranquility
    3. Contentment

Yoga Syllabus

Semester III

Yoga, its origin, history and development. Yoga, its meaning, definitions.
Different schools of yoga, Aim and Objectives of yoga, importance of prayer
Yogic practices for common man to promote positive health
Rules to be followed during yogic practices by practitioner
Yoga its misconceptions,
Difference between yogic and non yogic practices
Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12 count, 2 rounds

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana
Different types of Asanas

a. Sitting 1. Padmasana
   2. Vajrasana
b. Standing 1. Vrikshana
   2. Trikonasana
c. Prone line 1. Bhujangasana
   2. Shalabhasana
d. Supine line 1. Utthitadvipadasana
   2. Ardhahalasana

Semester IV

Patanjali's Ashtanga Yoga, its need and importance.
Yama :Ahimsa, satya, asteya, brahmacarya, aparigraha
Niyama :shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan

Suryanamaskar12 count- 4 rounds of practice

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana
Different types of Asanas

a. Sitting 1. Sukhasana
   2. Paschimottanasana
b. Standing 1. Ardhakati Chakrasana
   2. Parshva Chakrasana
c. Prone line 1. Dhanurasana
d. Supine line 1. Halasana
   2. Karna Peedasana

Meaning, importance and benefits of Kapalabhati.
40 strokes/min 3 rounds
Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama
Pranayama – 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana
4. Chandra Bhedana 5. Nadishodhana

Semester V

Patanjali'sAshtanga Yoga its need and importance.

Ashtanga Yoga

1. Asana
2. Pranayama
3. Pratyahara

Asana its meaning by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

a. Sitting 1. Ardha Ushtrasana
   2. Vakrasana
   3. Yogamudra in Padmasana

b. Standing 1. UrdhvaHastothanasana
   2. Hastapadasana
   3. ParivrittaTrikonasana
   4. Utkatasana

c. Prone line 1. Padangushtha Dhanurasana
   2. Poorna Bhujangasana / Rajakapotasana

d. Supine line 1. Sarvangasana
   2. Chakraasana
   3. Navasana/Noukasana
   4. Pavanamuktasana

Revision of practice 60 strokes/min 3 rounds

Meaning by name, technique, precautionary measures and benefits of each Pranayama

1. Ujjayi 2. Sheetali 3. Sheektari

Semester VI

Ashtanga Yoga 1. Dharana 2. Dhyana (Meditation) 3. Samadhi

Asana by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

a. Sitting 1. Bakasana
   2. Hanumanasana
   3. Ekapada Rajakapotasana
   4. Yogamudra in Vajrasana

b. Standing 1. Vatayanasana
   2. Garudasana

c. Balancing 1. Veerabhadrasana
   2. Sheershasana

d. Supine line 1. Sarvangasana
   2. Setubandha Sarvangasana
   3. Shavasanaa (Relaxation poisture).

Revision of Kapalabhati practice 80 strokes/min - 3 rounds

Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama 1. Bhastrika 2. Bhramari

Meaning, Need, importance of Shatkriya. Different types. Meaning by name, technique, precautionary measures and benefits of each Kriya 1. Jalaneti & sutraneti 2. Nouli (only for men) 3. Sheetkarma Kapalabhati

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Understand the meaning, aim and objectives of Yoga.
- Perform Suryanamaskar and able to Teach its benefits.
- Understand and teach different Asanas by name, its importance, methods and benefits.
- Instruct Kapalabhati and its need and importance.
- Teach different types of Pranayama by its name, precautions, procedure and uses
- Coach different types of Kriyas , method to follow and usefulness.
-

Assessment Details (both CIE and SEE)

- Students will be assessed with internal test by a. Multiple choice questions b. Descriptive type questions (Two internal assessment tests with 25 marks/test)
- Final test shall be conducted for whole syllabus for 50 marks.
- Continuous Internal Evaluation shall be for 100 marks (including IA test)

Suggested Learning Resources:

Books:

1. **Yogapravesha in Kannada by Ajitkumar**
2. **Light on Yoga by BKS Iyengar**
3. **Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly**
4. **Yoga Instructor Course hand book published by SVYASA University, Bengaluru**
5. **Yoga for Children –step by step – by Yamini Muthanna**

Web links and Video Lectures (e-Resources): Refer links

6. **https://youtu.be/KB-TYlgd1wE**
7. **https://youtu.be/aa-TG0Wg1Ls**

Dr. P V Kadagadakai
Yoga Teacher

National Service Scheme (NSS)		Semester	3rd to 6th
Course Code	**BNSK459**	CIE Marks	**25*4 = 100**
Teaching Hours/Week (L:T:P: S)	0:0:3:1	SEE Marks	------
Total Hours of Pedagogy	40 hour Practical Session +15 hour Planning	Total Marks	**25*4 = 100**
Examination nature (SEE)	Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th semester)		
Credits	NCMC – Non Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)		

Course objectives: National Service Scheme (NSS) will enable the students to:

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem –solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

General Instructions - Pedagogy :

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

National Service Scheme (NSS) – Contents

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1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/

technical/ vocational education.

7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

NOTE:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.

Distribution of Activities - Semester wise from 3rd to 6th semester

Sem	Topics / Activities to be Covered
3rd Sem for 25 Marks	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4th Sem for 25 Marks	4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
5th Sem for 25 Marks	7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs.(minimum5 programs). 10. Social connect and responsibilities.
6th Sem for 25 Marks	11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / community area/ College campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc…..	Group selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	site selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
9.	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
10.	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

11.	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities For Each Semester)

Sl.NO	Practice Session Description
1	**Lecture session by NSS Officer**
2	**Students Presentation on Topics**
3	**Presentation - 1 , Selection of topic, PHASE - 1**
4	**Commencement of activity and its progress - PHASE - 2**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
8	**Execution of Activity**
9	**Execution of Activity**
10	**Case study based Assessment, Individual performance**
11	**Sector wise study and its consolidation**
12	**Video based seminar for 10 minutes by each student At the end of semester with Report.**

- In every semester from 3rd semester to 6th semester, Each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.

CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Assessment Details for CIE (both CIE and SEE)

Weightage	CIE – 100%
Presentation - 1 Selection of topic, PHASE - 1	10 Marks
Commencement of activity and its progress - PHASE - 2	10 Marks
Case study based Assessment Individual performance	10 Marks
Sector wise study and its consolidation	10 Marks
Video based seminar for 10 minutes by each student At the end of semester with Report.	10 Marks
Total marks for the course in each semester	**50 Marks**

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
- Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

Marks scored for 50 by the students should be Scale down to 25 marks In each semester for CIE entry in the VTU portal.

25 marks CIE entry will be entered in University IA marks portal at the end of each semester 3rd to 6th sem, Report and assessment copy should be made available in the department semester wise.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general.

Suggested Learning Resources:

Books :

1. **NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, nss cell, Activities reports and its manual.

Semester: III						
PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I						
Course Code	**:**	BPEK359		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:1				
Total Hours	**:**	30 P				

Course Outcomes: At the end of the course, the student will be able to

1. Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state / national / international levels.
5. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

Module I : Orientation	**5 Hours**
A. Lifestyle B. Fitness C. Food & Nutrition D. Health & Wellness E. Pre-Fitness test.	
Module II : General Fitness & Components of Fitness	**15 Hours**
A. Warming up (Free Hand exercises) B. Strength – Push-up / Pull-ups C. Speed – 30 Mtr Dash D. Agility – Shuttle Run E. Flexibility – Sit and Reach F. Cardiovascular Endurance – Harvard step Test	
Module III : Recreational Activities	**10 Hours**
A. Postural deformities. B. Stress management. C. Aerobics. D. Traditional Games.	

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

Semester: IV						
PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II						
Course Code	**:**	BPEK459		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:1				
Total Hours	**:**	30 P				

Course Outcomes: At the end of the course, the student will be able to

1. Understand the ethics and moral values in sports and athletics
2. Perform in the selected sports or athletics of student's choice.
3. Understand the roles and responsibilities of organisation and administration of sports and games.

Module IV : Ethics and Moral Values **5 Hours**

A. Ethics in Sports
B. Moral Values in Sports and Games

Module V : Specific Games (Any one to be selected by the student) **20 Hours**

A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.
B. Throwball – Service, Receive, Spin attack, Net Drop & Jump throw.
C. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
D. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.
E. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash.
F. Athletics (Track / Field Events) – Any event as per availability of Ground.

Module VI : Role of Organisation and administration **5 Hours**

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

Universal Human Values (UHV)		Semester	3rd
Course Code	**BUHK408**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:1	SEE Marks	50
Total Hours of Pedagogy	15 hour Theory Session +15 hour Self study	Total Marks	100
Credits	01	Exam Hours	01 Hour
Examination type (SEE)	SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is **MCQ (multiple choice questions).**		

Course objectives:

This course is intended to:

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
- This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in the society and Provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous selfevolution.
7. Encourage the students for group work to improve their creative and analytical skills.

Module-1

Introduction to Value Education **(3 hours)**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

Module-2

Harmony in the Human Being : **(3 hours)**

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

Module-3

Harmony in the Family and Society : **(3 hours)**

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Module-4

Harmony in the Nature/Existence : **(3 hours)**

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Module-5

Implications of the Holistic Understanding – a Look at Professional Ethics : **(3 hours)**

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Course outcome (Course Skill Set)

At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature);

- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Expected to positively impact common graduate attributes like:

1. Ethical human conduct
2. Socially responsible behaviour
3. Holistic vision of life
4. Environmentally responsible work
5. Having Competence and Capabilities for Maintaining Health and Hygiene
6. Appreciation and aspiration for excellence (merit) and gratitude for all

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for **50 questions,** each of the 01 marks. **The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books for READING:

Text Book and Teachers Manual

a. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
b. The Teacher‟s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.

2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book).

4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5. Small is Beautiful - E. F Schumacher.

6. Slow is Beautiful - Cecile Andrews

7. Economy of Permanence - J C Kumarappa

8. Bharat Mein Angreji Raj – Pandit Sunderlal

9. Rediscovering India - by Dharampal

10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

11. India Wins Freedom - Maulana Abdul Kalam Azad

12. Vivekananda - Romain Rolland (English)

13. Gandhi - Romain Rolland (English)

14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.

16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.

17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.

18. A N Tripathy, 2003, Human Values, New Age International Publishers.

19. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.

20. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press

21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.

23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Web links and Video Lectures (e-Resources):

- Value Education websites,
- https://www.uhv.org.in/uhv-ii,
- http://uhv.ac.in,
- http://www.uptu.ac.in
- Story of Stuff,
- http://www.storyofstuff.com
- Al Gore, An Inconvenient Truth, Paramount Classics, USA
- Charlie Chaplin, Modern Times, United Artists, USA
- IIT Delhi, Modern Technology – the Untold Story
- Gandhi A., Right Here Right Now, Cyclewala Productions
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
- https://fdp-si.aicte-india.org/8dayUHV_download.php
- https://www.youtube.com/watch?v=8ovkLRYXIjE
- https://www.youtube.com/watch?v=OgdNx0X923I
- https://www.youtube.com/watch?v=nGRcbRpvGoU
- https://www.youtube.com/watch?v=sDxGXOgYEKM

V Semester

Environmental Studies			
Course Code:	**BESK508**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+0+0+0	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	02	Exam Hours	01

Course objectives:

- To create environmental and sustainbility awareness among the students.
- To gain knowledge on different types of pollution in the environment, waste management and Environmental legislation.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, and animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Environmental awareness program for the in house campus
3. Encourage collaborative (Group Learning) Learning in the class.
4. Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills.

Module-1

Module-1: ECOSYSTEM AND SUSTAINABILITY

Ecosystems (Structure and Function): Forest, Desert, Wetlands, River, Oceanic and Lake.

Sustainability: 17 SDGs- History, targets, implementation , Capacity Development

Teaching-Learning Process	Chalk and talk, PowerPoint presentation and animation tools

Module-2

Module 2: NATURAL RESOURCE MANAGEMENT

Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind.

Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining - case studies and Carbon Trading.

Teaching-Learning Process	Chalk and talk, powerpoint presentation and animation tools

Module-3

Module 3: ENVIRONMENTAL POLLUTION & WASTE MANAGEMENT

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.

Waste Management: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

Teaching-Learning Process	Chalk and talk, powerpoint presentation and animation tools

Module-4

Module 4: GLOBAL ENVIRONMENTAL ISSUES

Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Teaching-Learning Process	Chalk and talk, powerpoint presentation and animation tools

Module-5

Module 5: ENVIRONMENTAL LEGISLATION

Environmental Legislation : Water Act 1974, Air Act 1981, Environmental Protection Act 1984, Solid Waste Management Rules-2016, E- Waste management Rule - 2022, Biomedical Waste management- 2016.

Teaching-Learning Process	Chalk and talk, power point presentation and animation tools

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment as legislation.
- CO3: Apply their ecological knowledge to illustrate and grasp the problem and describe the realities that managers face when dealing with complex issues.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 01 hours)**

Question paper pattern:

1. The Question paper will have 50 objective questions.

2. Each question will be for 01 marks
3. Students will have to answer all the questions on an OMR Sheet.
4. The Duration of the Exam will be 01 hour

Suggested Learning Resources:

Books

- Environmental studies, Benny Joseph, Tata Mcgraw-Hill 2nd edition 2012
- Environmental studies, S M Prakash, pristine publishing house, Mangalore 3rd edition-2018

Reference Books: -

- Benny Joseph, Environmental studies, Tata Mcgraw-Hill 2nd edition 2009
- M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007
- Dr. B.S Chauhan, Environmental studies, university of science press 1st edition

Web links and Video Lectures (e-Resources):

Weblink:

- https://sdgs.un.org/goals

Video Lectures

- https://archive.nptel.ac.in/courses/109/105/109105190/ .

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Field work:** Visit to Zero Waste Management Plant / Solid waste management plant.

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V Semester

RESEARCH METHODOLOGY & IPR			
Course Code:	**BRMK557**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

CO1. To Understand the knowledge on basics of research and its types.
CO2. To Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
CO3. To learn Ethics in Engineering Research.
CO4. To Discuss the concepts of Intellectual Property Rights in engineering.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer methods (L) need not be only the traditional lecture methods, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video to explain various concepts on IPR.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class, which promotes critical thinking.
5. Introduce Topics in manifold representations.
6. Show the different ways to analyze the research problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps Improve the students' understanding.

Module-1 (5 Hours)

Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem.

Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.

Teaching- Learning Process	Chalk and talk method / PowerPoint Presentation.

Module-2(5 Hours)

Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet.

Attributions and Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-3(5 Hours)

Introduction To Intellectual Property: Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India.

Patents: Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public Disclosure of an Invention before Patenting. Process of Patenting.

Process of Patenting. Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Commercialization of a Patent. Need for a Patent Attorney/Agent. Can a Worldwide Patent be Obtained? Do I Need First to File a Patent in India? Patent Related Forms. Fee Structure. Types of Patent Applications. Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models.

Teaching- Learning Process	Chalk and talk method / PowerPoint Presentation.

Module-4(5 Hours)

Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol.

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Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright Agreements, Conventions and Treaties. Interesting Copyrights Cases.

Trademarks: Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark. Types of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration. Prior Art Search. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.

Module-5(5 Hours)

Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

Geographical Indications: Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India.

Case Studies on Patents. Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent. **IP Organizations In India. Schemes and Programmes**

Teaching- Learning Process	Chalk and talk method / PowerPoint Presentation

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6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will **be scaled down to 50 marks** (to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the Outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)

1. The question paper will be set for 100 marks. Marks scored shall be proportionally reduced to 50 marks
2. The question paper will have ten questions. Each question is set for 20 marks.
3. There will be 2 questions from each module. Each of the two questions is under a module (with a maximum of 2 sub-questions).
4. The students have to answer 5 full questions, selecting one full question from each module.

Course Outcomes (Course Skill Set)

At the end of the course, the student will be able to:

CO 1. To know the meaning of engineering research.

CO2. To know the procedure of the literature Review and Technical Reading

CO3. To understand the fundamentals of the patent laws and drafting procedure

CO 4. Understanding the copyright laws and subject matters of copyrights and designs

CO5. Under standing the basic principles of design rights

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Suggested Learning Resources:

Textbook

1. Dr. Santosh M Nejakar, Dr. Harish Bendigeri "Research Methodology and Intellectual Property Rights", ISBN 978-93-5987-928-4, Edition: 2023-24.

Reference Book:

1. David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488-4 –
2. Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

Semester: VI						
INDIAN KNOWLEDGE SYSTEMS (Theory) (Common to All UG Programs)						
Course Code	**:**	**BIKK657**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**1: 0: 0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**15L**		**SEE Duration**	**:**	**02 Hours**

Course Learning Objectives: The students will be able to	
1	To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2	To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.

Unit-I	**05 Hrs**
Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.	
Unit – II	**05 Hrs**
Traditional Knowledge in Humanities and Sciences: Lingistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology.	
Unit -III	**05 Hrs**
Traditional Knowledge in Professional domain: Town planning and architecture-Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Provide an overview of the concept of the Indian Knowledge System and its importance.
CO2:	Appreciate the need and importance of protecting traditional knowledge.
CO3:	Recognize the relevance of Traditional knowledge in different domains.
CO4:	Establish the significance of Indian Knowledge systems in the contemporary world.

Reference Books	
1	**Introduction to Indian Knowledge System- concepts and applications**, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93-91818-21-0
	Traditional Knowledge System in India, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230,
2	**Knowledge Traditions and Practices of India**, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334,
	Suggested Web Links:
1.	**https://www.youtube.com/watch?v=LZP1StpYEPM**
2.	**http://nptel.ac.in/courses/121106003/**
3.	http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4.	https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5.	https://unctad.org/system/files/official-document/ditcted10_en.pdf
6.	http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf
7.	https://unfoundation.org/what-we-do/issues/sustainable-development-goals/?gclid=EAIaIQobChMInp-Jtb_p8gIVTeN3Ch27LAmPEAAYASAAEgIm1vD_BwE

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50% (CIE)**	**50%(SEE)**
QUIZZES		
Quiz-I	Each quiz is evaluated for 05 marks adding up to **10 Marks.**	*****
Quiz-II		
THEORY COURSE - (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		
Test **–** I	Each test will be conducted for 25 Marks adding upto 50 marks. Final test marks will be reduced to **20 Marks**	*****
Test **–** II		
EXPERIENTIAL LEARNING	**20**	*****
Case Study-based Teaching-Learning	**--**	*****
Sector wise study & consolidation (viz., Engg. Semiconductor Design, Healthcare & Pharmaceutical, FMCG, Automobile, Aerospace and IT/ ITeS)	**--**	
Video based seminar (4-5 minutes per student)	**--**	
Maximum Marks for the Theory	**---**	**50 Marks**
Practical	**--**	**--**
Total Marks for the Course	**50**	**50**

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

High-3 : Medium-2 : Low-1