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) Brain -Computer Interfacing: An Introduction by Rajesh P. N Rao University of Washington DATE PUBLISHED: September 2013:ISBN:
2) Brain-Computer Interfaces : Foundations and methods Maureen Clerc, Laurent Bougrain, Fabien Lotte

Reference Books

1) Brain-Computer Interfaces 2: Technology and Applications, Volume 2 Maureen Clerc, Laurent Bougrain, Fabien Lotte John Wiley & Sons, 29-Aug-2016 – Computers Schalk, G., & Mellinger, J. (2010).
2) A Practical Guide to Brain–Computer Interfacing with BCI2000: General-Purpose Software for Brain-Computer Interface Research, Data Acquisition, Stimulus Presentation, and Brain Monitoring. Springer Science & Business

Web links and Video Lectures (e-Resources):

- https://sccn.ucsd.edu/wiki/Introduction_To_Modern_Brain- ComputerInterfaceDesign
- https://www.udemy.com/course/brain-computer-interface/

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

- Quizzes,
- Assignments
- Seminars

Semester | 7

VII Semester

Biomechanics and Biodynamics			Semester	VII
Course and Course Code	IPCC	**BBM701**	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

- Identify, analyze, and solve various biomechanical problems.
- Demonstrate an understanding of kinetic concepts including inertia, force, torque, and impulse.
- Identify the major factors involved in the angular kinematics of human movement.
- Understand human Gait.

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

Biomechanics Applications to Joint Structure and Function: Introduction to Kinematics, Displacement in space, Force vectors and gravity, Linear forces and concurrent forces. Kinetics of rotary and translatory forces. Classes of levers. Close chain force analysis.
Constitutive Equations: Equations for Stress and Strain, Non-viscous fluids, Newtonian viscous fluids, Elastic solids. Visco-elasticity andits applications in biology.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Joint Structure and Function: Properties of connective tissues; Human Joint design; Joint Function and changes in disease.
Integrated Functions: Kinetics and Kinematics of Postures; Static and Dynamic Postures; Analysis of Standing, Sitting and Lying Postures.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Gait Analysis: Gait cycle and joint motion; Ground reaction forces; Trunk and upper extremity motion; internal and external forces, moments and conventions; Gait measurements and analysis.
Force Platform and Kinematic Analysis: Design of force platforms, Integrating force and Kinematic data; linked segment, free-body analysis.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 4	
Bio-Viscoelastic Fluid: Viscoelasticity, Viscoelastic Models: Maxwell, Voigt and Kelvin Models Response to harmonic variation. Use of viscoelastic models. Bio-Viscoelastic fluids: Protoplasm. Mucus, saliva, semen, synovial fluids.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3
MODULE – 5	
Rheology of Blood in Microvessels: Fahreus·Lindqulsteffect and inverse effect, hematocrit in very narrow tube. **Finite Element Analysis in Biomechanics:** Model creation, Solution, Validation of results and applications of FEA.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

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

Sl. No	List of experiments to be performed
1	Measurement of EMG Signal using Bio-Pac -Acquisition System
2	Measurement of EEG Signal using Bio-Pac -Acquisition System
3	EEG signal Acquisition using ENO-BIO software
4	EEG signal measurement using Neuro-feedback and Bio-feedback
5	To Read and Plot ECG data with Random noise
6	To Read and Plot ECG data with 50Hz sinusoidal noise
7	Signal Averaging method for a given data
8	Data compression using Turning Point Algorithm using C and Matlab
9	To Read and Plot EEG data, Power Spectrum of EEG
10	Linear Regression
11	Multiple regression
12	Random Forest Classification

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

ARM Processor			Semester	VI
Course and Course Code	IPCC	**BBM702**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0		SEE Marks	50
Total Hours of Pedagogy	40 hours		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

- Understand the basic design and architecture of ARM processor
- To learn the ARM instruction for assembly and **C-**program
- To learn the thumb instruction for assembly and **C-**program and **C** basics for ARM
- Understand the usage of exceptions and interrupts in ARM and operating systems for ARM
- To learn the basic concepts of memory hierarchy, usage of cache memory and memory management

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 traditional lecture method, but different type of teaching methods like PPT presentation through LCD maybe adopted to develop the outcomes.
- Show Video/animation films to explain evolution of arm processor development technologies.
- Encourage collaborative (Group)Learning in the class
- Ask atleast 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 analyse information rather than simply recall it.
- Showthedifferentwaystosolvethesameprogramtaskandencouragethestudentstocomeupwiththeirown 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

ARM Embedded Systems: Introduction, RISC design philosophy, ARM design philosophy, Embedded system hardware-AMBA bus protocol, ARM bus technology, Memory, Peripherals, Embedded system software**–**Initialization(BOOT)code, Operating System, Applications.
ARM Processor Fundamentals: ARM core dataflow model, registers, current program status register, Pipeline, Exceptions, Interrupts and Vector Table.
Text Book 1: Chapter 1: 1.1 to 1.4, Chapter 2: 2.1 to 2.5

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2

MODULE – 2

Introduction to the ARM Instruction set: Introduction, Data processing instructions, Branch instructions, Load-Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, ARMv5E extensions, Conditional Execution
Text Book 1: Chapter 1: 1.1 to 1.4, Chapter 2: 1.1 to 2.5

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2

MODULE – 3

Introduction to the THUMB instruction set: Introduction, THUMB register usage, ARM–THUMB interworking, Other Branch instructions, Data processing instructions, single-register and multiple-register load-store instructions, Stack instructions, Software interrupt instructions. Efficient C-Programming: Overview of C-Compilers and optimization, Basic C Datatypes, C looping Structures Register allocation, Function calls.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2

MODULE – 4

Exception and Interrupt Handling: Exception Handling-ARM Processor Exceptions and Modes, Vector Table, Exception Priorities, Link Register Offset, Interrupts-Interrupt Latency, Basic Interrupt Stack design and implementation, Interrupt Handling Scheme- Non nested Interrupt Handler, Nested Interrupt Handler, Reentrant Interrupt Handler, Prioritized Simple Interrupt Handler,

Embedded Operating Systems: Fundamental Components, SLOS Directory Layout, Initialization, Interrupts and Exceptions handling, scheduler, Context Switch, Device Driver Framework.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L2, L3

MODULE – 5

CACHES: The memory Hierarchy and caches memory-caches and memory management units, Cache Architecture basic architecture of caches memory, basic operation of cache controller, the relationship between cache and main memory.

Memory Management Units: Moving from an MPU to an MMU, Virtual memory Working-Defining regions using pagers, multitasking and the MMU, Memory organization in a virtual memory system, page tables Translational look aside buffer

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2

Practical Component of IPCC *(May cover all / major modules)*

Sl. No	**List of experiments to be performed**
1	Write an ALP to find the sum of first 10 integer numbers.
2	Write an ALP to find factorial of a number.
3	Write an ALP to add an array of 16- bit numbers and store the 32- bit result in internal RAM
4	Write an ALP to find the square of a number (1 to 10) using look-up table.
5	Write an ALP to find the largest/smallest number in an array of 32 numbers.
6	Write an ALP to arrange a series of 32 bit numbers in ascending/descending order using Bubble sort algorithm
7	Interface with LPC1768 ARM to Display "Hello World" message using Internal UART.
8	Interface a DAC and generate Triangular and Square waveforms.
9	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction
10	Interface and Control a DC Motor.
	Demonstration Experiments (for CIE)
11	Interface a 4x4 keyboard and display the key code on an LCD.

12	Demonstrate the use of an external interrupt to toggle an LED ON/OFF.
13	Interface a simple Switch and display its status through Relay, Buzzer and LED
14	Interface a 4x4 keyboard and display the key code on an LCD.

Course outcomes (Course Skill Set):

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

1) After studying this course, students will be able to Depict the organization, architecture, bus technology, memory and operation of the ARM microprocessors.
2) Employ the knowledge of Instruction set of ARM processors to develop basic Assembly Language Programs.
3) Recognize the importance of the Thumb mode of operation of ARM processors and develop C-programs for ARM processors.
4) Describe the techniques involved in Exception and Interrupt handling in ARM Processors and understand the fundamental concepts of Embedded Operating Systems
5) Develop embedded C-programs to interact with Builtin Peripherals for hardware programs,
6) Design, analyse and write programs using Keil software,

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.

Semester End Examination 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:

Text Books

1) Andrew N Sloss, Dominic System and Chris Wright, "ARM System Developers Guide", Elsevier, Morgan Kaufman publisher, 1stEdition, 2008, ISBN:1758608745

Reference Books

1) David Seal, "ARM Architecture Reference Manual", Addison- Wesley, 2nd Edition, 2009, ISBN:978-0201737196.
2) Furber S, "ARM System on chip Architecture", Addison Wiley, 2nd Edition 2008, ISBN:978-0201675191
3) Rajkamal, "Embedded System", Tata McGraw-Hill Publishers, 2nd Edition, 2008,

Web links and Video Lectures (e-Resources):

- VTU e-shikshana programmes
- VTU Edu-sat programmes
- https://nptel.ac.in/courses/117106111
- https://www.youtube.com/watch?v=4VRtujwa_b8
- https://www.digimat.in/nptel/courses/video/117106111/L30.html

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

- Quizzes,
- Assignments,
- Seminars
- Mini project

Biometric System			Semester	VII
Course and Course Code	PCC	**BBM703**	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

- To introduce the general principles of design of biometric systems and the underlying trade-offs. personal privacy and security implications of biometrics based identification technology. Introduction to fingerprint biometric
- To familiarize with Face recognition and Hand Geometry, feature extraction, pattern classification. Authentication Methods and their algorithms
- To acquire knowledge about various parameters involved in Iris and Voice recognition. Authentication Methods and their algorithms.
- Introduction to multimodal Biometric system and its functional blocks and futuristic biometric 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

Introduction to biometrics: Introduction and back ground, Biometric technologies, Passive biometrics, Active biometrics, Biometric systems, Enrolment, Templates, Algorithm, Verification, Biometric applications, biometric characteristics- Authentication technologies –Need for strong authentication, Protecting privacy and biometrics and policy, Biometric applications, Biometric characteristics

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Fingerprint Technology: History of fingerprint pattern recognition, General description of fingerprints, Finger print feature processing techniques, Fingerprint sensors using RF imaging techniques – Fingerprint quality assessment, Computer enhancement and modeling of fingerprint images, Fingerprint enhancement**–** Feature extraction, Fingerprint classification, Fingerprint matching

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Face recognition and Hand Geometry: Introduction to face recognition _ Neural networks for face recognition, face recognition from correspondence maps, Hand geometry, Scanning, Feature Extraction, Adaptive Classifiers, Visual-Based Feature Extraction and Pattern Classification, Feature extraction, Types of algorithm, Biometric fusion.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

MODULE – 4

Iris, Voice recognition: Iris scan, Features, Components, Operation (Steps), Competing iris Scan technologies, Strength and weakness. Voice Scan, Features, Components, Operation (Steps), Competing voice Scan (facial) technologies**–**Strength and weakness.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

MODULE – 5

Biometric Authentication: Introduction, Biometric Authentication Methods, Biometric Authentication Systems, Biometric authentication by fingerprint -Biometric Authentication by Face Recognition, Expectation, Maximization theory, Support Vector Machines. Biometric authentication by fingerprint, Biometric authentication by hand geometry- Securing and trusting a Biometric transaction, Matching location, local host, authentication server, Match On Card (MOC), Multi-Biometrics and Two-Factor authentication

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

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

1) Demonstrate knowledge engineering principles underlying biometric systems.
2) Describe and explain Finger print feature processing and techniques, computer enhancement and modelling.
3) Face recognition, how to perform Feature Extraction, classification of features, training of algorithm using neural network
4) Competing iris Scan technologies, various steps involved in voice scan, challenges related to iris and voice scan
5) Demonstration of innovative multimodal Biometric system and Statistical Measures of Biometrics

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) Arun A. Ross, Karthik Nandakumar, Anil K. Jain, "Introduction to Biometrics", 2011, 1st edition, Springer, New York, USA.
2) Haizhou Li, Liyuan Li, Kar-Ann Toh, Advanced Topics in Biometrics, 2012, 1st edition, World Scientific Publisher, Singapore**.**

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

- Demonstration of Biometric devices
- Quizzes,
- Assignments,
- Seminars

Professional Elective Course

Biostatistics			Semester	VII
Course and Course Code	PEC	**BBM714A**	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 apply statistical methods for the design of biomedical analysis.
- Understand and use mathematical and statistical theory underlying the application of biostatistical methods
- Apply knowledge in statistical data analysis.
- Participate in a research team in the development and evaluation of new and existing statistical methodology.

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

Getting Acquainted With Biostatistics: Introduction, Some Basic Concepts, Measurement and Measurement Scales, Sampling and Statistical Inference, The Scientific Method and The Design of Experiments, Computers and Bio Statistical Analysis. (Text Book 1 : Chapter 1)

Strategies For Understanding The Meanings Of Data: Introduction, The Ordered array, Grouped Data : The Frequency Distribution, Descriptive Statistics: Measure of Central Tendency, Descriptive Statistics : Measure of Dispersion. (**Text Book** 1 : Chapter 2)

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

MODULE – 2

Probability: The Basis Of Statistical Inference: Introduction, Two Views of Probability: Objective and Subjective, Elementary Properties of Probability, Calculating the Probability of an Event. (Text Book 1 : 3.1, 3.2, 3.3, 3.4)

Probabilistic Features Of Certain Data Distributions: Introduction, Probability Distributions of Discrete Variables, The Binomial Distribution, The Poisson Distribution, Continuous Probability Distributions

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

MODULE – 3	
Probabilistic Features Of The Distributions Of Certain Sample Statistics: Introduction, Sampling Distribution, Distribution of the Sample Mean, Distribution of the Difference Between Two Samples Means, Distribution of the Sample Proportion, Distribution of the Difference Between Two Sample Proportions. (T**ext Book** 1 : Chapter 5) **Using Sample Data To Make Estimates About Population Parameters :** Introduction, Confidence Interval for a Population Mean, The *t* Distribution, Confidence Interval for the Difference Between Two Population Means, (**Text Book** 1 : 6.1, 6.2, 6.3, 6.4)	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3
MODULE – 4	
Using Sample Data To Make Estimates About Population Parameters: Confidence Interval for a Population Proportion, Confidence Interval for the Difference Between Two Population Proportions, Determination of Sample Size for Estimating Means, Determination of Sample Size for Estimating Proportions, Confidence Interval for the Variance of a Normally Distributed Population, Confidence Interval for the Ratio of the Variances of Two Normally Distributed Populations. (**Text Book**1 : 6.5, 6.6, 6.7, 6.8, 6.9, 6.10) **Using Sample Statistics To Test Hypotheses About Population Parameters:** Introduction, Hypotheses Testing : A Single Population Mean. (**Text Book** 1 : 7.1, 7.2)	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3
MODULE – 5	
Using Sample Statistics To Test Hypotheses About Population Parameters: Hypotheses Testing: The Difference Between Two Population Means, Paired Comparisons, Hypotheses Testing : A Single Population Proportion, Hypotheses Testing : The Difference Between Two Population Proportions, Hypotheses Testing : A Single Population Variance, Hypotheses Testing : The Ratio of Two Population Variances. The Type II Error and the Power of a Test, Determining Sample Size to Control Type II Errors. (**Text Book**1 : 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10)	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

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

1) Describe the basic statistical terms, concepts, procedures and statistical measures.
2) Apply probability concepts and probability distributions for statistical inferences.
3) Apply sampling distribution concepts and estimation procedures for population parameters.
4) Select and apply appropriate hypothesis tests for statistical analysis.

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

Textbook:

1) Biostatistics: Basic Concepts and Methodology for the Health Sciences – by Wayne W. Daniel, John Wiley & Sons Publication, 9th Edition, 2009.

Reference Books:

1) Principles of Biostatistics, by Marcello Pagano and KimberleeGauvreu, Thomson Learning Publication, Indian Edition, 2007.
2) Biostatistics, by Ronald N Forthofer, EunSul Lee and M. Hernandez, Academic Press, 2007.
3) Basic Biostatistics and its Applications, by Animesh K. Dutta, 2006.

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

- Quizzes,
- Assignments,
- Seminars

Medical Information and Expert Systems			Semester	VII
Course and Course Code	PEC	**BBM714B**	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 fundamental characteristics of data, information, and knowledge in the Health Informatics domain
- Become familiar with common algorithms for health applications and IT components in representative clinical processes
- Develop understanding of various aspects of Health Information Technology standards
- Become familiar with IT aspects of clinical process modeling and health information 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

Medical Informatics: Aim and scope, salient feature, Introduction, history, definition of medical informatics, bioinformatics, online learning, introduction to health informatics, prospectus of medical informatics.

Hospital Management And Information Science: Introduction, HMIS: need, Benefits, capabilities, development, functional areas. Modules forming HMIS, HMIS and Internet, Pre-requisites for HMIS- client server technology, PACS, why HMIS fails, health information system, disaster management plans, advantages of HMIS.

Text1: (Section I, 1 and 2, Section II-3)

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Hospital Management And Information Systems-Structure And Functions : Central Registration Module, OPD / Consultant Clinic / Polyclinic Module, Indoor Ward Module, Patient Care Module, Procedure Module, Diet Planning Module, MLC Register Module, Pathology Laboratory Module, Blood Bank Module, Operation Theatre Module, Medical Stores Module, Pharmacy Module, Radiology Module, Medical Records Index Module, Administration Module, Personal Registration Module, Employee Information Module, Financial modules, Health & Family Welfare, Medical Examination, Account Billing, Medical Research, Communication, General Information.

Text 1: (Section II-6)

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

MODULE – 3

Computer Assisted Medical Education: CAME, Educational software, Simulation, Virtual Reality, Teleeducation, Tele-mentoring.

Computer Assisted Patient Education: CAPE, patient counseling software. Computer assisted surgery (CAS), Limitations of conventional surgery, 3D navigation system, intra-operative imaging for 3D navigation system, merits and demerits of CAS.

Text1: (Section III **–** 7 & 8)

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

MODULE – 4

Telecommunication Based Systems: Tele-Medicine, Need, Advantages, Technology- Materials and Methods, Internet Tele-Medicine, Applications.

Tele-Surgery: Tele-surgery, Robotic surgery, Need for Tele-Surgery, Advantages, Applications.

Text1: (Section V- 13 & 14)

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

MODULE – 5

Knowledge Based And Expert Systems: Introduction, Artificial Intelligence, Expert systems, need for Expert Systems, materials and methods- knowledge representation & its methods, production rule systems, algorithmic method, OAV, object oriented knowledge, database comparisons, statistical pattern classification, decision analysis, tools, neural networks, advantages of ES, applications of ES.

Text 1: (Section II – 4)

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

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

1) Explain the basics and importance of medical informatics in hospital management.
2) Describe the different modalities functions exist in the hospital for effective management.
3) Explain the role of technology both hardware & software in training the medical personalities.
4) Discuss the role of telecommunication, tele-surgery, robotics in healthcare.
5) Explain the decision making concepts used in healthcare and their applications.
6) Apply information and communication technology in healthcare.

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:

Textbook:

1) Medical Informatics: A Primer, by Mohan Bansal, 1st Print, Tata McGraw Hill, Publications, 2003.

Reference Books:

1) Medical Informatics: Computer Applications in Health Care and Biomedicine by E.H.Shortliffe, G. Wiederhold, L.E.Perreault and L.M.Fagan, 2ndEdition, Springer Verlag, 2000.
2) Handbook of Medical Informatics by J.H.VanBemmel, Stanford University Press/ Springer, 2000.

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

- Quizzes,
- Assignments,
- Seminars

Physiological System Modelling			Semester	VII
Course and Course Code	PEC	**BBM714C**	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

- To introduce the basic system concepts and differences between engineering and physiological control systems.
- To acquaint students with different mathematical techniques in analysing a system and the various types of nonlinear modelling approaches.
- To teach neuronal membrane dynamics and to understand the procedures for testing, validation and interpretation of physiological models.
- To study the cardiovascular model and apply the modelling methods to multi-input and multi-output 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.
- Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.

MODULE – 1

The problem of system modelling in physiology, Need for modelling, Conceptual and mathematical models – Modelling, experiments and Simulation, Feedback control systems, Difference between engineering and physiological control systems.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Deductive and Inductive modelling, Characteristics of a reliable physiological model, Modelling a simple reflex, and Mathematical modelling.

System Identification, Model Specification, and Model estimation. Types of nonlinear modelling approaches. Non parametric modeling. Volterra and Wiener models. Volterra Kernels. Modelling the vertebrate retina. Analysis of estimation errors.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

A general model of the nerve membrane, Action potential and synaptic dynamics, Functional integration in the single neuron, Neuronal systems with point process inputs, Conduction in nerve fibres, Voltage clamp

experiment, Hodgkin Huxley (H-H) model, Circuit analog of the H-H nerve membrane model.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3
MODULE – 4	
System characteristics, System parameters, System functional properties, Input characteristics, Experimental considerations, Data preparation, Data consolidation, Model specification and estimation tasks, Model validation and interpretation.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3
MODULE – 5	
Cardiovascular systemic and pulmonary circulation, Lumped model of the cardiovascular system, Pulmonary physiology, Respiratory control system. Modeling of multi input/ multi output systems -The Two-input case, Applications of Two-input modeling to physiological systems.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint 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 system concepts and differences between an engineering and physiological control systems.
2) Apply different mathematical techniques to analyze a system.
3) Comprehend the various nonlinear modelling approaches.
4) Understand the neuronal membrane dynamics.
5) Apply the procedures for testing, validation and interpretation of physiological models.
6) Comprehend the cardiovascular model.
7) Analyse the modelling methods to multi input and multi output 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.

The 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) Michael C.K. Khoo, "Physiological Control Systems: Analysis, Simulation and Estimation," 2011, 1st edition, Prentice Hall of India, New Delhi.

Reference Books

1) Suresh Devasahayam, "Signal Processing and Physiological Systems Modeling", 2013, 1st edition, Springer, New York.
2) Joseph D. Bronzino and Donald R. Peterson, "The Biomedical Engineering Handbook", 2015, 4th edition, CRC Press, Florida.

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

- Quizzes,
- Assignments,
- Seminars

Advanced Clinical Instrumentation			Semester	VII
Course and Course Code	PEC	**BBM714D**	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 fundamental knowledge of Clinical Instrumentation, the science associated with the measurement of biological variables such as pressure, temperature etc related to human body, the complexities associated with the measurement of the biological parameters and the care that are to be taken for the measurement since it is concerned with human life
- Understanding basic principles and phenomena in the area of advanced clinical instrumentation,
- Theoretical and practical preparation enabling students to maintain medical 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

ICU Equipment's and Neonatal Equipment: Oxygen concentrators – Capnographs monitoring systems – cardiac monitor, multipara monitor, Advanced defibrillators –internal and external – Intermediate level of suction apparatus – Laryngoscope, Advance level of radiant warmer, phototherapy units, Doppler fetal heart rate device (handheld type), Fetal Tocography, Baby Incubator, Neonatal ventilator

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Diagnostic Equipment's: Stereo toxic unit- depth recording system-dot scanners- transcutaneous nerve Stimulator- anesthesia monitor, EEG controlled anesthesia- bio-feedback equipments, Spinal reflex measurements. Basic Blood gas analyzer, Photometer and spectrophotometer, Microtome, osometer, Lab freezer, PH meter, Optical microscope, Water bath types, Centrifuge (table), Shakers, Lab, laminar air flow units – Lab precision balances, Pippets, Washers, Incubator and Heating unit centrifuge (Flour) – Electrophoresis systems, tissue embedding equipment, Ambulance setup.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Surgical Equipment's: Warmer (Blood and Patient), tourniquet, insufflators, irrigation unit – Operating microscope, arthroscopic, Operation Theater (OT): Lights, and Patient's tables, Flow meters (gas & blood), sterilizing units (auto clave), Surgical driller, Sterilizing producers, manifold unit – Central supply of air. Laparoscope, Gastro scope, endoscopes -light sources. Bronchoscope: Video processors, Camera, and

Fiber optic cable. Physiological effects of stimulation, galvanic, Faradic and surged types, interferential therapy.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3
MODULE – 4	
Fundamental Troubleshooting Procedures: Making of an Electronic Equipment, causes of Equipment Failure, Troubleshooting Process & Fault finding Aids, Troubleshooting Techniques, Grounding Systems in Electronic Equipment, Temperature Sensitive Intermittent Problems, and Correction Action to repair the Equipment.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3
MODULE – 5	
Biomedical Equipment Troubleshooting: Trouble shooting of ECG Machine, EEG Machine, Defibrillator Electrosurgical unit, Anaesthesia machine, Autoclaves & sterilizers, Endoscope. Troubleshooting of Incubators, Nebulizer, Oxygen Concentrators, Oxygen cylinders & flow meters, Pulse Oximeter, Sphygmomanometers, Suction Machine, X-Ray Machine Troubleshooting.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

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

1) Describe about various neonatal and ICU equipment's
2) Discuss the use of surgical equipment's
3) Analyze different types Diagnostic devices
4) Understand fundamental troubleshooting procedures for biomedical instruments
5) Analyze different types troubleshooting techniques.

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:

Textbooks

1) Albert M, Cook and Webster J G, "Therapeutic Medical Devices", Prentice Hall Inc., New Jersey, 1982.
2) Geddes L A and Baker L E, "Principles of Applied Biomedical Instrumentation", John Wiley, 3rd Edition,
3) 1975, Reprint 1989.
4) Khandpur R S, "Hand-book of Biomedical Instrumentation", Tata McGraw Hill, 2nd Edition, 2003.
5) Khandpur R S, "Troubleshooting Electronic Equipment- Includes Repair & Maintenance", Tata McGraw-Hill, Second Edition 2009.
6) Dan Tomal & Neal Widmer, "Electronic Troubleshooting", McGraw Hill, 3rd Edn.

Reference Books

1) Leslie Cromwell, Fred J, Weibell, Erich A, Pfeiffer, "Biomedical Instrumentation andMeasurements", Prentice-Hall India, 2nd Edition,1997.
2) John G, Webster, "Medical Instrumentation application and design", JohnWiley, 3rd Edition, 1997.
3) Feinberg B N, "Applied Clinical Engineering", Prentice Hall Inc., New Jersey, 1986.
4) Nicholas Cram & Selby Holder, "Basic Electronic Troubleshooting for Biomedical Technicians", TSTC Publishing, 2nd Edition 2010.
5) World Health Organization, "Maintenance & Repair of Laboratory, Diagnostic Imaging & Hospital Equipment", Geneva,1994.
6) Ian R, McClelland , "X-ray Equipment maintenance & repairs workbook for Radiographers & Radiological Technologists", World Health Organization, Geneva, 2004.

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

- Quizzes,
- Assignments,
- Seminars

Open Elective Course

Neural Network and Fuzzy Logic Systems			Semester	VII
Course and Course Code	PEC	**BBM755A**	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, YouTube Videos, PowerPoint 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, YouTube Videos, PowerPoint 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	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	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	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	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	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

Course outcomes (Course Skill Set):

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

8) Compare and contrast the biological neural network and ANN.
9) Discuss the ANN for pattern classification.
10) Develop and configure ANN's with different types of functions and learning algorithms.
11) Apply ANN for real world problems.
12) Discuss the fundamentals of fuzzy logic, implementation and their functions.
13) 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).**

5. The question paper will have ten questions. Each question is set for 20 marks.
6. 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.
7. The students have to answer 5 full questions, selecting one full question from each module.
8. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books

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

Reference Books

3) 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

- Quizzes,
- Assignments,
- Seminars

Medical Informatics			Semester	VII
Course and Course Code	OEC	**BBM755B**	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

- Making data available: Ensuring data is available quickly and reliably
- Improving patient-physician relationships: Collecting, safeguarding, and understanding health data to positively impact the relationship between patients and physicians
- Providing decision support: Helping clinicians make decisions by processing data and knowledge
- Improving patient care: Helping doctors get a better picture of a patient's situation, determine the best treatment approach, and avoid unnecessary examinations
- Preventing diseases: Helping to recognize and prevent diseases
- Bringing research to patient care: Quickly applying research findings to patient care

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

Introduction, history, definition of medical informatics, bio-informatics, online learning, introduction to health informatics, prospectus of medical informatics. Impact of Systems on Health Care, Care Providers and Organizations, mobile health care technologies.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Hospital Management Need for HMIS, Capabilities & Development of HMIS, functional area, modules forming HMIS, (like Pathology Lab, Blood bank, Pharmacy, Diet planning). Maintenance and development of HMIS-Ideal Features and functionality of CPR, Development tools for CPR.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Computer Assisted Medical Education: CAME, Educational software, Simulation, Virtual Reality, Tele-education, Tele-mentoring. Computer Assisted Patient Education: CAPE, patient counseling software. Computer assisted surgery (CAS), Limitations of conventional surgery, 3D navigation system, intra-operative imaging for 3D navigation system, merits and demerits of CAS.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

MODULE – 4

Telecommunication Based Systems: Tele-Medicine, Need, Advantages, Technology- Materials and Methods, Internet Tele-Medicine, Applications. Tele-surgery, Robotic surgery, Need for Tele-Surgery, Advantages, Applications. Real-time Telemedicine. Data Exchange: Network Configuration, circuit and packet switching, H.320 series (Video phone based ISBN) T.120, H.324. Video Conferencing.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

MODULE – 5

Knowledge Based and Expert Systems: Introduction, Artificial Intelligence, Expert systems, need for Expert Systems, materials and methods- knowledge representation & its methods, production rule systems, algorithmic method, OAV, object oriented knowledge, database comparisons, statistical pattern classification, decision analysis, tools, neural networks, advantages of ES, applications of ES.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

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

1) Explain the basics and importance of medical informatics in hospital management.
2) Describe the different modalities functions exists in the hospital for effective management.
3) Discuss the role of telecommunication, tele-surgery, robotics in healthcare.
4) Explain the decision making concepts used in healthcare and their applications.
5) Apply information and communication technology in healthcare.

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

Text Books

1) Medical Informatics: A Primer - by Mohan Bansal, 1st Print, Tata McGraw Hill, Publications, 2003.
2) A.S. Tanenbaum, "Computer Networks", 2012, 5th Edition, Pearson Education, London.
3) Kenneth R. Ong, "Medical Informatics: An Executive primer", 2015, 1st Edition, HIMSS Publishing, Chicago

Reference Books

1) Medical Informatics: Computer Applications in Health Care and Biomedicine by E.H.Shortliffe, G. Wiederhold, L.E.Perreault and L.M.Fagan, 2ndEdition, Springer Verlag, 2000.
2) Handbook of Medical Informatics by J.H.VanBemmel, Stanford University Press/ Springer, 2000.

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

- Quizzes,
- Assignments,
- Seminars

Sensors and Measurements			Semester	VII
Course and Course Code	OEC	**BBM755C**	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 acquaint students basics of measurements system and investigate inductive and magnetic sensors
- Compare the resistive and capacitive sensors
- Interpretation of electromagnetic sensors and self-generating sensors
- Validate signal conditioning of sensors

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

Measurement System – Instrumentation – Classification and Characteristics of Transducers – Static and Dynamic – Errors in Measurements – Calibration – Primary and secondary standards.

Resistive sensors, Potentiometers, Strain gauges, Pressure resistive temperature detectors (RTD), thermistors – Magnetoresistors, Light dependent resistor (LDR), Resistive hygrometers, Resistive gas sensors, Liquid conductivity sensors, Capacitive sensors- Variable capacitor, Differential capacitor.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Inductive sensors, Variable reluctance sensors, Eddy current sensors, Linear Variable Differential Transformers (LVDT), Variable transformers, Magneto-elastic and magnetostrictive sensors, Super conducting quantum interference devices (SQUID). Electromagnetic sensors, Sensors based on Faraday's law, Hall effect sensors.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Thermoelectric sensors, Piezo electric sensors, Pyroelectric sensors, Photovoltaic sensors, Electrochemical sensors.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 4

Deflection bridges – Amplifiers, AC carrier system, Current transmitters, Oscillators and Resonators.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

MODULE – 5

Flow measurement systems: Measurement of velocity, Volume and mass flow rate, Heat transfer effect in measurement systems: Characteristics of thermal sensors, Ultrasonic measurement systems.

Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

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

1) Gain the basic idea of measurements and the errors associated with measurement
2) Differentiate between the types of sensors available
3) Select a suitable sensor for a given application
4) Apply the knowledge about the measuring instruments to use them more effectively
5) Relate the self-generating sensors with passive sensors
6) Comprehend the basics of signal conditioning
7) Comprehend the operation and characteristics of special measurement 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) Jacob Fraden, "Handbook of modern sensors", 2016, Stn Edition, Springer International Publishing, Switzerland.

Referance Books

1) Ramon Pallas-Areny and John G. Webster, "Sensors and Signal Conditioning", 2012, 211d Edition, John Wiley and Sons Inc, New Jersey.
2) John. G. Webster and HalitEren, "Measurements, Instrumentation and Sensors Handbook: spatial, mechanical, thermal and radiation measurements", 2014, fd edition, CRC Press, Florida.
3) Winncy Y. Du, "Resistive, Capacitive, Inductive, and Magnetic Sensor Technologies", 2015. 1st Edition, CRC Press Taylor & Francis Group, New York.

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

- Quizzes,
- Assignments,
- Seminars

Biomedical Image Processing			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	3		Exam Hours	3
Examination nature (SEE)	Theory			

Course objectives:

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

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement techniques
- To study image restoration procedures.
- To study the image compression procedures.
- To understand image analysis algorithms.

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

Fundamentals of Digital image, Image formation, visual perception, CCD & CMOS Image sensor, Image sampling: Two dimensional Sampling theory, Nonrectangular grid and Hexagonal sampling, Optimal sampling, Image quantization, Non uniform Quantization, Image formats. Types of pixel Operations, Types of neighborhoods, adjacency, connectivity, boundaries, regions, 2D convolution, Color models.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 2

Image Enhancement in Spatial Domain: Background, Point processing – Image negatives, Log transformations, Power law transformations, Contrast stretching, Intensity level slicing, Bit plane slicing, Histogram processing **–** Histogram equalization, Histogram matching (specification), Arithmetic/Logic operations – Image subtraction, Image averaging. Fundamentals of spatial filtering, Smoothing spatial filters, Sharpening spatial filters.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 3

Image Enhancement In Frequency Domain: Background, 2D-Discrete Fourier Transform and its Inverse, Basic properties of the 2D-Discrete Fourier Transform, Basics of filtering in the frequency domain. Image smoothing using frequency domain filters **–** Ideal low pass filters, Butterworth low pass filters, Gaussian low pass filters; Image sharpening using frequency domain filters – Ideal high pass filters, Butterworth high pass filters, Gaussian high pass filters, Homo-morphic filtering.

Teaching-Learning Process	Chalk and talk method, YouTube Videos, PowerPoint Presentation.
RBT Levels	L1, L2, L3

MODULE – 4	
Image Segmentation Detection of discontinuities, Point-line- edge detection, Linear and Circular Hough Transform, Basic Global and Adaptive Thresholding, Region Based segmentation, K-Means Clustering.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3
MODULE – 5	
Image Restoration: Model of the Image degradation/restoration process, Noise models, Restoration using spatial filtering: Mean filters, Order statistic filters - Median filter, Min and Max filters, Midpoint filter. **Image Compression:** Fundamentals, Image compression models, Basic compression methods – Huffman coding, Arithmetic coding, LZW coding, Run-length coding.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, YouTube Videos, PowerPoint Presentation. L1, L2, L3

Course outcomes (Course Skill Set):

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

1) Define the general terminology of digital image processing.
2) Identify the need for image transforms and their types both in spatial and frequency domain.
3) Identify different types of image enhancement techniques.
4) Describe image segmentation models and learn image segmentation techniques.
5) Explain and apply various methodologies for image compression.

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 Image Processing - Rafael. C. Gonzalez and Richard. E. Woods, Third Edition, Pearson Education, 2008.

Reference Books

1) Fundamentals of Digital Image Processing - Anil K. Jain, 5th Indian Print, PHI, 2002.
2) Digital Image Processing and Computer Vision - Milan Sonka, India Edition, Cengage Learning.

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

- Quizzes,
- Assignments,
- Seminars

Semester | 8

VIII Semester

Professional Elective Course

Artificial Intelligence and Machine Learning			Semester	VIII
Course and Course Code	PEC	**BBM801A**	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 basics of Artificial intelligence and concepts of natural language processing.
- To learn the working of Parallel, Distributed and connectionist models of AI.
- To learn the fundamentals of Genetic algorithms.
- To understand the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised learning.
- To 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.

- 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

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 **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. 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 **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. 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 **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. 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 hyperplane (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:

Text Books

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

- 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 increase awareness of the need for and role of ergonomics in occupational health
- To obtain basic knowledge in the application of ergonomic principles to design of industrial workplaces and the prevention of occupational injuries
- To understand the breadth and scope of occupational ergonomic

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

The Design of Work Places: Working heights, Room to grasp and move things, Seating at work.

Heavy Work: Physiological principles, Energy consumptions at work, Limits and norms of energy consumption at work, Organization of heavy work.

Handling loads: Lifting, Carrying a burden.

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

MODULE – 2

Skilled work: Acquiring skill, Maximum control of skilled movements, Facilitating skilled work.

Mental activity: Uptake of information, Memory, Sustained alertness.

Fatigue: Fatigue in industrial practice, Measuring fatigue.

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

MODULE – 3

Boredom: Boredom from the standpoint of psychology, Problems of monotonous, repetitive work.

Working hours and eating habits: Flexible and continuous working schedules, Rest pauses, Nutrition and work.

Night work and shift work: Night work and health, Organization of shift work.

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

MODULE – 4

Man – machine systems: Visual perception, Perception of sound, Display equipment, Controls, Relationship between controls and display instruments.

Light and colour in surroundings: Light measurement and light sources, Physiological requirements of artificial lighting, Lighting for the work place, Daylight, Colour in the work room.

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

MODULE – 5

Noise and Vibration: Measurement and sources of noise, Damage to hearing through noise, Physiological and psychological effects of noise, Protection against noise, Music and work, Vibrations. **Indoor climate:** Thermal regulation in man, Comfort, Dryness of the air during heating periods, Recommendations for comfort indoors, Air pollution and ventilation, Heat in industry.

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) Define the principles of Ergonomics.
2) Describe the work places in order to suit the physical and psychological requirements of the Workers.
3) Employ the principles of Ergonomics in design of work places.
4) Evaluate the work places based on efficiency, accuracy, and safety measures

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:

Textbook:

1) Fitting the Task to the Man **–** An ergonomic approach, by E. Grandjean, 3rd Edition, Taylor & Francis Ltd, London.

Reference Books:

1) Fitting the Task to the Human - A Text Book of Occupational Ergonomics by H. E. Kroemer and Etienne Grandjean, 5th Edition, Taylor & Francis Ltd, London.
2) Human Factors in Engineering and Design - by Mark S. Sanders and Ernest J. McCormick, 1993.

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

- Quizzes,
- Assignments,
- Seminars

Lasers and Optical Fibers in Medicine			Semester	VIII
Course and Course Code	PEC	**BBM801C**	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 optical properties of the tissues and the applications of laser in diagnosis and therapy.
- To familiarize about fiber optic lasers and applications in medicine.
- To learn and practice the techniques used by an optical phenomenon.

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

Applications Of Lasers In Therapy & Diagnosis: Introduction, laser assisted diagnosis and therapy fundamentals, interaction of laser beams and materials-principles (except 3.3.4), laser interaction with tissue principles, laser assisted diagnostics-principles, applications of lasers in diagnosis and imaging-advances, laser surgery and therapy-principles photo-thermal & photomechanical mechanisms, thermal interaction between laser and tissue-advances.

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

MODULE – 2

Single Optical Fibers: Introduction, historical background, optical fibers-fundamentals, light transmission in optical fibers-principles, optical properties of optical fibers-advances, fabrication of optical fibers-principles, optical fibers for UV, visible, IR light-principles, power transmission through optical fibers-principles, modified fiber ends and tips-principles, fiber lasers advances.

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

MODULE – 3

Optical Fiber Bundles: Introduction, non-ordered fiber-optic bundles for light guides-fundamentals & principles, ordered fiber-optic bundles for imaging devices-fundamentals & principles, fiber-scopes and endoscopes fundamentals, fiber optic imaging systems-advances.

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

MODULE – 4

Endoscopy: Introduction, endoscopic imaging systems-fundamentals, principles, advances, endoscopic diagnostics-advances, endoscopic therapy fundamentals, endoscopic ultrasound imaging-principles.

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

MODULE – 5

Clinical Applications Of Fiber Optic Laser Systems: Introduction, fiber-optic laser systems in cardiovascular disease (except 9.2.6), gastroenterology, gynecology, neurosurgery, oncology, ophthalmology, orthopedics, otolaryngology (ENT), urology, flow diagram for laser angioplasty & photodynamic therapy.

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) Explain the basics and principles of LASERS in Medicine.
2) Discuss the fundamentals and properties of optical fibers for UV, IR, power transmission and advancement.
3) Describe the working of optical fibre bundles for imaging devices applying the light guided
4) fundamentals & principles.
5) Explain and demonstrate the working of endoscopic therapy, diagnostic & imaging principles.
6) Outline the clinical applications of fiber optic Lasers 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:

Textbook

1) Lasers and Optical Fibers in Medicine - by Abraham Katzir, Academic Press, 1998.

Reference Books

1) Lasers in Medicine - by Ronal W. Waynant, CRC Press, 2002.

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

- Quizzes,
- Assignments,
- Seminars

Bio-MEMS			Semester	VIII
Course and Course Code	PEC	**BBM801D**	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

- Development of basic principles of Bio-MEMS device manufacturing.
- Development of basic knowledge about the solid mechanics, fluid mechanics, material properties involved in Bio-MEMS.
- Development of basic principles of Bio-MEMS device design.

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

Overview of MEMS and Micro systems: MEMS and Microsystems, Typical MEMS and Microsystem Products, Evolution of Micro-fabrication, Micro systems and Microelectronics, Multidisciplinary nature of Microsystem design and Manufacture, Microsystems and Miniaturization, Applications of Microsystem in Health-care Industry. (**Text** 1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.8.1)
Bio-MEMS: Fabrication of Bio-MEMS, Structure, The Driving Force behind Biomedical Application, Biocompatibility, Reliability consideration. (**Text** 2: 1.1, 1.1.1, 1.1.2, 1.2, 1.3, 1.4)
Microsensors: Acoustic wave sensor, Biomedical Sensors and Biosensors, Chemical Sensors, Optical Sensors, Pressure sensors, Thermal sensors. (**Text** 1: 2.2)

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

MODULE – 2	
Microactuation: Principal means of Microactuation, MEMS with Microactuators, Microaccelrometer, Microfluidic. (**Text** 1: 2.3, 2.4, 2.5, 2.6) **Engineering Science for Microsystem Design and Fabrication:** Ions and Ionization, The Diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics. (**Text** 1: 3.3, 3.6, 3.7, 3.8, 3.9) **Scaling Laws:** Scaling in Geometry, Scaling in Rigid body Dynamics, Scaling in Electrostatic force, Electricity, Fluid mechanics, Heat Transfer. (**Text** 1: 6.2, 6.3, 6.4, 6.6, 6.7, 6.8)	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 3	
Engineering Mechanics for Microsystem Design: Static Bending of Thin plates – Circular Plates, Rectangular Plates, Square Plates with all Edges Fixed, Mechanical vibrations – General Formulation, Resonant Vibration, Design theory of Accelerometers. (**Text** 1: 4.2, 4.2.1, 4.2.2, 4.2.3, 4.3, 4.3.1, 4.3.2, 4.3.4) **Detection and Measurement Methods:** Detection Scheme–Electrochemical Detection, Chemiluminescence and Bioluminescence, Fluorescence, Molecular Beacons, Measurement Systems. (**Text** 2: 10.2.1, 10.2.2, 10.2.3, 10.2.4, 10.3)	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 4	
Materials for MEMS and Microsystems: Substrates and wafers, Active Substrate materials, Silicon as a Substrate material – Ideal Substrate, Crystal Structure, Mechanical Properties of Silicon, Silicon Compounds, Silicon Peizoresistors, Gallium Arsenide, Quartz, Polymers, Packaging Materials. (**Text 1**: 7.2, 7.3, 7.4.1, 7.4.3, 7.4.5, 7.5, 7.6, 7.7, 7.8, 7.10, 7.11) **Emerging Bio-MEMS Technology:** Minimally invasive Surgery, Cardiovascular, Diabetes, Endoscopy, Oncology, Ophthalmology, Tissue Engineering, Cell-Based Biosensors, Home land Security. (**Text** 2: 13.2, 13.4, 13.5, 13.6, 13.8, 13.9, 13.11, 13.12, 13.13)	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Microsystem Fabrication Process: Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition, Physical Vapour Deposition, Deposition By Epitaxy, Etching, The LIGA Process, Design Consideration Overview, Design Constraints. (**Text 1**: 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 9.4, 10.2, 10.2.1)	
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) Discuss MEMS with current and potential markets for types of Microsystems 2) Identify the suitable material to develop a microsystem. 3) Explain the principles of emerging Bio-MEMS technology. 4) Apply the principles of microsensors and microactuators to design microsystem. 5) Illustrate micro-manufacturing techniques..	

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

Textbooks

1) "MEMS & Microsystems: Design and Manufacture", Tai-Ran Hsu, Tata McGraw-Hill, 2002.
2) "Fundamentals of Bio-MEMS and Medical Microdevices", Steven S. Saliterman, Wiley Interscience, 2006.

Reference Books

1) "Introduction to Bio-MEMS", Albert Folch, CRC Press, 2012.
2) "Bio-MEMS: Technologies and Applications", Wanjun Wang, Steven A. Soper, CRC Press, 2006.

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	**BBM802A**	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 basic concepts and the applications of database System in Healthcare.
- Master the basics of SQL and construct queries using SQL.
- Understand the relational database design principles.
- Familiar with database storage structures and access techniques

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

Database and Database Users: Introduction, Characteristics of the Database Approach, Advantages of Using the DBMS Approach. (**Text Book** 2 : 1.1, 1.3, 1.6)
Database System Concepts and Architecture: Data models, Schemas, and Instances, Three – Schema Architecture and Data Independence, Database Languages and Interfaces, Classification of Database Management Systems. (**Text Book** 2 : 2.1, 2.2, 2.3, 2.6)
Patient Database: Patient Database strategies for HIS, data acquisition, patient admission, transfer, discharge, evaluation & management. Computer based patient record, clinical decision support systems.
(**Text Book** 3)

Overview of Database Systems: A Historical Perspective, File Systems versus a DBMS, Describing and Storing Data in a DBMS, Queries in a DBMS, Transaction Management, Structure of a DBMS. (**Text Book** 1 : 1.2, 1.3, 1.5, 1.6, 1.7, 1.8)	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2
MODULE – 2	
Data Modelling using the Entity – Relationship (ER) Model: Using High – Level Conceptual Data Models for Database Design, An Example Database Application; Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database, ER Diagrams, Naming Conventions and Design Issues. (**Text Book** 2 : 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7) **Relational Model:** Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations. (**Text Book** 2 : 5.1, 5.2, 5.3) **Relational Algebra and Relational Calculus:** Unary Relational Operations: SELECT and PROJECT. (**Text Book** 2: 6.1)	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 3	
Relational Algebra and Relational Calculus: Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations. (**Text Book** 2 : 6.2, 6.3, 6.4) **SQL – 99:** SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema Change Statements in SQL, Basic Queries in SQL, More Complex SQL Queries, INSERT, DELETE and UPDATE Statements in SQL, Specifying Constraints as Assertions and Triggers, Views (Virtual Tables) in SQL, Additional Features of SQL. (**Text Book** 2 : 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9)	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 4	
Database Design Theory and Methodology: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form. (**Text Book** 2 : 10.1, 10.2, 10.3, 10.4, 10.5) **Relational Database Design Algorithms and Further Dependencies:** Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Multivalued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Inclusion Dependencies, Other Dependencies and Normal Forms. (**Text Book** 2 : 11.1, 11.2, 11.3, 11.4, 11.5, 11.6)	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Overview Of Transaction Management: The ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control, Performance of Locking, Transaction Support in SQL, Introduction to Crash Recovery. (**Text Book** 1 : Chapter 16) **Concurrency Control :** 2PL, Serializability and Recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Deadlocks, Specialized Locking Techniques, Concurrency Control without Locking.(**Text Book** 1 : Chapter 17) **Crash Recovery :** Introduction to ARIES, The Log, Other Recovery- Related Structures, The Write- Ahead	

Log Protocol, Check-pointing, Recovering from a System Crash, Media Recovery.
(**Text Book** 1 : 18.1, 18.2, 18.3, 18.4, 18.5, 18.6, 18.7)

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:

- Describe the basic concepts of DBMS, languages, and DBMS architecture.
- Describe the concept of the ER model and Relational Model.
- Apply the Relational operations and Structured Query Languages for RDBMS.
- Analyze the data model based on normalization theory.
- Discuss database transaction management and data recovery from system crashes.

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) Database Management Systems - by Raghu Ramakrishna and Johannes Gehrke, (3rd Edition), McGraw Hill, 2003.
2) Fundamentals of Database Systems - by RamezElmasri and ShamkantB.Navathe (5thEdition), Pearson Education, 2007.
3) The Biomedical Engineering Handbook-Volume II (2nd Edition) **–** by Joseph D. Bronzino, CRC/IEEE Press, 2000.

Reference Books

1) Data base System Concepts - by Silberschatz, Korth and Sudharshan. (4th Edition), McGraw Hill, 2002.

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

- Quizzes,
- Assignments,
- Seminars

Hospital Management			Semester	VIII
Course and Course Code	OEC	**BBM802B**	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

- With an objective of imbibing a professional approach amongst students towards hospital management.
- The subject encompasses management principles, staffing and marketing processes, discussing their significance and role in effective and efficient management of health care organizations.

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

Principle of Hospital Management: Importance of management and Hospital-Management control systems-Forecasting techniques decision-making process-Staffing pattern in hospitals-Selection-Recruiting process-Training of staff-Organizational structures.
Computers in Hospital Management: System Development life cycle-Reasons to use computers in hospital-Main categories of information systems in hospitals-EPR-E health care.

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

MODULE – 2

Sterilization and waste management: Disease Transmission - Disinfection methods **–** Sterilization - steam sterilizing (Auto claving) - Microwave (Non-burn treatment technology).-Disposal methods - Incinerator - Hazardous waste- Radioactive waste-Liquid waste destruction landfill-Air pollution and Emission control- Instrumentation and monitoring-Crematories.

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

MODULE – 3

Electrical and fire safety: Sources of shocks, macro & micro shocks-Hazards, monitoring and interrupting the Operation from leakage current- Elements of fire-causes of fire-Action to be taken in case of fire in a hospital.

Assessing Quality Health Care: Patient Safety Organization-Governmental & Independent-Measuring Quality care-Evaluation of hospital services – Six sigma way-Quality assurance in hospitals – Patient Orientation for total patient satisfaction-5S techniques

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

MODULE – 4

Material Management: Classification of Materials-Purchase Management- Purchase system (Centralized, Decentralized, Local purchase)-Purchase Procedures:-Selection of Suppliers-Tendering procedures-Analyzing bids-Price negotiations-Issue of purchase orders-Rate Contracts-Follow up action.

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

MODULE – 5

Finance and Legal Aspects in a Hospital: Introduction to principal and methods of budgeting-internal and external auditing-Medico legal aspects-Preventive Steps for Doctors/Hospitals to Avoid Litigation-Consent Form-Life Support Dying Declaration-Death Certificate-Post Mortem

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 principles in hospital system management.
2) Apply the system development life cycle concepts.
3) Comprehend the disposal and hospital waste management mechanisms.
4) Analyse the electrical and fire safety measures.
5) Understand the principles of material management in a hospital.
6) Analyse the financial and legal aspects in hospital management.

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 Book

1) K. V. Ramani, "Hospital Management: Text and Cases", 2013, 1st edition, Pearson Education, New Delhi, India.

Reference Books

1) G. D Kunders, "Hospitals - Facilities Planning & Management", 2017,1st edition, Tata McGraw Hill Education, New Delhi, India
2) Sharon Bell Buchbinder, Nancy H. Shanks, "Introduction to Health Care Management", 2011, 1st edition, Jones & Bartlett Publishers, Boston, USA.

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

- Quizzes,
- Assignments,
- Seminars

Sensor Technology			Semester	VIII
Course and Course Code	OEC	**BBM802C**	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

- Introduce various developments in sensor technology.
- Familiarize with the basics of optimal system layout, partitioning and device scaling.
- Know various thick film and thin film techniques used for sensor development.
- Study the various sensor technologies for the measurement of Force, Pressure, acceleration, vibration and Torque.

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

Developments in Sensor Technology: Semiconductor sensors, smart sensors, micro sensors, fiber optic sensors, chemical sensors, bio sensors, TEDs.
Sensor Design and Packaging: Partitioning, Layout, technology constraints, scaling, compatibility study.

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

MODULE – 2

Thick Film Technology: Thick-film processing-screen printing, Lasering of substrates, curing, low temperature co-fired ceramic processing, wire bonding. Micro machining, IOC (Integrated Optical circuit) fabrication process.

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

MODULE – 3

Thin Film Technology: Thin film formation and characterization- sol-gel method, chemical vapour deposition, physical vapour deposition, sputtering, plasma/Ion beam deposition, structural and physical properties, Applications- Thin films for microelelctronics, MEMS, optical coatings, photodetectors, smart sensors.

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

MODULE – 4

Sensor Technologies for Flow and Level Measurement: Differential pressure- primary element options, mechanical and electronic flowmeters- design, installation and maintenance, selection and sizing, recent developments. Level probe design, materials, characteristics, installation considerations, applications and manufacturers.

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

MODULE – 5

Sensor Technologies for Force, Pressure and Torque Measurement: Sensor Technologies for Force, Pressure and Torque Measurement

Sensor Technologies for Acceleration, Vibration and Shock Measurement: Mass-Spring system, sensing technologies, selecting and specifying accelerometers, applicable standards, interfacing and design, applications and manufacturers.

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) Study the basics of sensor technology and the various sensors.
2) Understand the basics of optimal system layout, partitioning and device scaling.
3) Acquaint with various thick and thin film techniques used in sensor development.
4) Know about various sensor technologies for flow and level measurement.
5) Recognize various sensor technologies for Force, Pressure and Torque measurement.
6) Identify the sensor for acceleration, vibration and shock measurement.
7) Familiarize with the fabrication techniques for packaging of sensors.
8) Apply an integrated knowledge on the sensors, work with and interpret the data obtained from various sensor applications.

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) Jon S Wilson, Sensor Technology Handbook, 2005, Elsevier Inc., USA.

Reference Books

1) BC Nakra& K K Choudhry, Instrumentation Measurement and Analysis, 2010, 3rd ed., Tata McGraw Hill, India.
2) Jacob Fraden, Hand Book of Modern Sensors: Physics, Designs and Applications, 2010, 3rd ed., Springer, USA.
3) John G Webster, Measurement, Instrumentation and sensor Handbook, 2014, CRC Press,

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

- Quizzes
- Assignments
- Seminars

Medical Optics			Semester	VIII
Course and Course Code	OEC	**BBM802D**	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 discuss the physical properties of optical fiber, fabrication methods employed to manufacture them.
- To describe the principles of transmission of light signal and its interaction with biological tissues for medical application
- To investigate the application of optical, fluorescence and atomic force microscopy used for the diagnosis of diseases
- To familiarize with the application of laser in the field of Ophthalmology and Dermatology

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 Optics and Optical fibers: Introduction to Optical Fibers - Fiber Fabrication techniques-vapor phase oxidation - Outside Vapor-phase oxidation - Modified chemical vapor deposition and Plasma-activated chemical vapor deposition -Transmission Losses - Attenuation - Material absorption-Extrinsic and Intrinsic - Scattering losses- Mie Scattering - Rayleigh Scattering –SBS – SRS - Fiber bending loss-Micro and Macro bending losses.

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

MODULE – 2

Connectors, Splices and Couplers: Introduction to fiber Splices- Fusion splice - Mechanical splice – Snug tube splice - Loose tube splice - Multiple splice - Protection of splice -Connectors: - SMA – STC - Bionic etc, - Coupling – Passive – Stan - TEE types	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 3	
Fiber optics Applications in Healthcare: Fiber optic endoscopes and its types - Laparoscopes, colonoscopes, Bronchoscopes, Arthroscopes - equipmental setup - Mechanism and applications. **Microscopy and its applications:** Principle - modes of operation- properties - advantages-disadvantages and its applications of Optical Microscopy- Fluorescence microscopy and Atomic Force Microscopy.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 4	
Laser Safety and Tissue Interactions: Type of laser- tissue interaction and Laser safety- Photocoagulation Photothermal Ablation - Photochemical ablation- Photodisruption - Photochemcial interaction. **Lasers in Opthalmology:** Introduction to Eye - Tissue Interactions - Different Corneal Refractive surgeries – Glaucoma - Lens and Retinal surgeries - Laser Treatment of choroidal Neovascularization.	
Teaching-Learning Process **RBT Levels**	Chalk and talk method, You Tube Videos, Power Point Presentation. L1, L2, L3
MODULE – 5	
Lasers in Dermatology: Structure of Skin - Modes of action of Laser Light - Human Skin and Laser interaction - Factors and effects of laser light on skin lesions - Types of skin diseases and types of lasers used in Dermatology.	
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 physical properties of optical fiber, fabrication methods employed to manufacture them.
2) Select the coupling instrumentation needed for transmission of light signal for a given application
3) Build optical instruments used for the diagnosis of diseases in humans
4) Use optical, fluorescence and atomic force microscopy and their applications
5) Develop instrumentation for therapeutic purposes considering interaction of light with biological tissues
6) Comprehend the application of laser in the field of Ophthalmology and Dermatology.

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.

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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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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) Kirill Kulilov, "Laser Interaction with Biological Material: Mathematical Modeling (Biological and Medical Physics, Biomedical Engineering)", 2014, 1st edition, Springer International Publishing Switzerland.
2) Gerd Keiser, "Optical fibre communication", 2011, 4th edition, McGraw-Hill, New York.

Reference Books

1) Peter. B. Cotton and Williams, "Practical Gastrointestinal Endoscopy: The Fundamentals", 2011 6th edition, Wiley Blackwell, New Jersey.
2) Fundamentals of Light Microscopy and electronic Imaging, Douglas B. Murphy., 2011, 1st edition, John Wiley & Sons, New Jersey.

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

- 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

==========

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%**	• 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.
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**	

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 Quiz-II	Each quiz is evaluated for 05 marks adding up to **10 Marks.**	*****
THEORY COURSE - (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		
Test – I Test – II	Each test will be conducted for 25 Marks adding upto 50 marks. Final test marks will be reduced to **20 Marks**	*****
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