



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE
www.sathyabama.ac.in

DEPARTMENT OF BIOMEDICAL ENGINEERING

BOARD OF STUDIES – 2022-2023 [ODD SEMESTER] Minutes of the Meeting

07/06/2022

As per discussion with the BOS members, B. Tech (Biomedical Engineering) the following list of experiments have been included in the Lab SBMA2701, SBMA2602 to enrich the advanced techniques in biomedical arena. M.Tech (Medical instrumentation) the members suggested to include in the Medical instrumentation lab which will enable the students to gain research knowledge to implement in mini project.

SBMA2602 – Diagnostic instrumentation lab

1. Detection of parameters using a Plethysmograph
2. GSR measurement to diagnose skin impedance.

SBMA2701 – Therapeutic instrumentation Lab

1. Analysis of pacemaker output using simulator and processor unit.

SBMA6101 – Biomedical instrumentation Lab

1. Cardiac pacemaker output analysis using analyser and simulator unit.
2. Extraction and diagnosis of parameters using a plethysmograph

The above revision is based to meet the industry demands to enrich the knowledge of technical skill, latest and updated methods of learning techniques

Members of BoS – Biomedical Engg.

EXTERNAL MEMBERS

1. Dr. **G. Harikrishnan**, Associate Professor & Research Coordinator, Department of Electrical & Electronics Engg., Sree Vidyanikethan Engg. College, Tirupati

INTERNAL MEMBERS

1. Dr. **T. Sudhakar**, Member, Department of Biomedical Engg., Sathyabama
2. Dr. **J. Premkumar**, Member, Department of Biomedical Engg., Sathyabama
3. Ms. **Sindu Divakaran**, Member, Department of Biomedical Engg., Sathyabama
4. Dr. **P. Grace Kanmani**, Member, Department of Biomedical Engineering, Sathyabama

SBMA2602 (old)	DIAGNOSTIC INSTRUMENTATION LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To provide hands-on knowledge on different diagnostic equipment.
- To analyse and measure various bio signals

SUGGESTED LIST OF EXPERIMENTS

1. ECG monitoring using trainer kit and real time monitoring.
2. Plot respiratory waveforms using Spirometer
3. Measuring pulse rate and analyse waveforms.
4. Phonocardiogram monitor
5. Multi parameter monitoring system
6. Respiration rate analysis
7. Measurement of EMG signals.
8. EEG monitoring using simulator.
9. Medical telemetry system to transmit and receive ECG signals.
10. Human auditory response using a Audiometer

COURSE OUTCOMES

At the end of the lab, the student should be able to:

CO1: Measure different bioelectrical signals using suitable sensors/transducers.

CO2: Calibrate medical instruments.

CO3: Analyze the different bio signals using suitable tools

CO4: Apply the learnt knowledge to design or troubleshoot instruments.

CO5: Acquire skills to operate medical equipment.

CO6: Design cost effective and simple biomedical instruments.

SBMA2602 (Revised)	DIAGNOSTIC INSTRUMENTATION LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To provide hands-on knowledge on different diagnostic equipment.
- To analyse and measure various bio signals

SUGGESTED LIST OF EXPERIMENTS

1. ECG monitoring using trainer kit and real time monitoring.
2. Plot respiratory waveforms using Spirometer
3. Measuring pulse rate and analyse waveforms.
4. Phonocardiogram monitor
5. Multi parameter monitoring system
6. Respiration rate analysis
7. Measurement of EMG signals.
8. EEG monitoring using simulator.
9. Medical telemetry system to transmit and receive ECG signals.
10. Human auditory response using a Audiometer
11. Detection of parameters using a Plethysmograph
12. GSR measurement to diagnose skin impedance.

COURSE OUTCOMES

At the end of the lab, the student should be able to:

CO1: Measure different bioelectrical signals using suitable sensors/transducers.

CO2: Calibrate medical instruments.

CO3: Analyze the different bio signals using suitable tools

CO4: Apply the learnt knowledge to design or troubleshoot instruments.

CO5: Acquire skills to operate medical equipment.

CO6: Design cost effective and simple biomedical instruments.

S.No.	Course Code	Course Name	Deleted Topics	Added Topics
1	SBMA2602	Diagnostic Instrumentation	NIL	Detection of parameters using a Plethysmograph GSR measurement to diagnose skin impedance.

 Added Content

 Deleted Content

SBMA2701 (old)	THERAPEUTIC INSTRUMENTATION LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

- To provide hands-on knowledge on different therapeutic equipment.
- To impart knowledge of therapy and surgical tools.

SUGGESTED LIST OF EXPERIMENTS

1. Cutting and coagulation using Surgical Diathermy machine.
2. Working of Defibrillator
3. Study of Haemodialysis machine
4. Demonstration of Ventilators
5. Study of Shortwave diathermy
6. Design a Pacemaker circuit using modules.
7. Stimulate nerves using a nerve stimulator
8. Study of Heart lung machine model
9. Working of anesthesia machine.

COURSE OUTCOMES

At the end of the lab, the student should be able to:

- CO1:** Measure different bioelectrical signals using various methods
CO2: Illustrate various diagnostic and therapeutic techniques
CO3: Evaluate the working and performance of medical instruments.
CO4: Identify suitable equipment for therapeutic applications.
CO5: Apply safe handling of equipment in hospitals.
CO6: Design circuits and develop simple biomedical instruments.

SBMA2701 (Revised)	THERAPEUTIC INSTRUMENTATION LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

- To provide hands-on knowledge on different therapeutic equipment.
- To impart knowledge of therapy and surgical tools.

SUGGESTED LIST OF EXPERIMENTS

1. Cutting and coagulation using Surgical Diathermy machine.
2. Working of Defibrillator
3. Study of Haemodialysis machine
4. Demonstration of Ventilators
5. Study of Shortwave diathermy
6. Analysis of pacemaker output using simulator and processor unit.
7. Stimulate nerves using a nerve stimulator
8. Study of Heart lung machine model
9. Working of anesthesia machine.

COURSE OUTCOMES

At the end of the lab, the student should be able to:

- CO1:** Measure different bioelectrical signals using various methods
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CO3: Evaluate the working and performance of medical instruments.
CO4: Identify suitable equipment for therapeutic applications.
CO5: Apply safe handling of equipment in hospitals.
CO6: Design circuits and develop simple biomedical instruments.

S.No.	Course Code	Course Name	Deleted Topics	Added Topics
1	SBMA2701	THERAPEUTIC INSTRUMENTATION LAB	NIL	Analysis of pacemaker output using simulator and processor unit.

 Added Content

 Deleted Content

SBMA6101 (old)	BIOMEDICAL INSTRUMENTATION LAB	L	T	P	C	Total Marks
		0	0	6	3	100

COURSE OBJECTIVES

- To provide the student with an advanced understanding of biomedical instrumentation, from signal acquisition to measuring and processing.
- To understand the fundamental principles and working of biomedical instruments.
- To learn about applying MATLAB in signal simulation.

BIOMEDICAL INSTRUMENTATION LAB

1. Design of ECG Amplifier using Instrumentation Amplifier
2. Heart Rate Measurement using modules n trainer kit
3. Identification of Heart Sounds-PCG
4. Defibrillator
5. Design of Cardiac Pacemaker.
6. Study of Heart Lung Machine.
7. Study of Haemodialysis.
8. Study of Short wave Diathermy.
9. Surgical Diathermy
10. Simulation of ECG waveforms using MATLAB.

Course Outcomes

- CO1- Illustrate various diagnostic and therapeutic techniques
- CO2- Evaluate the working and performance of medical instruments.
- CO3- Analyze the different bio signals using suitable tools
- CO4- Apply safe handling of equipment in hospitals.
- CO5- Acquire skills to operate medical equipment.
- CO6- Design cost effective and simple biomedical instruments.

SBMA6101 (Revised)	BIOMEDICAL INSTRUMENTATION LAB	L	T	P	C	Total Marks
		0	0	6	3	100

COURSE OBJECTIVES

- To provide the student with an advanced understanding of biomedical instrumentation, from signal acquisition to measuring and processing.
- To understand the fundamental principles and working of biomedical instruments.
- To learn about applying MATLAB in signal simulation.

BIOMEDICAL INSTRUMENTATION LAB

1. Design of ECG Amplifier using Instrumentation Amplifier
2. Heart Rate Measurement using modules n trainer kit
3. Identification of Heart Sounds-PCG
4. Defibrillator
5. Cardiac pacemaker output analysis using analyser and simulator unit.
6. Study of Heart Lung Machine.
7. Study of Hemodialysis.
8. Study of Short wave Diathermy.
9. Surgical Diathermy
10. Simulation of ECG waveforms using MATLAB.
11. Extraction and diagnosis of parameters using a plethysmograph

Course Outcomes

- CO1- Illustrate various diagnostic and therapeutic techniques
CO2- Evaluate the working and performance of medical instruments.
CO3- Analyze the different bio signals using suitable tools
CO4- Apply safe handling of equipment in hospitals.
CO5- Acquire skills to operate medical equipment.
CO6- Design cost effective and simple biomedical instruments.

S.No.	Course Code	Course Name	Deleted Topics	Added Topics
1	SBMA6101	BIOMEDICAL INSTRUMENTATION LAB	NIL	Cardiac pacemaker output analysis using analyser and simulator unit Extraction and diagnosis of parameters using a plethysmograph

 Added Content

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DEPARTMENT OF BIOMEDICAL ENGINEERING

BOARD OF STUDIES – 2022-2023 [EVEN SEMESTER]

Minutes of the Meeting

01/11/2022

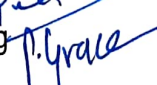
1. As per discussion with the BOS members, B.Tech (Biomedical Engineering) the community internship was included as per the members suggested to include VI Semester which will enable the students to gain technical knowledge.
2. SBAA4004 – Venture Creation has been introduced in one of the Elective course to update the entrepreneur qualities to qualify themselves as a successful leader. This course is designed to enable students to build an entrepreneurial mindset, explore the concept of entrepreneurship, Design thinking, understand the startup journey from opportunity identification to a validated MVP, build sustainable business model, Business planning & financial feasibility and creation of pitch deck.
3. PG Course Medical Instrumentation external experts suggested us to incorporate new electives for students which enriches the students to build up their knowledge in the field of innovation, implement ideas in their research, and achieve a goal towards startup and acquire knowledge towards pattern..
4. UG-Elective course is SBAA4004-Venture creation.
5. PG-Elective courses are-
 - A. SBMA7008-Computers in Medicine
 - B. SBMA7009-Robotics& Artificial Intelligence
 - C. SBMA7010-Neural Networks &Fuzzy Logic in Medicine
 - D. SBMA7011-Pattern Recongnitions & its applications.
 - E. SBMA7012-Physiological control systems.

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3. Ms. **Sindu Divakaran**, Member, Department of Biomedical Engg., 
4. Dr. **P. Grace Kanmani**, Member, Department of Biomedical Engineering 

SBAA4004	VENTURE CREATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Learning Objectives:

1. To develop an entrepreneurial mindset, understand the concept of entrepreneurship and identify personal strengths and weaknesses
2. To understand the design thinking process and apply design thinking to real-world problems
3. To identify problems and opportunities and develop ideas for new ventures by assessing market potential
4. To develop a value proposition, business model canvas, build MVP to create sustainable differentiation for the venture with a well-structured business plan, unit economics, go-to-market strategies and funding plan for managing business growth
5. To build an idea pitch and deliver it with confidence to potential stakeholders

Course Contents

Unit	Unit title	Descriptors
Unit 1	Introduction to Entrepreneurship	Defining Entrepreneurship, evolution the concept & Emerging Trends in Entrepreneurship (Domain specific), Understanding the unique opportunities
		Why be an Entrepreneur?
		Entrepreneurship in Indian Scenario & Its role in economic development
		Success stories of Entrepreneur (Domain specific)
		Entrepreneurial style assessment tool
		Developing the Entrepreneurial mindset- Attributes & skills, recognizing your sweet spot for starting up
		Principles of Effectuation
		Myths about Entrepreneurship
		Types of Entrepreneurs
		Entrepreneur vs Intrapreneur
		Role of Entrepreneurial Teams
Unit 2	Design Thinking & Opportunity Discovery	Introduction to Design Thinking for startups
		Design Thinking principles & process
		Define the problem using Design thinking principles and validate Problem
		Generation of ideas, Idea generation techniques and evaluating creative ideas
		Identify problem worth solving
		Sharpen your Problem Pitch
Unit 3	Customer, Markets and creating a sustainable differentiation	Differentiate between a customer and a consumer
		Who is your customer and what is your segment
		Customer Job, Pains, and Gains using Value proposition Canvas
		Build solution using Value Proposition Canvas
		Market Estimation-TAM,SAM,SOM
		Competitive analysis
		Minimum viable product – what is MVP: Build - Measure - Learn, differentiate between solution Demo & MVP
		How to validate MVP- Achieve a Product – Market fit
		Introduction to Business model, Business plan

Unit 4	Business Model, Business Planning and Go to Market strategies	Lean approach 9 block lean canvas model
		Financial feasibility: Costs, revenue streams, Pricing, Financial Projections, Key Financial Metrics using financial template, Managing growth & targeting scale, Unit economics
		Selecting the Right Channel
		Introduction to Digital Marketing and tools
		Branding strategy
Unit 5	Funding strategy	Sources of funds: Debt & Equity
		Map the Start-up Lifecycle to Funding Options
		Build an Investor ready pitch deck

Assessment

Assessment	Internal evaluation	External examination
Weightages	50%	50%

Internal Assessment CAE1,2

External Assessment

Component 1	Component 2	
Milestone 1 & 2	Milestone 3 & 4	Pitch presentation
20 marks	20 marks	10 marks

Note :

- Internal evaluation will be based on Milestone deck submission in the LMS NextGen Platform provided by Wadhvani Foundation and presentation.
- The students form venture teams and work with their venture idea. This practice venture will converge to a Milestone, a pitch deck presentation created by students in the templates provided as part of the Ignite program.

External Examination

- Written examination for 50 marks on the Ignite program content.

Teaching Learning Process (Pedagogy)

The program is driven by facilitator with top-notch curated material, real life examples and case studies, access to experts and mentors, masterclasses and expert webinars. The Ignite program is hosted in the LMS NextGen Platform provided by Wadhvani Foundation. The program helps students to build practice ventures with the help of milestone deck to gain global jury certification. Students successfully completing the course will get an opportunity to get their milestone deck evaluated by team of global jury. On qualifying the global jury based on rubric assessment the student venture team gains a global jury certification from Wadhvani Foundation.

Course Learning Outcome:

Upon completion of the course, students will be able

1. To define entrepreneurship and explain emerging trends in entrepreneurship
2. To identify and evaluate business opportunities and assess market potential



3. To conduct customer discovery, market research, build a lean canvas, develop a business plan and marketing strategies
4. To identify sources of funding and develop a funding strategy, understand basic legal requirement for starting and running a business
5. To build an idea pitch and deliver it with confidence to various stakeholders

References

1. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2017). Entrepreneurship (10th ed.). McGraw-Hill Education.
2. Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business.
3. Blank, S. G., & Dorf, B. (2012). The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. K&S Ranch.
4. Roy, R. (2017). Indian Entrepreneurship: Theory and Practice. New Delhi: Oxford University Press.
5. Chandan, J. S., & Rana, S. S. (2019). Entrepreneurship Development and Management. New Delhi: McGraw Hill Education.
6. Sinek, S. (2011). Start with Why: How Great Leaders Inspire Everyone to Take Action. Portfolio.
7. Choudhary, R., & Mehta, N. (2019). From Zero to One: How to Build a Successful Startup in India. Notion Press.
8. Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons.
9. Mitra, P., & Banerjee, A. (2019). Startup Minds: The Entrepreneur's Journey from Idea to Success. SAGE Publications India.
10. Thiel, P. (2014). Zero to One: Notes on Startups, or How to Build the Future. Crown Business.
11. Zappos, T. (2010). Delivering Happiness: A Path to Profits, Passion, and Purpose. Business Plus.



SBMA7008	COMPUTERS IN MEDICINE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- This course is an introduction to the most important technical ,clinical, and social aspects of health information technology as they relate to clinical research
- .At the conclusion of this course ,students will be familiar with core concepts in medical informatics :vocabularies, interchange standards, decision support systems;
- Understand how computers are used to manage information in healthcare and to support clinical research; Be familiar with pros and cons of using health information technology in the care setting for career research.

UNIT 1 HEALTH INFORMATICS & MEDICAL STANDARDS

9 Hrs.

Introduction, Needs of computers in medicine, Historical highlights and Evolution, Hospital Information System its characteristics and functional online and offline modules ,e–healthservices, Medical Standards –HL7–DICOMPACS, Medical data formats Bioethics.

UNIT 2 MEDICAL INFORMATICS

9 Hrs.

Definitions and its six levels of interfacing, Electronic Patient Records - Biometrics, Telemedicine – Technologies and applications,Evidence Based Medicine,Virtual Reality and Multimedia applications in Medicine– Virtual Hospital

UNIT 3 BIOMEDICAL INFORMATION TECHNOLOGY

9 Hrs.

Genesis of JAVA, Data types, Operators, Control statements, Classes – Inheritance – packages and interfaces/ Oapplets,Stringhandling Applet Classes AWT and wing classes Javaapplets, Javaserve Javascript programming, Creating events, interactive forms ,frames, documents ,spreadsheet sandwindows -Client Server programming

UNIT 4 MEDICAL DATA COMPRESSION, STORAGE AND RETRIEVAL

9 Hrs.

Introduction, Picture Compression, Compression in the DICOM Standard, Data Compression for Dynamic Functiona lImages,Content-Based Medical Image Retrieval: Image Retrieval by Physical Visual Features ,Geometric Spatial Filters,Combination of Semantic and Visual Features and Physiologically functional features.

UNIT 5 DATA COMMUNICATION, NETWORK INFRASTRUCTURE AND SECURITY

9 Hrs.

Transmission and Communication Technologies, The Internet and World Wide Web, Wireless an Mobile Technologies in M-Health, Sensor Networks for Health Monitoring, Applications of Wireless Technologies in Telemedicine, Overview of Cryptographic system, Digital Watermarking, Medical Image Watermarking, Region- Based Reversible Water marking for Secure Positron Emission Tomography ImageManagement.

Max45Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1-Identify the medical standards for hospital information system and the procedure for bioethics

CO2-Apply the knowledge of Virtual Reality and Multimedia applications in medicine

CO3-Discuss about the information technologies in biomedicalllllustrate

CO4-Illustrate the technique of data compression, storage, retrieval and transmission of bioinformation

CO5- Develop Transmission and Communication Technologies for Health Monitoring

~~~~~CO6-Explores the application ofCryptographic system and Medical Image Watermarking healthcare

#### TEXT / REFERENCE BOOKS

1. RamachandraLele,ComputersinMedicineProgressinMedicalInformatics,TataMcGrawHillPublishingCompany,New Delhi,2005
2. HerbertSchildt,TheCompleteReference–JAVA,TataMcGrawHillPublishingCompany,NewDelhi,2005
3. MohanBansalMS,MedicalInformatics,TataMcGrawHillPublishingCompany,NewDelhi,2005
4. DavidDaganFeng,Biomedicalinformationtechnology,AcademicPressseriesinBiomedicalEngineering2008.
- 5.

|                 |                                             |          |          |          |          |                    |
|-----------------|---------------------------------------------|----------|----------|----------|----------|--------------------|
| <b>SBMA7009</b> | <b>ROBOTICS AND ARTIFICIAL INTELLIGENCE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> | <b>Total Marks</b> |
|                 |                                             | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> | <b>100</b>         |

### **COURSE OBJECTIVE**

- The course covers fundamentals of robot working, programming and integration.
- To develop the student's understanding of the issues involved in trying to define and
- Simulate intelligence and to familiarize the student with specific ,well known AI methods ,algorithms and results and to provide the student additional experience in the analysis and evaluation of complicated systems.

### **UNIT 1 INTRODUCTION TO ARTIFICIAL INTELLIGENCE**

**9 Hrs.**

Definition, AI versus Natural Intelligence, Defining a problem- characteristic, Search, Production Systems- characteristics ,issues in design of search programs ,heuristic search technique- hill climbing ,best first search, problem reduction.

### **UNIT 2 KNOWLEDGE REPRESENTATION**

**9 Hrs.**

Representation and mapping, Knowledge Types, Knowledge representation using rules, predicate logic, symbolic reasoning under uncertainty, statistical reasoning-probability and bayes' theorem, Dempster- Shafer theory. Characteristic of AI language-PROLOG and LISP definition.

### **UNIT 3 INTRODUCTION TO ROBOTICS**

**9 Hrs.**

Classification of robots, basic robot components, manipulator end effectors, controller, accuracy precision and repeatability .Robotic vision system ,Position, velocity and acceleration sensors ,proximity and range sensors, touch and slip sensors, tactile sensors, and force and torque sensors.

### **UNIT 4 ROBOT MOTION ANALYSIS**

**9 Hrs.**

Manipulator Kinematics ,Inverse Manipulator Kinematics, Manipulator Dynamics- Newton-Euler and Lagrange formulation

### **UNIT 5 ROBOT APPLICATIONS**

**9 Hrs.**

Material transfer and machine loading /unloading, processing applications, welding and painting assembly and inspection, future robotic applications and related technologies developments.

**Max. 45 Hours.**

### **Course Outcomes:**

- At the end of the course, the student will be able to
- CO1- Identify and describe how human intelligence and AI works.
  - CO2- Summarize the learning methods adopted in AI.
  - CO3- Analyze the working of sensors utilized in robotics.
  - CO4- Prioritize on the analysis of robotic motion.
  - CO5- Design and evaluate functions of robots.
  - CO6- Demonstrate and Illustrate about functionalities of Robots and Robotics.

### **TEXT / REFERENCE BOOKS**

1. Mikell P. Groover, Mitehell Weiss, Roger Negaland Nicholes G. Odress. Industrial Robotics–Technology–Programming and Applications - McGraw-Hill, Latest edition.
2. Fu, Gonzalez And Lee: Robotics: Control, Sensing, Vision And Intelligence, McGraw-Hill, 1987
3. Elaine Rich And Kevin Knight, Artificial Intelligence, McGraw-Hill, 1983
4. George F. Luger, Artificial Intelligence–Structures and Strategies for Complex Problem Solving Education, 2003.
5. Russell & Norvig, second edition, Artificial Intelligence–a Modern Approach, Pearson Education, 2003.

| SBMA7010 | NEURAL NETWORKS AND FUZZY LOGIC IN MEDICINE | L | T | P | Credits | Total Marks |
|----------|---------------------------------------------|---|---|---|---------|-------------|
|          |                                             | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVE

- This program gives a comprehensive package in the area of fuzzy logic and neural network fundamental with applications ranging in the engineering field.
- This concise bioinspired course will deal with and enable the student to underlying concepts and medical applications of Self-organizing maps, Genetic algorithm, Support Vector Machines.

### UNIT 1 INTRODUCTION

**9 Hrs.**

Neural network learning rules– Supervised and Unsupervised Learning, single layer networks–Perceptron- Linear separability Single Layer and Multilayer Perception, Adaptive linear neuron (Adaline) and LMS algorithm - Error back propagation algorithm ,generalized deltarule.

### UNIT 2 SOM AND ART

**9 Hrs.**

Counter propagation network -Training of Kohonen And Grossberg Layer-feature mapping, self organizing feature maps, Adaptive Resonance theory (ART) Network- ART1 and ART 2 Architecture

### UNIT 3 GENETIC ALGORITHMS AND SVM

**9 Hrs.**

Evolution, search spaces and fitness landscapes ,Elements of Genetic Algorithms, Datastructures ,Adaptive Encoding.SelectiveMethods,Geneticoperators,FitnessScaling,GAApplication

### UNIT 4 FUZZY LOGIC SYSTEMS

**9 Hrs.**

Introduction to fuzzy set theory—membership function –basic concepts of fuzzysets–Operations on fuzzy sets and relations,classical set Vs fuzzy set–properties of fuzzyset–fuzzy logic control principles–fuzzyrelations fuzzyrules – Defuzzification

### UNIT 5 ADVANCES AND APPLICATIONS

**9 Hrs.**

Evolving Support Vector Machine ,Neural networks using GA ,Applications of ANN in biomedical Isignal analysis and medical image analysis.

**Max. 45 Hours**

### COURSE OUTCOMES

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

CO1: Comprehend the concepts of biological neurons and artificial neurons

CO2: Analyze the different neural networks and their learning algorithms.

CO3: Comprehend the genetic algorithms and classifiers.

CO4: Interpret the concepts of a fuzzy logic system.

CO5: Summarize on the applications of fuzzy in biomedical engineering

CO6: Apply fuzzy logic and neural network to real world problems and give solutions

### TEXT / REFERENCE BOOKS

1. JamesA.Freeman&DavidM.Skapura,NeuralNetworksAlgorithms,Applications,andProgrammingTechniques,Pearson Education1991.
2. S.Haykin,NeuralNetworks:AComprehensiveFoundation,PearsonEducation(Asia)Pte.Ltd/prenticeHallofIndia,2003.
3. TimothyJ.Ross,FuzzylogicwithEngineeringApplications;McGrawHill,1997.
4. M.T.Hagan,H.B.DemuthandM.Beale,NeuralNetworkDesign,ThomsonLearning,2002.
5. BartKosko,NeuralNetworksandFuzzySystems.PrenticeHallofIndia,2005
6. MelanieMitchell,AnIntroductiontoGeneticAlgorithms:PrenticeHallofIndia,NewDelhi1998.
7. GeorgeJ.KlirandBoyaun,FuzzyLogic:TheoryandApplication,PrenticeHallofIndia,2001

|                 |                                             |          |          |          |                |                    |
|-----------------|---------------------------------------------|----------|----------|----------|----------------|--------------------|
| <b>SBMA7011</b> | <b>PATTERN RECOGNITION AND APPLICATIONS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credits</b> | <b>Total Marks</b> |
|                 |                                             | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b>       | <b>100</b>         |

## COURSE OBJECTIVE

- To equip the student with basic mathematical and statistical techniques, pattern recognition algorithms commonly used in pattern recognition, and thereby to help understand, compare and contrast various pattern recognition techniques and to provide adequate background on probability theory, statistics, and optimization theory to tackle a wide spectrum of engineering problems.

### UNIT 1 INTRODUCTION

**9 Hrs.**

Machine perception, an example, Pattern Recognition System, The Design Cycle, Learning and Adaptation, Architecture of Pattern recognition system,

### UNIT 2 MAXIMUM – LIKELIHOOD AND BAYESIAN PARAMETER ESTIMATION

**9 Hrs.**

**Bayesian Decision Theory:** Minimum Error Rate Classification, Classifiers, Discriminant functions, and decision surfaces, Introduction to Maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models.

### UNIT 3 UNSUPERVISED CLASSIFICATION

**9 Hrs.**

Clustering for unsupervised learning and classification, clustering concepts C-means algorithm- hierarchical clustering-Graph theoretic approach to pattern clustering-Validity of clustering solutions.

### UNIT 4 FEATURE EXTRACTION

**9 Hrs.**

KL Transforms - feature selection through functional approximation - Binary selection Elements of formal grammars, syntactic description, stochastic grammars, Structural representation.

### UNIT 5 INTRODUCTION TO BIOMETRICS

**9 Hrs.**

Identification Methods, Biometric Technologies, Automatic Identification, Fingerprint verification, Face recognition, Hand Geometry based verification, Retina Identification, DNA based identification, Smart card based authentication.

**Max. 45 Hours**

## COURSE OUTCOME

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

CO1: Understand basic concepts in pattern recognition

CO2: Gain knowledge about state-of-the-art algorithms used in pattern recognition research

CO3: Appraise various unsupervised classification algorithms.

CO4: Recommend techniques to extract features from visuals, images.

CO5: Infer on different methods by which biometric is utilized in day to day activities.

CO6: Apply pattern recognition techniques in practical problems.

## TEXT / REFERENCE BOOKS

1. Richard O. Duda, Peter E. Hart, and David G. Stork, Pattern Classification, 2<sup>nd</sup> Edition, Wiley-Interscience, 2001.
2. Earl Gose, Richard Johnsonbaugh, Steve Jost, Pattern Recognition and Image Analysis, Pearson Education, 2007.
3. K. Jain, R. Bolle, S. Pankanti, Biometrics: Personal Identification in Networked Society, Kluwer Academic, 1999.

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|-----------------|--------------------------------------|----------|----------|----------|----------------|--------------------|
| <b>SBMA7012</b> | <b>PHYSIOLOGICAL CONTROL SYSTEMS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credits</b> | <b>Total Marks</b> |
|                 |                                      | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b>       | <b>100</b>         |

## COURSE OBJECTIVE

- The main objective of this course is to provide background knowledge on specific physiological systems nervous system, sensory systems, muscle control systems, cardiovascular systems, respiratory system, hormonal control mechanisms) and to apply control theory, system analysis, and model identification techniques to better understand the processes involved in physiological regulation.
- In this course, besides qualitative descriptions of physiological systems, we shall be dealing with the mathematical modeling and computer simulation of these models.

### UNIT 1 INTRODUCTION 9 Hrs.

System Analysis fundamental Concepts, Physiological control systems analysis with simple example, Differentiate between Engineering and physiological control system, The science of modeling, Control system: open loop system, closed loop system, Feedback, Mathematical model of mechanical translational and mechanical rotational systems, Electrical analogous of mechanical translational and mechanical rotational system, Transfer function.

### UNIT 2 MATHEMATICAL MODELING 9 Hrs.

Generalized System properties, Models with combinations of system elements, Linear models of Physiological Systems with Examples, Distributed –parameter versus Lumped-parameter model, Linear systems and the superposition principle.

### UNIT 3 STATIC ANALYSIS OF PHYSIOLOGICAL SYSTEMS 9 Hrs.

Open -Loop versus Closed- Loop Systems, Determination of the Steady-State Operating Point, Regulation of Cardiac Output, Regulation of Glucose, Chemical regulation of Ventilation.

### UNIT 4 TIME RESPONSE & FREQUENCY RESPONSE ANALYSIS OF LINEAR SYSTEM 9 Hrs.

Standard test signals, Response of First- Order & Second Order for unit step input, Bodeplot, Polarplot, Transient Response Descriptor. Frequency Response of a Model of Circulatory Control, Frequency Response of Glucose –Insulin -Regulation.

### UNIT 5 STABILITY ANALYSIS AND IDENTIFICATION OF PHYSIOLOGICAL CONTROL SYSTEMS 9 Hrs.

Root Locus, Routh –Hurwitz Stability Criterion, Stability Analysis of Pupillary Light Reflex( Using Routh-Hurwitz Analysis), Model of Cheyne-Stokes Breathing. Identification of Physiological Control Systems: Basic Problems in Physiological Analysis, The Starling Heart-lung preparation.

**Max. 45 Hours**

## COURSE OUTCOME

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

- CO1: Develop an in-depth knowledge in basic tools needed for modeling physiological systems.
- CO2: Discuss on system concept and different mathematical techniques applied in analyzing any given system
- CO3: Summarize on the static analysis of real time physiological systems.
- CO4: Analyze a given system in time domain and frequency domain
- CO5: Infer on the techniques of plotting the responses in both domain analysis.
- CO6: Apply all these analyses to study the biological system.

### TEXT / REFERENCE BOOKS

1. Michael C.K. Khoo, Physiological Control System - Analysis, Simulation and Estimation - Prentice Hall of India, New Delhi, 2001
2. William B. Blesser, A System Approach to Biomedicine, McGraw Hill Book Co, New York, 1969.
3. Manfredo Clynes and John H. Milsom, Biomedical Engineering System, McGraw Hill and Co, New York, 1970.
4. Douglas S. Rigg, Control Theory and Physiological Feedback Mechanism, The William and Wilkins Co, Baltimore, 1970.
5. Richard Skalak and Shu Chien, Hand Book of Biomedical Engineering, McGraw Hill and Co, New York, 1987.

