ANNA UNIVERSITY, CHENNAI
NON - AUTONOMOUS COLLEGES AFFILIATED ANNA UNIVERSITY
M.E. MEDICAL ELECTRONICS

REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM

1. **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):**

   I. To enable the graduates to pursue Clinical Research or lead a successful career in the academic field of medical electronics.
   II. To enable the graduates to acquire all the required Medical Electronics Manufacturing skills for Industrial Application or for Hospital Requirement
   III. To enable the graduates to critically analyse, acquire essential skills ,innovate medical products and to become successful Entrepreneurs in the field of medical electronics.
   IV. To facilitate the graduates to exhibit leadership skills, make decisions with societal and ethical responsibilities, function and communicate effectively in multidisciplinary settings.
   V To enable the graduates to identify, analyze sustainable solutions and to develop ethical practicing ability to collaborate with team members for building medical electronics systems with cutting-edge technology.

2. **PROGRAM SPECIFIC OUTCOMES (PSOs) :**

1. To acquire and understand the basic skill sets required for Medical Electronics Engineering.

2. To implement the techniques and tools of Medical Electronics Engineering to address the needs of technology in healthcare domain

3. To address the problems associated with the interaction between living and non-living materials and systems

4. To adapt to emerging information and communication Technologies to innovate an idea and identify the solutions

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M.E. MEDICAL ELECTRONICS
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I TO IV SEMESTERS CURRICULA AND 1st SEMESTER SYLLABI
SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK L	T	P	TOTAL CONTACT PERIODS	CREDITS
THEORY								
1.	MA4152	Advanced Applied Mathematics	FC	3	1	0	4	4
2.	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
3.	MX4101	Biomedical Instrumentation and Equipment	PCC	3	0	0	3	3
4.	MX4102	Embedded Systems and Internet of Things for Medical Application	PCC	3	0	2	5	4
5.	BM4151	Bio Signal Processing	PCC	3	0	0	3	3
6.	BM4152	Human Anatomy and Physiology	PCC	3	0	0	3	3
7.		Audit Course – I*	AC	2	0	0	2	0
PRACTICALS								
8.	MX4111	Biomedical Instrumentation Laboratory	PCC	0	0	3	3	1.5
9.	BM4161	Bio Signal Processing Laboratory	PCC	0	0	3	3	1.5
			TOTAL	19	1	8	28	22

*Audit course is optional

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK L	T	P	TOTAL CONTACT PERIODS	CREDITS
THEORY								
1.	MX4251	Medical Image Processing	PCC	3	0	2	5	4
2.	MX4201	Medical Electronics Device Design	PCC	3	0	0	3	3
3.	MX4202	Medical Imaging Systems and Radio Therapy	PCC	3	0	0	3	3
4.	BM4251	AI and Machine Learning	PCC	3	0	2	5	4
5.		Professional Elective I	PEC	3	0	0	3	3
6.		Professional Elective II	PEC	3	0	0	3	3
7.		Audit Course – II*	AC	2	0	0	2	0
PRACTICALS								
8.	MX4211	Medical Electronics Device Design Laboratory	PCC	0	0	4	4	2
9.	MX4212	Term Paper and Seminar	EEC	0	0	2	2	1
			TOTAL	20	0	10	30	23

*Audit course is optional

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective III	PEC	3	0	0	3	3
2.		Professional Elective IV	PEC	3	0	2	5	4
3.		Open Elective	OEC	3	0	0	3	3
PRACTICALS								
4.	MX4311	Project Work I	EEC	0	0	12	12	6
5.	MX4312	Hospital / Biomedical Industry Training	EEC	0	0	4	4	2
			TOTAL	9	0	18	27	18

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	MX4411	Project Work II	EEC	0	0	24	24	12
			TOTAL	0	0	24	24	12

TOTAL NO. OF CREDITS: 75

PROFESSIONAL ELECTIVES
SEMESTER II, PROFESSIONAL ELECTIVES – I

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX4001	Nanotechnology and Its applications	PEC	3	0	0	3	3
2.	MX4002	Biomechanics	PEC	3	0	0	3	3
3.	MX4003	Biometrics	PEC	3	0	0	3	3
4.	MX4004	Biomaterials	PEC	3	0	0	3	3
5.	MX4072	Medical Optics	PEC	3	0	0	3	3
6.	MX4071	Human Assist Devices	PEC	3	0	0	3	3

SEMESTER II, PROFESSIONAL ELECTIVES – II

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	BM4075	Wearable Technologies	PEC	3	0	0	3	3
2.	BM4076	Brain Computer Interface	PEC	3	0	0	3	3
3.	BM4071	Genetic Algorithms and Fuzzy Logics	PEC	3	0	0	3	3
4.	MX4073	Medical Robotics	PEC	3	0	0	3	3
5.	BD4251	Big Data Mining and Analytics	PEC	3	0	0	3	3
6.	BM4073	Rehabilitation Engineering	PEC	3	0	0	3	3
7.	BM4074	Tele Health Technology	PEC	3	0	0	3	3

SEMESTER III, PROFESSIONAL ELECTIVES – III

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX4005	Health Care, Hospital and Equipment Management	PEC	3	0	0	3	3
2.	MX4006	Ultra Sound in Medicines	PEC	3	0	0	3	3
3.	MX4007	Bio Ethics and Standards	PEC	3	0	0	3	3
4.	BM4072	Medical Device Standards and Regulation	PEC	3	0	0	3	3
5.	MX4008	Tissue Engineering and Immuno Engineering	PEC	3	0	0	3	3
6.	MX4009	Medical Equipment	PEC	3	0	0	3	3

SEMESTER III, PROFESSIONAL ELECTIVES - IV

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX4010	Biomems and Artificial Organs	PEC	3	0	2	5	4
2.	MX4011	Physiological Modeling	PEC	3	0	2	5	4
3.	MX4074	Pattern Recognition Techniques and Applications	PEC	3	0	2	5	4
4.	MU4253	Mixed Reality	PEC	3	0	2	5	4
5.	MX4012	3D Printing in Medicines	PEC	3	0	2	5	4

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

SL. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	AX4091	English for Research Paper Writing	2	0	0	0
2.	AX4092	Disaster Management	2	0	0	0
3.	AX4093	Constitution of India	2	0	0	0
4.	AX4094	நற்றமிழ் இலக்கியம்	2	0	0	0

MA4152   **ADVANCED APPLIED MATHEMATICS**   **L T P C**
                                                              3 1 0 4

COURSE OBJECTIVES:

- To encourage students to develop a working knowledge of the central ideas of Linear Algebra.
- To enable students to understand the concepts of Probability and Random Variables.
- To make students understand the notion of a Markov chain, and how simple ideas of conditional probability and matrices can be used to give a thorough and effective account of discrete-time Markov chains.
- To familiarize the students with the formulation and construction of a mathematical model for a linear programming problem in real life situation.
- To introduce the Fourier Transform as an extension of Fourier techniques on parodic functions and to solve partial differential equations.

UNIT – I   LINEAR ALGEBRA   12
Vector spaces – Norms – Inner products – Eigenvalues using QR transformations – QR factorization – Generalized eigenvectors – Canonical forms – Singular value decomposition and applications – Pseudo inverse – Least square approximations – Toeplitz matrices and some applications.

UNIT – II   ONE DIMENSIONAL RANDOM VARIABLES   12
Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

UNIT – III   RANDOM PROCESSES   12
Classification – Auto correlation – Cross correlation - Stationary random process – Markov process – Markov chain – Poisson process – Gaussian process.

UNIT – IV   LINEAR PROGRAMMING   12
Formulation – Graphical solution – Simplex method – Two phase method – Transportation and Assignment models.

**UNIT – V   FOURIER TRANSFORM FOR PARTIAL DIFFERENTIAL
                     EQUATIONS   12**
Fourier transforms: Definitions, properties – Transform of elementary functions, Dirac Delta functions – Convolution theorem, Parseval's identity – Solutions to partial differential equation: Heat equations, Wave equations, Laplace and Poisson's equations.

                                                             TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to

- apply the concepts of linear algebra to solve practical problems.
- use the ideas of probability and random variables in solving engineering problems.
- classify various random processes and solve problems involving stochastic processes.
- formulate and construct mathematical models for linear programming problems and solve the transportation and assignment problems.

- apply the Fourier transform methods of solving standard partial differential equations.

REFERENCES:

1. Andrews, L. C. and Philips. R.L., "Mathematical Techniques for engineering and scientists", Prentice Hall of India, New Delhi,2006.
2. Bronson, R.," Matrix Operation", Schaum's outline series, Tata McGrawHill, New York,2011.
3. O'Neil P.V.,, "Advanced Engineering Mathematics", Cengage Learning", 8th Edition, India, 2017.
4. Oliver C. Ibe, "Fundamentals of Applied Probability and Random Processes", Academic Press, Boston, 2014.
5. Sankara Rao,K., " Introduction to partial differential equations" Prentice Hall of India Pvt. Ltd., 3rd Edition, New Delhi,2010.
6. Taha H.A., "Operations Research: An Introduction", Ninth Edition, Pearson Education, Asia, 10th Edition, New Delhi, 2017.

RM4151	RESEARCH METHODOLOGY AND IPR	L T P C
		2 0 0 2

UNIT I   RESEARCH DESIGN   6

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II   DATA COLLECTION AND SOURCES   6

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III   DATA ANALYSIS AND REPORTING   6

Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV   INTELLECTUAL PROPERTY RIGHTS   6

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V   PATENTS   6

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL: 30 PERIODS

REFERENCES

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).

2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

MX4101	BIOMEDICAL INSTRUMENTATION AND EQUIPMENT	L T P C
		3 0 0 3

COURSE OBJECTIVES:
- Study about the different bio potential and electrodes for its measurement.
- Understand the biosignal characteristics and the electrode placement for recording.
- Familiarize the different signal conditioning circuits.
- Learn the different measurement techniques for non-electrical parameters.
- Familiarize the different biochemical measurements.

UNIT I BIO POTENTIAL ELECTRODES 9
Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half-cell potential, impedance, polarization effects of electrode – non polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Biochemical-and Transcutaneous- electrodes: pH, pO_2, pCO_2.

UNIT II ELECTRODE CONFIGURATIONS 9
Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven's triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode. Recording of ERG, EOG and EGG.

UNIT III BIOAMPLIFIERS 9
Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier, Impedance matching circuit, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier., Power line interference, Right leg driven ECG amplifier, Band pass filtering

UNIT IV MEASUREMENT OF NON-ELECTRICAL PARAMETERS 9
Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - Auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers, Systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement

UNIT V BIO-CHEMICAL MEASUREMENT 9
Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors, Blood gas analyzers - colorimeter, Sodium Potassium Analyser, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description) – Bio Sensors – Principles – Amperometric and Voltometric techniques.

TOTAL:45 PERIODS

SUGGESTED ACTIVITIES:
1: Demonstration on various electrodes and study of its characteristics

2: Demonstration about ECG, EEG, ERG, EOG & EGG

3: Design of amplifiers for ECG, EMG, EEG, EGG & EOG

4: Conduct experiments to measure BP, SpO2, Heart Rate, Body temperature

5: Conduct experiments to measure Blood Glucose, Blood cell counts,

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to:

CO1: Understand the origin of bio potentials and electrodes for its measurement.

CO2: Describe the biosignal characteristics and the electrode placement for various physiological recording

CO3: Design bio amplifier for various physiological recording.

CO4: Perform various techniques for measuring non-electrical parameters.

CO5: Apply different techniques for biochemical measurements.

REFERENCES:

1. John G. Webster, Amit J. Nimunkar, Medical Instrumentation application and design – 5th Edition, (An Indian Adaptation), Wiley India, 2021.
2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", edition, 2015. Pearson education, 2012
3. Leslie Cromwell, —Biomedical Instrumentation and measurement, Prentice hall of India, New Delhi, 2nd edition, 2015.
4. Myer Kutz, "Standard Handbook of Biomedical Engineering & Design", McGraw Hill, 2003.
5. KhandpurR.S, Handbook of Biomedical Instrumentation, Tata McGraw Hill, New Delhi, 3rd edition, 2014.

www.binils.com

MX4102	EMBEDDED SYSTEMS AND INTERNET OF THINGS FOR MEDICAL APPLICATION	L T P C 3 0 2 4

COURSE OBJECTIVES:

- To understand hardware and software for ARM processor.
- To understand ARM processor and Building Blocks of Embedded Systems
- To provide information about sensor interfacing with microcontroller boards
- To provide information about various protocols for IoT
- To familiarize the student with the various applications in healthcare using IOT

UNIT I HARDWARE AND SOFTWARE OF ARM PROCESSOR 9

ARM processor fundamentals, architecture, Instruction set, Memory system, Exception/ Interrupt handling. Cortex-M Processors, Embedded Software Development- Introduction to C language and C preprocessor.

UNIT II DATA ACQUISITION SYSTEMS 10

Analog signals: amplitude, bandwidth; Analog multiplexing, Anti-aliasing filters, Analog to Digital converter, Sensor interfacing, sampling theorem, Digital filters, UART to USB converters, Bluetooth, Zigbee and Wi-fi Communication protocols.

UNIT III SENSOR INTERFACING WITH MICROCONTROLLER BOARDS 8

Basics of hardware design, functions of passive components-sensors and actuators, Introduction

to Arduino Due; Arduino integrated development environment and programming.

UNIT IV **IOT: AN INTRODUCTION** **9**
Networked Embedded System types and overview, Introduction to IOT , Application of IOT in health-care - Patient Monitoring & diagnostics, Home healthcare & Personal care & Fitness.

UNIT V **EMBEDDED WEB-SERVER & IOT CLOUD** **9**
  SERVICES APPLICATION & CASE STUDY
Embedded web server: Basic introduction and its application in IOT.
Case Study1: Wireless Patient Monitor system
Case Study2: Wearable Fitness & Activity Monitor
Application Design: Design of IOT based pulse oximeter, block diagram, concepts of analog front end, signal process and Wi-Fi integration, Design of single channel and multi-channel ECG and EMG amplifier systems incorporating analog, digital communication.

45 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**
LIST OF EXPERIMENTS
1. Interfacing with Pressure sensor, Light sensor, IR sensor.
2. Temperature sensor Interfacing using ARM processor
3. Experiments with Atmega -Digital: - Button, Digital Input Pullup, Blink Without Delay
4. Introduction to ARM7- Cortex processor Instruction set
5. EPROM Interfacing using ARM processor.
6. Study of basic image processing algorithm using Single board computers such as Raspberry Pi, Beagle Bone black etc

COURSE OUTCOMES:
Upon Completion of the course, the students will be able to:
CO1: Develop hardware and software for ARM processor, Understand ARM processor and Building Blocks of Embedded Systems
CO2: Understand the data acquisition system.
CO3: Acquire Knowledge on sensor interfacing with Arduino
CO4: Analyze various protocols for IoT,
CO5: Build various applications in healthcare using IOT based approach and substantiate the same with appropriate

TOTAL:75 PERIODS

REFERENCES:

1. Andrew Sloss, Dominic Symes, Chris Wright, ARM system developer's guide: designing and optimizing system software, Morgan Kaufmann, 2004.
2. Getting Started with Internet of Things- CunoPfister, 2011
3. S. Salivahanan, S. Arivazhagam, "Digital circuits and Design", 4th Edition, Vikas Publishing House, 2012.
4. Interconnecting Smart Objects with IP- J. P Vasseur, Adam Dunkels, 2010 24 Course
5. R. S. Khandpur, "Printed Circuit Boards Design - Fabrication, Assembly and Testing", 1st Edition, McGraw Hill Education, 2017.
6. Brian W. Kernighan, Dennis M. Ritchie, "The C programming language", 2nd Edition, Prentice Hall, Englewood Cliffs, New Jersey, 1988

BM4151   **BIO SIGNAL PROCESSING**   **L T P C**
                                                                           3 0 0 3

COURSE OBJECTIVES:
- To introduce the characteristics of different biosignals
- To discuss linear and non-linear filtering techniques to extract desired information
- To demonstrate the significance of wavelet detection applied in biosignal processing.
- To extract the features from the biosignal
- To introduce techniques for automated classification and decision making to aid diagnosis

UNIT I   **SIGNAL, SYSTEM AND SPECTRUM**   **9**
Characteristics of some dynamic biomedical signals, Noises- random, structured and physiological noises. Filters- IIR and FIR filters. Spectrum – power spectral density function, cross-spectral density and coherence function, cepstrum and homomorphic filtering. Estimation of mean of finite time signals.

UNIT II   **TIME SERIES ANALYSIS AND SPECTRAL ESTIMATION**   **9**
Time series analysis – linear prediction models, process order estimation, non-stationary process, fixed segmentation, adaptive segmentation, application in EEG, PCG and HRV signals, model based ECG simulator. Spectral estimation – Blackman Tukey method, periodogram and model based estimation. Application in Heart rate variability, PCG signals.

UNIT III   **ADAPTIVE FILTERING AND WAVELET DETECTION**   **9**
Filtering – LMS adaptive filter, adaptive noise cancelling in ECG, improved adaptive filtering in FECG, EEG and other applications in Bio signals, Wavelet detection in ECG – structural features, matched filtering, adaptive wavelet detection, detection of overlapping wavelets.

UNIT IV   **ANALYSIS OF BIOSIGNAL**   **9**
Removal of artifact – ECG, Even detection –ECG, P Wave, QRS complex, T wave, Correction analysis of ECG signals, Average of Signals-PCG, ECG and EMG,

UNIT V   **BIOSIGNAL CLASSIFICATION AND RECOGNITION**   **9**
Statistical signal classification, linear discriminate function, direct feature selection and ordering, Back propagation neural network based classification.
Case study: 1. Various methods used to extract features from EEG signal
Case Study 2: Diagnosis and monitoring of sleep apnea

COURSE OUTCOMES:
Upon Completion of the course, the students will be able to:
CO1: Analyse the different types of signals & systems
CO2: Analyse signals in time series domain & estimate the spectrum
CO3: Understand the significance of wavelet detection applied in biosignal processing
CO4: Extract the features from biosignal
CO5: Describe the performance of the classification of biosignals

                                                         TOTAL:45 PERIODS

REFERENCES:
1. P.Ramesh Babu, ―Digital Signal Processing, Sixth Edition, Scitech publications, Chennai, 2014.

2.   Raghuveer M. Rao and AjithS.Bopardikar, Wavelets transform – Introduction to theory and its applications, Pearson Education, India 2000

3.   Rangaraj M. Rangayyan, 2nd edition "Biomedical Signal Analysis-A case study approach", Wiley- Interscience /IEEE Press, 2015

4.   Emmanuel C. Ifeachor, Barrie W.Jervis, second edition, "Digital Signal processing- A Practical Approach" Pearson education Ltd., 2002

5.   Willis J.Tompkins, Biomedical Digital Signal Processing, Prentice Hall of India, New Delhi, 2006

BM4152	HUMAN ANATOMY AND PHYSIOLOGY	L T P C
		3 0 0 3

COURSE OBJECTIVES:
- To identify all the organelles of an animal cell and their function.
- To understand the structure and functions of the different types of systems of the human body.
- To understand about sensory organs and accessory organs of human being
- To demonstrate their knowledge of importance of anatomical features and physiology of human systems
- Gain knowledge in regulatory mechanism of human body

UNIT I   ORGANIZATION OF THE HUMAN BODY   8

Organization of the human body: from atoms to the entire organism. Anatomical directions and planes. Cell structures and functions – Plasma membrane and sub-organelles. Cell membrane transport. Cell to cell signaling, Cell cycle and regulations. Action potential, Homeostasis, Types of specialized tissues

**UNIT II   INTEGUMENTARY, SKELETAL, MUSCULAR AND   9
                   RESPIRATORY SYSTEMS**

Skin: Structure of skin and their parts, Skeletal: Types of Bone and function – Physiology of Bone formation – Division of Skeleton – Types of joints and function – Types of cartilage and function. Muscular: Parts of Muscle – Movements. Respiratory: Parts of Respiratory Systems – Types of respiration - Mechanisms of Breathing – Regulation of Respiration

**UNIT III   CARDIOVASCULAR, LYMPHATIC AND ENDOCRINE   10
                   SYSTEMS**

Cardiovascular: Structure of Heart, Conducting System of Heart – Properties of Cardiac Muscle - Cardiac Cycle – Heart Beat – Types of Blood vessel – Regulation of Heart rate and Blood pressure. Blood: Components of Blood and functions.- Blood Groups and importance Lymphatic: Types of Lymphatic organs and vessels – Functions. Endocrine: Pituitary and Thyroid glands

**UNIT IV   NERVOUS, SENSE ORGANS AND REPRODUCTIVE   10
                   SYSTEMS**

Nervous: Structure, types and properties of Neuron, Mechanism of Nerve impulse. Brain: Structure and parts of brain – central and peripheral nervous system – Reflex mechanism. Sense: Structure and functions of eye and ear. Reproductive: Anatomy of testis and ovary

UNIT V DIGESTIVE AND URINARY SYSTEMS 8

Digestive: Organs of Digestive system – Digestion and Absorption. **Urinary:** Structure of Kidney and Nephron – Mechanisms of Urine formation – Regulation of Blood pressure by Urinary System – Urinary reflex

TOTAL:45 PERIODS

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to:

CO1: Explain the general terminology, cell structure and function, histology, gross anatomy, and physiology related to the various human systems

CO2: Acquire knowledge various anatomical parts of the human systems

CO3: Understand about interconnectedness of anatomy and physiology of various systems

CO4: Acquire knowledge in human organ systems interrelation and apply a holistic approach to human health.

CO5: Apply concept and knowledge of human systems to novel technical and/or clinical scenarios

REFERENCES:

1. Frederic H. Martini, Judi L. Nath, Edwin F. Bartholomew, Fundamentals of Anatomy and Physiology. 11th Edition, Pearson Publishers, 2014 -
2. Gillian Pocock, Christopher D. Richards, The human Body – An introduction for Biomedical and Health Sciences, Fifth Edition , Oxford University Press, USA, 2017.
3. William F.Ganong, "Review of Medical Physiology", 22nd Edition, Mc Graw Hill, New Delhi, 2010.
4. Eldra Pearl Solomon,"Introduction to Human Anatomy and Physiology", - 4th Edition , W.B. Saunders Company, 2015.
5. Guyton & Hall, "Medical Physiology", 13th Edition - Elsevier Saunders, 2015.
6. Elaine.N.Marieb, "Essential of Human Anatomy and Physiology", Eleventh Edition, Pearson Education, New Delhi, 2015.

MX4111	BIOMEDICAL INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- Familiarize the preamplifiers and signal conditioning circuits for ECG acquisition.
- Understand the designing of amplifiers for acquiring bio signals like EEG, EOG, and EMG.
- Study the concept of designing an isolation amplifier.
- Learn the different measurement techniques for non-electrical parameters.
- Design the PCB layout for any bio amplifier.

LIST OF EXPERIMENTS:

1. Design of pre amplifiers to acquire bio signals along with impedance matching circuit using suitable IC's.
2. Design of ECG Amplifiers with appropriate filter to remove power line and other artefacts.
3. Design of EMG amplifier.
4. Design a suitable circuit to detect QRS complex and measure heart rate.
5. Design of frontal EEG amplifier.

6. Design of EOG amplifier to detect eye blink.
7. Design a right leg driven ECG amplifier.
8. Design a Pulse Oximeter and Measure O2 Saturation and HR
9. Design and study the characteristics of optical Isolation amplifier.
10. Measurement of pulse-rate using Photo transducer.
11. Measurement of pH and conductivity.
12. Measurement of blood pressure using sphygmomanometer.
13. Measurement and recording of peripheral blood flow.
14. Design a PCB layout for any bio amplifier using suitable software tool.

COURSE OUTCOMES:
Upon completion of this course the students will be able to

CO1: Design and implement preamplifiers and signal conditioning circuits for ECG signal acquisition.
CO2: Design and implement amplifiers for different bio signals like EEG, EOG, EMG.
CO3: Design an optical isolation amplifier
CO4: Acquire various non-electrical parameters using suitable sensors/transducers.
CO5: Implement PCB layout for any bio amplifier.

TOTAL:45 PERIODS

| BM4161 | BIO SIGNAL PROCESSING LABORATORY | L T P C |
| | | 0 0 3 1.5 |

COURSE OBJECTIVES:
- To understand the analysis of biosignals
- To know the various methods for denoising of biosignals.
- To understand the extraction of features in biosignals
- To gain knowledge about biosignal compression.
- To detect and classify the abnormalities in biosignals

LIST OF EXPERIMENTS: MATLAB / EQUIVALENT SOFTWARE PACKAGE
1. Removal of noise and artifact using filtering
2. Denoising of biosignals using wavelets
3. Noise cancellation using Adaptive filters
4. QRS detection using Pan-Tompkins algorithm
5. Heart rate variability analysis in ECG signals
6. Event detection in EEG signals
7. Cepstral analysis of speech signals
8. Multiresolution analysis of EEG signal using wavelet transform
9. Feature extraction in EMG signals
10. Adaptive segmentation of EEG signals
11. Feature reduction using PCA
12. Disease classification of biosignals
13. Autoregressive modelling of biosignals
14. Biosignal compression
15. Biosignal analysis in virtual instrumentation platform

COURSE OUTCOMES:

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

CO1: Develop an algorithm for preprocessing of biosignals.

CO2: Perform denoising and analyze the spectral characteristics of biosignals.

CO3: Perform biosignal compression.

CO4: Analyze the biosignals in virtual instrumentation platform

TOTAL:45 PERIODS

AUDIT COURSES

AX4091	ENGLISH FOR RESEARCH PAPER WRITING	L T P C
		2 0 0 0

COURSE OBJECTIVES:
- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I   INTRODUCTION TO RESEARCH PAPER WRITING   6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II   PRESENTATION SKILLS   6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III   TITLE WRITING SKILLS   6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV   RESULT WRITING SKILLS   6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V   VERIFICATION SKILLS   6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission

TOTAL: 30 PERIODS

COURSE OUTCOMES:

CO1 –Understand that how to improve your writing skills and level of readability

CO2 – Learn about what to write in each section

CO3 – Understand the skills needed when writing a Title

CO4 – Understand the skills needed when writing the Conclusion

CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

AX4092	DISASTER MANAGEMENT	L T P C
		2 0 0 0

COURSE OBJECTIVES:
- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I   INTRODUCTION   6

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II   REPERCUSSIONS OF DISASTERS AND HAZARDS   6

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III   DISASTER PRONE AREAS IN INDIA   6

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV   DISASTER PREPAREDNESS AND MANAGEMENT   6

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V   RISK ASSESSMENT   6

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

COURSE OUTCOMES:

CO1: Ability to summarize basics of disaster

CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES:
1. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'NewRoyal book Company,2007.
3. Sahni, PardeepEt.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi,2001.

AX4093   **CONSTITUTION OF INDIA**   **L T P C**
                                                       2 0 0 0

COURSE OBJECTIVES:
Students will be able to:
*   Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
*   To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
*   Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
*   To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution.

UNIT I   HISTORY OF MAKING OF THE INDIAN CONSTITUTION
History, Drafting Committee, (Composition & Working)

UNIT II   PHILOSOPHY OF THE INDIAN CONSTITUTION
Preamble, Salient Features

UNIT III   CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV   ORGANS OF GOVERNANCE
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V   LOCAL ADMINISTRATION
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila

Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT VI   ELECTION COMMISSION

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization
- of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING

1.   The Constitution of India,1950(Bare Act),Government Publication.
2.   Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.
3.   M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014
4.   D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

AX4094	நற்றமிழ் இலக்கியம்	L T P C
		2 0 0 0

UNIT I   சங்க இலக்கியம்   **6**

1.   தமிழின் துவக்க நூல் தொல்காப்பியம்
      – எழுத்து, சொல், பொருள்
2.   அகநானூறு (82)
      - இயற்கை இன்னிசை அரங்கம்
3.   குறிஞ்சிப் பாட்டின் மலர்க்காட்சி
4.   புறநானூறு (95,195)
      - போரை நிறுத்திய ஔவையார்

UNIT II   அறநெறித் தமிழ்   **6**

1.   அறநெறி வகுத்த திருவள்ளுவர்
      - அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புரவு அறிதல், ஈகை, புகழ்
2.   பிற அறநூல்கள் - இலக்கிய மருந்து
      – ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)

UNIT III இரட்டைக் காப்பியங்கள் **6**

1. கண்ணகியின் புரட்சி
   - சிலப்பதிகார வழக்குரை காதை
2. சமூகசேவை இலக்கியம் மணிமேகலை
   - சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை

UNIT IV அருள்நெறித் தமிழ் **6**

1. சிறுபாணாற்றுப்படை
   - பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஒளவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்
2. நற்றிணை
   - அன்னைக்குரிய புன்னை சிறப்பு
3. திருமந்திரம் (617, 618)
   - இயமம் நியமம் விதிகள்
4. தர்மச்சாலையை நிறுவிய வள்ளலார்
5. புறநானூறு
   - சிறுவனே வள்ளலானான்
6. அகநானூறு (4) - வண்டு
   நற்றிணை (11) - நண்டு
   கலித்தொகை (11) - யானை, புறா
   ஐந்திணை 50 (27) - மான்
   ஆகியவை பற்றிய செய்திகள்

UNIT V நவீன தமிழ் இலக்கியம் **6**

1. உரைநடைத் தமிழ்,
   - தமிழின் முதல் புதினம்,
   - தமிழின் முதல் சிறுகதை,
   - கட்டுரை இலக்கியம்,
   - பயண இலக்கியம்,
   - நாடகம்,
2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,
3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,
4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
5. அறிவியல் தமிழ்,
6. இணையத்தில் தமிழ்,
7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

TOTAL : 30 PERIODS

<u>தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்</u>

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University)
   - www.tamilvu.org
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)
   - https://ta.wikipedia.org
3. தர்மபுர ஆதின வெளியீடு
4. வாழ்வியல் களஞ்சியம்
   - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம்
   - தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம்
   - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்