RAMAIAH
Institute of Technology

# CURRICULUM

**for the Academic year 2019 – 2020**

**(Revised Scheme)**

## MEDICAL ELECTRONICS

**III & IV SEMESTER B.E**

**RAMAIAH INSTITUTE OF TECHNOLOGY**
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

## About the Institute

Ramaiah Institute of Technology (RIT) (formerly known as M. S. Ramaiah Institute of Technology) is a self-financing institution established in Bangalore in the year 1962 by the industrialist and philanthropist, Late Dr. M S Ramaiah. The institute is accredited with "A" grade by NAAC in 2014 and all engineering departments offering bachelor degree programs have been accredited by NBA. RIT is one of the few institutes with prescribed faculty student ratio and achieves excellent academic results. The institute was a participant of the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. All the departments have competent faculty, with 100% of them being postgraduates or doctorates. Some of the distinguished features of RIT are: State of the art laboratories, individual computing facility to all faculty members. All research departments are active with sponsored projects and more than 304 scholars are pursuing PhD. The Centre for Advanced Training and Continuing Education (CATCE), and Entrepreneurship Development Cell (EDC) have been set up on campus. RIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with over 1,35,427 books with subscription to more than 300 International and National Journals. The Digital Library subscribes to several online e-journals like IEEE, JET etc. RIT is a member of DELNET, and AICTE INDEST Consortium. RIT has a modern auditorium, several hi-tech conference halls and all are air-conditioned with video conferencing facilities. It has excellent hostel facilities for boys and girls. RIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association. RIT obtained Academic Autonomy for all its UG and PG programs in the year 2007. As per the National Institutional Ranking Framework, MHRD, Government of India, Ramaiah Institute of Technology has achieved 64th rank in 2019 among the top 100 engineering colleges across India.

## About the Department

The Medical Electronics department at Ramaiah Institute of Technology (MSRIT), Bangalore was started in the year 1996. The department is offering 4-year full time B. E. degree course in Medical Electronics, affiliated to VTU, Belgaum, recognized by Government of Karnataka, approved by AICTE, New Delhi and accredited by NBA. The department is located at Lecture Hall Complex of RIT Campus. The department consists of a highly motivated & qualified faculty and dedicated supporting staff headed by Dr. N. Sriraam, Academy-industry experienced Professor with specialization in biomedical signal processing.

## VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

## MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations
- Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs

## QUALITY POLICY

We at M. S. Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

## VISION OF THE DEPARTMENT

Provide quality education, motivational academic environment and foster a conducive Institute-industrial relationship to empower the students to face the real-time challenges in the field of engineering and medicine

## MISSION OF THE DEPARTMENT

The department shall transform the entrant of the program into professionally competent engineers through innovative curricula, research, practical training and effective collaboration with industry, hospital and academia

## PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

**PEO 1 :**Solve the real-life engineering problems by employing the knowledge and skillsofMedical Electronics

**PEO 2 :**Provide a multi-disciplinary environment to link engineering and medical domains

**PEO 3 :**Inculcate professional and ethical values in lifelong learning process

## PROGRAM OUTCOMES (POs):

**PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## PROGRAM SPECIFIC OUTCOMES (PSOs):

**PSO1:** Acquire and comprehend the basic skillsets of mathematical approaches along with analog and digital electronics essential in the development of biomedical systems

**PSO2:** Provide hardware and software oriented real-time solutions in healthcare using the knowledge of Biomedical electronics and instrumentation

**PSO3:** Utilize the concepts of advanced clinical engineering to cater to the requirements of healthcare oriented applications

## Semester wise Credit Breakdown for B E Degree Curriculum
## Batch 2018-22

| Semester / Course Category | First | Second | Third | Fourth | Fifth | Sixth | Seventh | Eighth | Total Credits |
|---|---|---|---|---|---|---|---|---|---|
| **Basic Sciences (BSC)** | 9 | 8 | 4 | 4 | | | | | **25** |
| **Engineering Sciences (ESC)** | 11 | 10 | | | | | | | **21** |
| **Humanities, Social Sciences and Management (HSMC)** | | 2 | | | 3 | | 3 | | **8** |
| **Professional Courses – Core (PCC)** | | | 21 | 21 | 15 | 11 | 10 | | **78** |
| **Professional Courses– Elective (PEC)** | | | | | 3 | 3 | 6 | 3 | **15** |
| **Other Open Elective Courses (OEC)** | | | | | 3 | 3 | | | **6** |
| **Project Work (PROJ), Internship (IN)** | | | | | | 4 | 1 | 17 | **22** |
| **Total Credits** | **20** | **20** | **25** | **25** | **24** | **21** | **20** | **20** | **175** |

**SCHEME OF TEACHING**
**III SEMESTER**

| Sl. No. | Course Code | Course Name | Category | Credits | | | | Contact Hours |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Total | |
| 1 | ML31 | Engineering Mathematics-III | BS | 3 | 1 | 0 | 4 | 5 |
| 2 | ML32 | Analog and Digital Electronics Circuits | PC-C | 4 | 0 | 0 | 4 | 4 |
| 3 | ML33 | Control Systems | PC-C | 3 | 1 | 0 | 4 | 5 |
| 4 | ML34 | Signal Processing | PC-C | 3 | 1 | 0 | 4 | 5 |
| 5 | ML35 | Human Anatomy | PC-C | 2 | 0 | 0 | 2 | 2 |
| | ML36 | Human Physiology | PC-C | 2 | 0 | 0 | 2 | 2 |
| 6 | ML37 | Object Oriented Programming (OOP) | PC-C | 3 | 0 | 0 | 3 | 3 |
| 7 | MLL38 | Analog and Digital Electronics circuits Lab | PC-C | 0 | 0 | 1 | 1 | 2 |
| 8 | MLL39 | Object Oriented Programming Lab | PC-C | 0 | 0 | 1 | 1 | 2 |
| 9 | AM01* | Additional Mathematics - I | BSC | 3 | 0 | 0 | 0 | 3 |
| **Total** | | | | **23** | **3** | **2** | **25** | **33** |

* Non Credit Mandatory Course  L – Lecture (one hour)  T - Tutorial (Two hours)  P - Practical (Two hours)

**Note:**

1. The Non Credit Mandatory Course, Additional Mathematics – I is prescribed for III Semester Lateral Entry Diploma students admitted to III Semester of BE Program. The student shall register for this course along with other III semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE to appear for SEE. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.
2. **AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
   Every regular student, who is admitted to the 4 year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
   Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

**IV SEMESTER**

| Sl. No. | Course Code | Course Name | Category | Credits | | | | Contact Hours |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Total | |
| 1 | ML41 | Engineering Mathematics-IV | BS | 3 | 1 | 0 | 4 | 5 |
| 2 | ML42 | Linear Integrated Circuits and its Applications | PC-C | 4 | 0 | 0 | 4 | 4 |
| 3 | ML43 | Biomedical Signal Processing | PC-C | 3 | 1 | 0 | 4 | 5 |
| 4 | ML44 | Digital Image Processing | PC-C | 3 | 1 | 0 | 4 | 5 |
| 5 | ML45 | Biomedical Instrumentation-I | PC-C | 3 | 0 | 0 | 3 | 3 |
| 6 | ML46 | Microcontroller –MSP430 | PC-C | 4 | 0 | 0 | 4 | 4 |
| 7 | MLL47 | Linear Integrated Circuits Lab | PC-C | 0 | 0 | 1 | 1 | 2 |
| 8 | MLL48 | Microcontroller –MSP430Lab | PC-C | 0 | 0 | 1 | 1 | 2 |
| 9 | AM02* | Additional Mathematics - II | BSC | 3 | 0 | 0 | 0 | 3 |
| **Total** | | | | **23** | **3** | **2** | **25** | **33** |

* Non Credit Mandatory Course  L – Lecture (one hour)  T - Tutorial (Two hours)  P - Practical (Two hours)

**Note:**

1. The NonCredit Mandatory Course, Additional Mathematics – II is prescribed for IV Semester Lateral Entry Diploma students admitted to BE Program. The student shall register for this course along with other IV semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE to appear for SEE. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.
2. **AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
   Every regular student, who is admitted to the 4 year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
   Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

## ENGINEERING MATHEMATICS III

**Course Code: ML31** **Credit: 3:1:0**
**Prerequisite: Calculus** **Contact Hours: 42+28**
**Course coordinators: Dr. M. V. Govindaraju & Dr. M. Girinath Reddy**

### Course Content:

### Unit I

**Numerical solution of Algebraic and Transcendental equations:** Method of false position, Newton - Raphson method.
**Numerical solution of Ordinary differential equations:** Taylor's series method, Euler's and modified Euler's method, fourth order Runge-Kutta method.
**Statistics:** Curve fitting by the method of least squares, fitting linear, quadratic and geometric curves. Correlation and Regression.

### Unit II

**Linear Algebra:** Elementary transformations on a matrix, Echelon form of a matrix, rank of a matrix, Consistency of system of linear equations, Gauss elimination and Gauss – Seidel method to solve system of linear equations, Eigen values and Eigen vectors of a matrix, Rayleigh power method to determine the dominant Eigen value of a matrix, Diagonalization of a matrix, Solution of system of ODEs using matrix method.

### Unit III

**Complex Variables-I:** Functions of complex variables, Analytic function, Cauchy-Riemann equations in Cartesian and polar coordinates, Consequences of Cauchy-Riemann equations, Construction of analytic functions.
**Transformations:** Conformal transformation, Discussion of the transformations - $w = z^2, w = e^z$ and $w = z + \frac{a^2}{z}$ $(z \neq 0)$, Bilinear transformation.

### Unit IV

**Complex Variables-II:** Complex integration, Cauchy theorem, Cauchy integral formula. Taylor and Laurent series (statements only). Singularities, Poles and residues, Cauchy residue theorem (statement only).

### Unit V

**Fourier series:** Convergence and divergence of infinite series of positive terms. Periodic function, Dirichlet's conditions, Fourier series of periodic functions of period $2\pi$ and arbitrary period. Half range Fourier series. Fourier series for Periodic square wave, Half wave rectifier, Full wave rectifier, Saw-tooth wave with graphical representation, Practical harmonic analysis.

**Text Books**

1. Erwin Kreyszig –Advanced Engineering Mathematics – Wiley publication – 10th edition-2015.
2. B. S. Grewal – Higher Engineering Mathematics – Khanna Publishers – 44th edition – 2017.

**Reference Books**

1. Glyn James – Advanced Modern Engineering Mathematics – Pearson Education – 4th edition – 2010.
2. Dennis G. Zill, Michael R. Cullen - Advanced Engineering Mathematics, Jones and Barlett Publishers Inc. – 3rdedition – 2009.
3. Dennis G. Zill and Patric D. Shanahan- A first course in complex analysis with applications- Jones and Bartlett publishers-2nd edition-2009.

**Course Outcomes (COs):**

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

1. Apply numerical techniques to solve engineering problems and fit a least squares curve to the given data. (PO-1,2&PSO-1)
2. Test the system of linear equations for consistency and solve system of ODE's using matrix method. (PO-1,2&PSO-1)
3. Examine and construct analytic functions. (PO-1,2&PSO-1)
4. Classify singularities of complex functions and evaluate complex integrals. (PO-1,2&PSO-1)
5. Construct the Fourier series expansion of a function/tabulated data. (PO-1,2&PSO-1)

## ANALOG AND DIGITAL ELECTRONICS CIRCUITS

**Course Code: ML32** **Credit: 4:0:0**
**Prerequisite: Basic Electronics** **Contact Hours: 56**
**Course coordinators: Mrs.Uma Arun, Mrs.Prabhu Ravikala Vittal**

**Course Contents:**

**Unit-I**

**Introduction to Circuit Theory:** Introduction to mesh and nodal analysis, Network Theorems- Thevenin's, Norton's, Maximum power transfer and Superposition Theorem (Only for resistive networks).

**Unit-II**

**Diodes and Transistors:** Types of diodes, Application in various contexts, comparison of different transistor configuration(CE,CB,CC),Design of RC Coupled amplifier, characteristics parameters and impedance measurement.

**Unit-III**

**Transistor Amplifiers:** Design of CC Amplifer (Emitter follower), Darligton emitter follower, Power amplifier and types, multistage amplifier, feedback amplifiers, types-positive and negative feedback ,advantages.

**Unit-IV**

**Combinational Logic circuits:** Introduction tosimplication of Logic circuits,Parallel adder, decoders, encoders, multiplexers and demultiplexers,
**Introduction to digital logic families**: TTL,CMOS and tristate buffer.

**Unit-V**

**Sequential circuits:** Overview of JK Flipflop, Counters, synchronous ,asynchronous ,design of counters, Shift registers, Application of shift registers

**Text Books:**


1. K Alexander & N.O. Sadiku"Fundamentals of Electric circuits" - McGraw Hill International 6th Edition, 2017
2. Ronald J Tocci, Neal S Widmer Gregory L. Moss "Digital Systems Principles and Applications" – Printice hall 12th Edition, 2018
3. Robert L. Boylested and Louis Nashelsky"Electronic Devices and Circuit Theory"- Pearson Education. 11th Edition, 2015


**Reference Books:**


1 David A. Bell "Electronic Devices and Circuits" by - PHI, 5th Edition, 2008
2 ChannaVenkatesh & D.Ganesh Rao "Network Theory" by K, Sanguine Technical Publications,2012
3 John M Yarbrough "Digital Logic – Application and Design" - Thomson Brooks/Cole 7th Edition, 2012

**Course Outcomes (COs):**

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

1. Analyze, reduce and solve any complicated networks using a set of standard circuit theorems. (PO-1,2,3&PSO-1)
2. Apply the basic knowledge of transistor and diode to design various transistor amplifiers. (PO-1,2&PSO-1)
3. Understand the concept of feedback, power and cascading effect in respect to multistage transistor amplifiers. (PO-1,2& PSO-1)
4. Analysis the performance of decoders, encoders, multiplexers, demultiplexers and code converters. (PO-1,2& PSO-1)
5. Apply the knowledge of flip-flops in designing synchronous and asynchronous counters. (PO-1,2,3& PSO-1)

## CONTROL SYSTEMS

**Course Code: ML33** **Credit :3:1:0**
**Prerequisite: Nil** **Contact Hours: 42+28**
**Course coordinators: Dr.C.K.Narayanappa, Dr.Sanjay H S**

**Course contents:**

**Unit -I**

**Introduction to Control Systems**: Introduction, Types of control systems, Design considerations, Mechanical translation & rotational systems, Analogous circuits
**Block Diagram & Signal flow graph**: Introduction, Transfer function, Elements of block diagram, Closed loop transfer function, Block diagram algebra, Signal flow graphs, Electromechanical systems, Introduction to Mat lab

**Unit -II**

**Time domain analysis of control systems:** Introduction, Typical test signals, First order systems, Formal representation of second order systems, Determination of undamped response, natural frequency & damping ratio, Step response of second order systems, Time domain specifications, System types, Different forms of representation, Steady state & static errors, Approximation of higher order systems, Step response of second order systems with zeros, Generalized error series, response.

**Unit -III**

**Stability of Linear Control systems:** Introduction, BIBO stability, Relationship between characteristic equation roots & BIBO stability, Zero input stability, Stability criterion, RH criterion, RH analysis using Matlab
**Root Locus:** Introduction, The RL concept, Steps for rapid plotting, RL analysis using Matlab

**Unit -IV**

**Frequency Domain Analysis:** Correlation between time and frequency response, Frequency domain specifications
**Bode Plot:** Introduction, Asymptotic approximations, Bode diagram for a practical system, Determination of transfer functions

**Unit –V**

**Stability in the frequency domain:** Introduction to polar plots (Inverse polar plots excluded), Mathematical preliminaries, Nyquist Stability Criterion, Assessment of relative stability Nyquist Stability criterion
**State Space Theory:** Introduction, State & state variables, Selection of state variables, state model, Non-homogenous solution, converting a transfer function to a state model
Note: Matlab based problem solving topics are to be taught as demo sessions.

**Text Books:**


1. Katsuhiko Ogata, 'Modern Control Engineering', 5th edition, PHI, 2009
2. Nagrath & Gopal, 'Control Systems Engineering', New Age International Publications, 5th Edition, 2008

**Course outcomes (COs)**:

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

1. Comprehend and interpret the basic concepts of control theory. (PO-1,2,3& PSO-1)
2. Compare the performances of a first and second order system in time domain. (PO-1,2,3&PSO-1)
3. Analyze the stability of a given system using different stability assessment techniques. (PO-1,2,5 & PSO-1)
4. Assess the various factors involved with the time and frequency domain approaches and to use BODE plot based approach to conclude on the stability of a given system (PO-1,2,5 &PSO-1)
5. Apply polar plot and Nyquist criterion techniques for system stability analysis and to model a given system in state space thereby solving the state space equation. (PO- 1,2,5&PSO-1)

## SIGNAL PROCESSING

**Course Code :ML34** **Credit: 3:1:0**
**Prerequisite: Nil** **Contact Hours: 42+28**
**Course coordinators: Dr.C.K.Narayanappa, Dr.Sanjay H S**

**Course contents:**

**Unit I**

**Introduction to Signals &Systems:** Introduction to Signals and Systems: Introduction to various types of signals, Basic operations on continuous and discrete time signals, Properties of discrete time LTI systems, Convolution Sum and Convolution Integral, Correlation.

**Unit II**

**Frequency Domain Analysis using Z transforms:** Relation between Z transform and DTFT, Z transform-properties-region of convergence- representation of poles and zeros in z transform. Inverse z transform- residue method, Partial fraction method, frequency response of LTI DT signals.

**Unit III**

**Frequency Domain Analysis using Fourier transform:** Introduction to Fourier domain representation, Definition and Properties of DFT, Introduction to Fast Fourier Transform, Decimation in Time & Decimation in Frequency computation of DFT and Introduction to Discrete Cosine Transform and its Applications

**Unit IV**

**IIR Filter Design:** Introduction, Butterworth filters, Chebyshev filters, general filter forms, design of IIR digital filter through analog filters, impulse invariant transformations, bilinear transformations, design of digital Butter worth &Chebyshev filters, problems.

**Unit V**

**FIR Filter Design:** Introduction, different types of windows- rectangular, Design of FIR filters using different windows, frequency sampling design, comparison of IIR & FIR digital filters.

**Text Books:**


1. Simon Haykin, "Signals and systems",2nd edition,Wiley India Publications
2. Ganesh Rao, "Signals and systems",Cengage Publications,4th edition.
3. A. V Oppenheim & R W Schafer "Digital Signal Processing"–,*Pearson Education / PHI, 4th Edition, 2013.*
4. Ganesh Rao &Vineetha P Gejji, Digital Signal Processing Cengage Learning India Pvt. Ltd. 2017

**References:**


1. Sanjit K Mitra "Digital Signal Processing" *3rd-edition,2011*
2. L R Rabiner and B Gold, McGraw Hill. **"**Theory and applications of DSP" 2nd edition, McGraw *Hill, 2006.*


**Course Outcomes (COs):**

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

1. Understand the basic concepts of signals and their characteristics. (PO-1, 2,5,12& PSO-1,2)
2 Describe the Properties of various systems with respect to time and frequency domain (PO-1, 2,3,5& PSO1,2)
3. Represent different systems in the Frequency domain using Fourier and Z transforms and highlight their interrelationship. (PO-1, 2,5& PSO-1,2)
4. Analyze the given systems in Time domain using convolution and differential equations. (PO-1,2,5, & PSO-1)
5. Design and implement IIR and FIR filters for the given specifications in analog and digital domains. (PO-1, 2,3,12& PSO-1,3)

## HUMAN ANATOMY

**Course Code : ML35** **Credit: 2:0:0**
**Prerequisite: Nil** **Contact Hours: 28**
**Course coordinators: Dr.Jyothi, Dr.Anupama**

**Course contents:**

### UNIT-I

**General Anatomy, General Histology:** Terms & terminologies, Tissues:Epithelial tissue-definition, function classification with examples, modifications:Skin, Connective tissue definition, components, function classification with examples, modifications:Cartilage –types features,Bone- definition, components, function classification with examples, parts, blood supply periosteum and microscopic picture. Lymphoid tissue- definition, function classification with examples.Nervous system- definition, components, function, classification with examples, neuroglia: Muscular system-types with example, features. Cardiovascular system- definition, components, function. Joints -definition, components, function, classification with examples

### UNIT-II

**Musculo-skeletal system**: All bones of the body: Joints of upper limb-shoulder, elbow and wrist: Joints of lower limb- hip, knee and ankle. Vertebral column- parts, function, curvatures, vertebrae. Thoracic cage- ribs, sternum.

### UNIT-III

**Cardiovascular and Respiratory system:** Heart – pericardium, external features, blood supply to heart, interior of chambers of heart and applied aspects, Blood vessels of the body . Nasal cavity – nasal septum & lateral wall, paranasal air sinuses; larynx; trachea; pleura, lung.

### UNIT-IV

**Nervous and Digestive system:** Meninges, classification of nervous system, cerebrum – sulci &gyri, functional areas, blood supply, ventricles of brain, diencephalon, brainstem, cerebellum, spinal cord, cranial nerves, special senses. Nerves of the body. Pharynx, tongue, esophagus, stomach, small intestine, large intestine, liver, pancreas & spleen.

### UNIT-V

**Uro-genital system and Radiological Imaging:**Kidneys, ureter, urinary bladder; urethra-parts, relation, functions blood supply applied anatomy,Components of female reproductive system - uterus, ovaries & fallopian tube -parts, relation, functions blood supply applied anatomy,Components of male reproductive system - testis, vas deferens, and scrotum -parts, relation, functions blood supply applied anatomy.Principle& applications of radiography, ultrasound, CT, MRI, Recent advancing imaging.

**Text Books:**


1. Dr.Jayanthi. V –Text book of anatomy for nursing and Allied science- EMMES publishers, 1st edition,2008
2. Vishram Singh or B.D.Chaurasia, GeneralAnatomy.CBS publishers, 6thedition ,2013
3. Vishram Singh or B.D.Chaurasia,Anatomy of Upper Limb & Thorax Volume I ,Elsevier, 1stedition, reprinted 2008.
4. Vishram Singh or B.D.Chaurasia, Anatomy of Lower Limb & Abdomen (Volume II) Elsevier, 1stedition,reprinted 2008
5. Vishram Singh orB.D.Chaurasia,Anatomy of Head, Neck & Brain (Volume III),Elsevier, 1stedition, reprinted 2008


**Course Outcomes (COs):**

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

1. Explain the anatomical structure of human body. (PO-1, 6, 12& PSO-1)
2. Relate the various anatomical parts with their structure and functionality.(PO-1, 6,12& PSO-1)
3. Locate and have idea while dealing with images**.** (PO-1, 6, 12& PSO-1)

# HUMAN PHYSIOLOGY

**Course Code : ML36** **Credit: 2:0:0**
**Prerequisite: Nil** **Contact Hours: 28**
**Course coordinators:Dr. Arun Kumar, Mrs.Prabhu Ravikala Vittal**

**Course contents:**

## UNIT-I

**General Physiology:** Homeostasis, Feedback mechanism body fluids, Measurement of Body fluids, Resting Membrane potential, action potential, Measurement of action potential,
**Muscular system**: Types of muscles and their properties, Muscle fatigue, Difference in the properties of three types of muscles, Molecular basis of muscle contraction, excitation contraction coupling, EMG measurement Neuromuscular junction, Physiology of exercise Neuromuscular blockers

## UNIT-II

**Nervous System:** Neuron, Properties of neurons, types of nerves**,** synapse and neurotransmitters**,** Nerve conduction studies**,** Functions of cerebrum, cerebellum, cerebrospinal fluid, EEG recording, Lumbar puncture**,** Ascending and descending tracts, Autonomic nervous system: functions and effects. Digital Reflex testing, Autonomic function testing**,**
**Special senses:** Vision, refractive errors, Refractive error testing, color vision testing, Physiology of vision electro retinogram, electrooculogram, VEP, Physiology of hearing, Physiology of smell and taste Tuning fork tests, audiometry, BAEP

## UNIT – III

**Hematology:** Introduction, Composition and functions of blood (RBC, WBC, Hemoglobin), Measurement of Hemoglobin Blood groups, Blood Transfusion, functions of Platelet
Identification of blood groups, PTT, APTT, INR.
**Cardiovascular system:** Cardiac action potential, conducting system of heart, Principles of ECG Measurement, Heart rate, factors affecting HR, Pulse rate, factors affecting pulse Measurement of HR, Measurement of PR, Cardiac cycle, cardiac output, factors affecting CO, Heart sounds, Measurement of CO, Blood pressure, factors affecting BP, Hypertension Measurement of BP

## UNIT – IV

**Respiratory system:** Functions of respiratory passages and lungs, muscles of respiration, mechanics of breathing, Variables affecting respiration**,** Volume and pressure changes during normal respiration**,** Lung volumes and capacities, Restrictive and obstructive diseases ,Vitalograph, Measurement of Dead space, Computerized spirometry, PEFR
**Digestive System:** Introduction, Saliva and Deglutition, Functions of stomach, Functions of Liver, Jaundice Oesophaealmanometry, Electrogastrogram, Bilirubin measurement, Peristalsis and movements in GIT, Functions of pancreas, Small intestine and large intestine, Defecation Basal Electrical rhythm,

**Renal system:** Structure and functions of Kidneys, nephron, GFR and factors affecting it Trans epithelial potential difference, Measurement of GFR, clearance tests, Formation of Urine –normal constituents, Micturition reflex, Renal failure, Uroflowmetry, Cystometrogram, Dialysis

**UNIT – V**

**Endocrine system:** Types of hormones, Hypothalamus, Pituitary Gland, Thyroid gland**,** Thyroid function tests**,** Functions of cortisol, aldosterone, insulin, glucagon, parathyroid glands and miscellaneous hormones**,** Stress assessment, Diabetes Mellitus

**Reproductive system:** Gender differentiation and pubertal changes , functions of male reproductive system**,** Karyotyping, Semen testing **,** Female reproductive system, menstrual cycle, Pregnancy and lactation, Contraceptive methods, Tests for ovulation and Tests for pregnancy**,** Environmental physiology **:**Physiology of High altitude, Dysbarism, Regulation of temperature

**Text Books**:


1 Dr. Venkatesh & Dr.Sudhakar, "Basics of Medical Physiology", Wolters Kluwer Health Lippincott Williams and Wilkins, 3rd edition, 2010.
2 Ross &Wilson's,"Anatomy and Physiology in Health and Illness", Anne Waugh and Allison Grant, 9thEdition, Churchill Livingstone Publications.2006
3 Sujit K. Chaudhuri, "Concise Medical Physiology", 5th Edition, New Central Book Agency Pvt. Ltd.1996.


**Course Outcomes (COs):**

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

1. Explain the basic physiological functions of various types of organs within the human body. (PO-1, 6, 12& PSO-1)
2. Compare and contrast normal physiological processes and be able to recognize the relationship between pathogenic progression and altered physiological responses. (PO-1, 6, 12& PSO-1)
3. Analyze and interpret physiological data to design of medical instruments used for diagnosis. (PO-1, 6, 12& PSO-1)

## OBJECT ORIENTED PROGRAMMING (OOP)

**Course Code: ML37** **Credit: 3:0:0**
**Prerequisite: Basic programming knowledge** **Contact Hours: 42**
**Course coordinators:Mr. Mahendra.S.J, Dr.Basavaraj V Hiremath**

**Course Contents**:

### Unit I

Introduction: Overview of C++, Sample C++ program, Different data types, operators, expressions, and statements, arrays and strings, pointers & function components, recursive functions, user -defined types, function overloading, inline functions, Classes & Objects – I: classes, Scope resolution operator, passing objects as arguments, returning objects, and object assignment.

### Unit II

Classes & Objects –II: Constructors, Destructors, friend functions, Parameterized constructors, Static data members, Functions, Arrays of objects, Pointers to objects, this pointer, and reference parameter, Dynamic allocation of objects, Copy constructors, Operator overloading using friend functions such as +, - , pre-increment, post-increment

### Unit III

Templates: Generic functions and Generic classes, Inheritance: Base Class, Inheritance and protected members, Protected base class inheritance, Inheriting multiple base classes, Constructors, Destructors and Inheritance, Passing parameters to base class constructors, Granting access, Virtual base classes.

### Unit IV

Virtual functions, Polymorphism: Virtual function, calling a Virtual function through a base class reference, Virtual attribute is inherited, Virtual functions are hierarchical, pure virtual functions, Abstract classes, Using virtual functions, Early and late binding.

### Unit V

Exception Handling, I/O System Basics, File I/0: Exception handling fundamentals, Exception handling options. C++ stream classes, Formatted I/O, fstream and the File classes, Opening and closing a file, Reading and writing text files.

**Text Book:**

1. SouravSahay, Object Oriented Programming Using C++, 2nd edition 2013

**Reference Books:**

1. Stanley B.Lippmann, JoseeLajoie: C++ Primer, 4th Edition, Addison Wesley, 2012.

2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2011.

**Course Outcomes (COs):**

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

1. Identify classes, objects, members of a class and the relationships among them needed to solve a specific problem. (PO-12,3& PSO-2)
2. Demonstrate the concept of constructors and destructors. And create new definitions for some of the operators (PO-1,2,3& PSO-2)
3. Create function templates, overload function templates, Understand and demonstrate the Concept data encapsulation and inheritance (PO-1,2,3&PSO-2)
4. Demonstrate the concept of polymorphism with virtual functions. (PO-1,2,3& PSO-2)
5. Demonstrate the concept of file operations, streams in C++ and various I/O manipulators.(PO-1,2, 3& PSO-2)

## ANALOG AND DIGITAL ELECTRONICS CIRCUITS LABORATORY

**Course Code : MLL38** **Credit: 0:0:1**
**Prerequisite: Basic Electronics** **Contact Hours: 28**
**Course coordinators: Mrs.Uma Arun, Mrs.Prabhu Ravikala Vittal**

**Course Contents**:

1. Verification of network theorems
2. Design of Full wave rectifier with filter
3. Design of Regulated DC power supply.
4. Design of RC coupled Amplifier Applications
5. Design & Analysis of High Impedance Amplifier & Application.
6. Design of negative feedback Amplifier.
7. Verification of encoder and decoder.
8. Implementation of half adder and full adder using MUX 74153
9. Implementation of code converters using DEMUX- 74139
10. Implementation T and D flip-flop using JK Master slave configuration and IC 7446
11. Implementation of MOD N Counters using ICs 7476, 7490, 7493
12. Verification of SISO, SIPO, PIPO, PISO operation using shift register 7495

**Text Book(s):**

1. "Electronic Devices and Circuit Theory" by Robert L. Boylested and Louis Nashelsky- Pearson Education,11th Edition, 2015
2. "Digital Systems Principles and Applications" by Ronald J Tocci, Neal S Widmer Gregory L. Moss – Printice hall, 12th Edition, 2018

**Course Outcomes (COs):**

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

1. Design various linear and nonlinear circuits for requiredapplications.(PO-1,2,3& PSO-1)
2. Demonstrate the practical skills of building circuits. (PO-1,2,3& PSO-1)
3. Analyze the Outcomes both theoretically and practically. (PO-1,2,3& PSO-1)

## OBJECT ORIENTED PROGRAMMING LAB

**Course Code : MLL39** **Credit: 0:0:1**
**Prerequisite: Basic programming knowledge** **Contact Hours: 28**
**Course coordinators: Mr. Mahendra.S.J, Dr.Basavaraj V Hiremath**

**Course Contents:**

1. Inline functions & function overloading.
2. Classes & objects.
3. Constructors, destructors & static data members.
4. Friend functions & generic functions.
5. Operator overloading.
6. Inheritance - protected members, protected base class inheritance
7. Inheritance - inheriting multiple base classes.
8. Passing parameters to base class constructors, granting access and virtual base class.
9. Virtual functions and polymorphism.
10. Pure virtual functions and abstract classes.
11. Standard Template Library (STL).
12. Exception handling.

**Reference Books:**


1. Stanley B.Lippmann, JoseeLajoie: C++ Primer, 4th Edition, Addison Wesley, 2012.
2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2011.


**Course Outcomes (COs):**

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

1. Develop classes incorporating object-oriented techniques. (PO-1,2,3& PSO-2)
2. Design and implement object-oriented concepts of inheritance and polymorphism. (PO-1,2,3& PSO-2)
3. Illustrate and implement STL class of containers and need for exceptions to handle errors for object Orientedprograms. (PO-1,2,3& PSO-2)

## ENGINEERING MATHEMATICS-IV

**Course Code: ML41** **Credit: 3:1:0**
**Prerequisite: Calculus & Probability** **Contact Hours: 42+28**
**Course coordinators:Dr. M. V. Govindaraju & Dr. M. Girinath Reddy**

**Course Content:**

**Unit I**

**Finite Differences and Interpolation**: Forward and backward differences, Interpolation, Newton-Gregory forward and backward interpolation formulae, Lagrange's interpolation formula and Newton's divided difference interpolation formula (no proof).

**Numerical Differentiation and Numerical Integration**: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson's 1/3rd rule and Simpson's 3/8th rule.

**Unit II**

**Fourier Transforms:** Infinite Fourier transform, Infinite Fourier sine and cosine transforms, Properties, Inverse transform, Convolution theorem, Parseval's identity (statements only). Fourier transform of rectangular pulse with graphical representation and its output discussion, Continuous Fourier spectra-example and physical interpretation.

**Z-Transforms**: Definition, standard Z-transforms, Single sided and double sided, Linearity property, Damping rule, Shifting property, Initial and final value theorem, Convergence of Z-transforms, Inverse Z-transform, Convolution theorem and problems. Application of Z-transform to solve difference equations.

**Unit III**

**Random Variables:** Random variables (discrete and continuous), Probability density function, Cumulative distribution function, Mean, Variance and Moment generating function.

**Probability Distributions:** Binomial and Poisson distributions, Uniform distribution, Exponential distribution, Gamma distribution and Normal distribution.

**Unit IV**

**Joint probability distribution:** Joint probability distribution (both discrete and continuous), Conditional probability and Conditional expectation.

**Stochastic Processes:** Introduction, Classification of stochastic processes, discrete time processes, Stationary, Ergodicity, Autocorrelation and Power spectral density.

**Markov Chain:** Probability vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of regular Markov chains and absorbing states. Markov and Poisson processes.

## Unit V

**Series Solution of ODEs and Special Functions:** Series solution, Frobenius method, Series solution of Bessel differential equation leading to Bessel function of first kind, Orthogonality of Bessel functions. Series solution of Legendre differential equation leading to Legendre polynomials, Rodrigue's formula**.**

**Text Books:**


1. R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9th edition – 2012.
2. B.S. Grewal-Higher Engineering Mathematics-Khanna Publishers - 44th edition-2017.


**Reference Books:**


1. Erwin Kreyszig –Advanced Engineering Mathematics – Wiley publication – 10th edition-2015
2. Glyn James- Advanced Modern Engineering Mathematics-PearsonEducation-4th edition-2010
3. Kishor S. Trivedi – Probability & Statistics with reliability, Queuing and Computer Science Applications – John Wiley & Sons – 2nd edition – 2008.


**Course Outcomes (COs):**

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

1. Find functional values, derivatives, areas and volumes numerically from a given data. (PO-1,2&PSO-1)
2. Evaluate Fourier transforms and use Z-transforms to solve difference equations. (PO-1,2&PSO-1)
3. Analyze the given random data and their probability distributions. (PO-1,2& PSO-1)
4. Determine the parameters of stationary random processes and use Markov chain in the prediction of future events. (PO-1,2&PSO-1)
5. Obtain the series solution of ordinary differential equations. (PO-1,2&PSO-1)

# LINEAR INTEGRATED CIRCUITS

**Course Code : ML42** **Credit: 4:0:0**
**Prerequisite: Basic Electronics** **Contact Hours: 56**
**Course coordinators: Prof.P.G.Kumaravelu, Mrs.Chandana.S**

**Course Contents:**

**Unit-I**

**Introduction to Operational Amplifiers and Characteristics:** Introduction to Linear IC's, Block diagram, characteristics and equivalent circuits of an ideal op-amp, various types of Operational Amplifiers and their applications, Power supply configurations for Op-Amp applications, inverting and non-inverting amplifier configurations.

**The Practical op-amp:** Introduction, Input offset voltage, offset current, thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, Slew rate and its Effect, PSRR and gain – bandwidth product, frequency limitations and compensations, transient response, interpretation of μA741C datasheet.

**Unit-II**

**Amplifiers and Oscillators**: Summing amplifier, Integrators and differentiators, Instrumentation amplifier and its types, Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Log and Antilog amplifier, Analog Multiplier and Divider, Triangular/rectangular wave generator, phase-shift oscillators, Wein bridge oscillator.

**Unit-III**

**Active Filters**: Characteristics of filters, Classification of filters, Magnitude and frequency response, Butter worth 1st and 2nd order Low pass, High pass and band pass filters, Chebyshev filter characteristics, Band reject filters, Notch filter, All pass filters.

**Unit-IV**

**Comparators and Converters**: Comparator, Zero Crossing Detector, Voltage limiters, Clipper and clampers, Absolute value output circuit, Peak detector, Sample and hold Circuit, Precision rectifiers, DAC- Binary weighted type and R-2R ladder type, ADC- successive approximation type and ADC 0801

**Unit-V**

**Multivibrators and Advanced Applications:** Schmitt Trigger- inverting and non-Inverting type, Monostable and AstableMultivibrators using Opamp, Monostable and AstableMultivibrators using 555 timer,Linear and switching Voltage regulator using Opamp, Isolation Amplifier, Cardiac Pacemaker, PLL and VCO.

**Text Book(s):**

1. Ramakant A. Gayakwad- "Op - Amps and Linear Integrated Circuits" PearsonIn, 4th Edition,2015
2. D. Roy Choudhury and Shail B. Jain "Linear Integrated Circuits" - New Age International, 5th Edition, 20186 Reprint.
3. B Somanath Nair "Linear Integrated Circuits- Analysis, Design & Applications" by, Wiely India Pvt. Ltd. 1st Edition, 2009.

**Reference(s):**

1. "Operational Amplifiers and Linear IC's" by David A. Bell, Oxford Higher Education, 3rd Edition 2011.
2. "Operational Amplifiers & Linear Integrated Circuits: Theory and Application / 3E: by James M. Fiore- Thomson Learning, 2019

**Course Outcomes (COs):**

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

1. Illustrate the working of operational amplifier and relate various characteristics of an operational amplifier.(PO-1,9&PSO-1)
2. Build various signal generation and signal enhancement circuits using op-amp.(PO-1,3,5, 9,10,12&PSO-1,2)
3. Apply the knowledge of analog circuits and Op-Amp in the design of active filters.(PO-1,3,5, 9,10,12&PSO-1,2)
4. Analyze various signal processing circuits using Op-Amp.(PO-1,3,5,9,10,12&PSO-1,2)
5. Analyze various biomedical applications involving Multivibrator and PLL.(PO-1,9& PSO1)

## BIOMEDICAL SIGNAL PROCESSING

**Course Code: ML43** **Credit: 3:1:0**
**Prerequisite: Signal processing** **Contact Hours: 42+28**
**Course coordinators: Dr.Sanjay H S, Mrs.Purnima B R**

### Course Contents:

### Unit -I

**Fundamentals of biomedical Signals and their Processing:** Sampling and aliasing, simple signal conversion systems, Different types of bio-electric signals and its properties, Difficulties in signal analysis, computer aided diagnosis, Concurrent, coupled and correlated process: illustration of problem with case studies, Physiological interference, noise, Correlation and Covariance, Illustration of noise removal with case studies,

### Unit -II

**Filtering for Removal of artifacts**: Time domain filtering- Synchronized Averaging, Moving Average filters, Derivative based filters, Frequency domain filters Notch filters, Comb filters, Optimal filters- Wiener filter, Homomorphic filters, Adaptive filters

### Unit -III

**IIR Digital Filter Design and its Applications**: Impulse invariant method, Bilinear transformation method, Design of bilinear transformation method using Butterworth, Design of impulse invariant method using Butterworth technique, Design of bilinear transformation method using Chebyshev techniques, Design of impulse invariant method using Chebyshev techniques,

**FIR Digital Filter Design and its Applications**: Characteristics of FIR filter, FIR filter design using windowing techniques- rectangular window, Hamming window, Hanning window, Blackmann window

### Unit –IV

**Event Detection**: Derivative Based methods for QRS detection, Pan–Tompkins algorithm for QRS detection, Detection of Dicrotic notch, Correlation Analysis of EEG channels.

**Data Reduction techniques**-Turning point algorithm, Fan Algorithm Wave shape and Waveform Complexity: Analysis of event related potentials, morphological analysis of ECG waves, envelope extraction and analysis, analysis of activityproblems.

### Unit-V

**Frequency domain Characterization**: Estimation of power spectral density function, Measures derived from PSD's,

**Modeling of Biomedical Systems:** Parametric system modeling, Autoregressive or All-Pole modeling, Pole-Zero Modeling.

**Text Books:**

1. Rangaraj M Rangayyan," Biomedical Signal Analysis", WielyOublications, 2nd Edition, 2016.
2. Willis J Tomkins, "Biomedical Digital Signal Processing", PHI,1993.

**Reference Book:**

1. John L Semmlow, "Biosignal&amp Biomedical Image Processing" –CRC Press, 3rd Edition, 2014.

**Course outcomes:**

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

1. Demonstrate an understanding of biomedical signals and identify the need forbiomedical signal analysis. (PO-1,2,3,12& PSO-1,3)
2. Identifyphysiological interferences and artifacts affecting the biomedical signals and apply Variousfiltering mechanisms for the enhancement of signals. (PO-2,4&PSO-1)
3. Detect various events involved in EEG & ECG signals and apply data reductiontechniques. (PO-1,3&PSO-1)
4. Analysis of biomedical signal in time and frequency domain. (PO-2,4&PSO-1)
5. Apply advanced signal processing and modeling techniques for the analysis ofbiomedical signals. (PO-1,2,12&PSO-1,3)

## DIGITAL IMAGE PROCESSING

**Course Code : ML44** **Credit: 3:1:0**
**Prerequisite: Nil** **Contact Hours: 42+28**
**Course coordinators: Dr.C.K.Narayanappa, Dr.Basavaraj V Hiremath**

**Course contents:**

### UNIT - I

**Introduction:** Origin and importance of DIP, fundamental steps in digital image processing, elements of digital image processing system. Digital image fundamentals: image sensing and acquisition, sampling and quantization, some basic relationships between pixels, some basic transformations

### UNIT– II

**Morphological Image Processing** : Preliminaries, dilation and erosion, opening and closing, the Hit-or-miss transformation, some basic morphological algorithms, extensions to gray scale images

### UNIT – III

**Image Enhancement in the spatial domain:**Background, Basic gray level transformations, histogram processing, enhancement using arithmetic/logic operations, basics of spatial filtering, smoothing and sharpening spatial filters, combining spatial enhancement methods

### UNIT - IV

**Image enhancement in the frequency domain:** Background, introduction to the frequency domain, Fourier transform, Discrete Fourier transform, some properties of the 2-dimensional Fourier transform, Fast Fourier Transform, smoothing and sharpening frequency domain filters, homomorphic filtering, implementation, generation of spatial masks from frequency domain specifications

**Color image processing:** Color Fundamentals, color Model, Pseudo color processing, Basics of full color processing

### UNIT - V

**Image restoration:** Degradation model, Noise models, restoration in the presence of noise only (Spatial and frequency domain filters),Diagonalization of circulant and block circulant matrices, algebraic approach to restoration, Inverse filtering, LMS filtering, constrained least square restoration, interactive restoration, restoration in the spatial domain

**Text Book:**

1. R C Gonzalez & R E Woods," Digital Image Processing" , Pearson Education,3e, 2008

**Reference Books:**


1. A K Jain, " Fundamentals of Digital Image processing ", PHI / Pearson Education, 1st edition, 2011
2. Chanda and Majumder," Digital Image Processing and Analysis",PHI Learning Pvt. Ltd., 2004.


**Course outcomes (COs):**

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

1. Identify the basic Digital image representation and analyze the relationship between the pixels. (PO-1,2,3&PSO-1)
2. Analyze and implement morphological image processing. (PO-1,2,3&PSO-1,2 )
3. Analyze the aspects involved with respect to various enhancement techniques on an image. (PO-1,2,3,5&PSO-1).
4. Emphasize on the different color models and their importance. (PO-1,2,3&PSO-1)
5. Discuss various restoration technique used in image processing. (PO-1,2,3&PSO-1)

## BIOMEDICAL INSTRUMENTATION I

**Course Code : ML45** **Credit: 3:0:0**
**Prerequisite: Nil** **Contact Hours: 42**
**Course coordinators: Prof.P.G .Kumaravelu ,Dr.Sanjay H S**

**Course Contents:**

**Unit -I**

**Introduction to Biomedical Instrumentation**: Introduction, generalized instrumentation system, alternate operating modes, measurement constraints, classification of biomedical instruments, interfering and modifying inputs, compensation techniques, static and dynamic characteristics, design criteria, biostatistics, commercial development process, regulations.

**Unit-II**

**Origin of bioelectric potentials**: Electrical activity of the excitable cells, volume conductor fields, functional organization of peripheral nervous system, electroneurogram, electromyogram,electrocardiogram, electroretonigram, electroencephalogram, Magnetoencephalogram

**Unit-III**

**Biopotential Electrodes**: Electrode-electrolyte interface, polarization, polarisable and non-polarizable electrodes, electrode behaviour and circuit models, electrode-skin interface, motionartifacts, body surface recording electrodes, internal electrodes, electrode arrays, microelectrodes, electrodes for electric stimulation of tissues, practical aspects involved

**Unit- IV**

**Biopotential amplifiers:** basic requirements, electrocardiograph, problems encountered, transient protection, interference reduction circuits, amplifiers for biopotential signals – design and working, biopotential signal processors, cardiac monitors, biotelemetry

**Unit-V**

**Electrical safety**: physiological effects of electricity, important susceptibility parameters, distribution of electric power, macroshock and microshock, electrical safety codes and standards, protection against shock, power distribution, equipment design, electrical safety analysers, testing the electric system and appliances.

**Text Book:**

1. John G Webster, “Medical Instrumentation-Application and design”, 4 th edition, John Wiley Publications, 2009

**Reference Books**

1. R S Khandpur, “Handbook of biomedical Instrumentation”, 3 rd edition, Tata McGraw Hill publications (2017)
2. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Pearson Education, New Delhi, 2007.

**Course outcomes (COs)**:

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

1. Accent the basics of biomedical instrumentation used to acquire bio potential signals from human beings. (PO-1,2,3,12&PSO-1,3)
2. Comprehend the origin of bio potentials from human body. ( PO-2,3&PSO-1)
3. Interpret the importance of bio potentials electrodes in the process of signal acquisition. (PO-1, 4&PSO-1)
4. Recognize and realize the need for usage of bio potential amplifiers in biomedical instruments and applications. ( PO-3, 4 &PSO-1)
5. Analyze the safety aspects involved with electricity in medical instruments. (PO-2,3, &PSO-1)

## MICROCONTROLLER- MSP430

**Course Code : ML46** **Credit: 4:0:0**
**Prerequisite: Nil** **Contact Hours: 56**
**Course coordinators: Mrs.Prabhu Ravikala Vittal, Mrs.Uma Arun**

**Course Contents:**

**Unit-I**

**Introduction to Embedded system**: What (and Where) are Embedded Systems, Approaches toEmbedded Systems, Anatomy of a Typical Small Microcontroller.
**Memory**: Computer System and Memory organization, Harvard and Van-Nuemaan architecture, Memory terminology, Basic RAM and ROM architecture, Flash memory, Advanced Memory. Architecture of MSP430, Microcontrollers: Central Processing Unit, Registers, Program Counter, Status Register, Constant Registers, Stack Pointer , Basic Clock Module and their operation.

**Unit-II**

**Programming model of MSP 430:** Addressing modes, Instruction set, Basic and Emulated Instructions, Memory Mapped Peripherals, Programming System Registers, I/O pin multiplexing, Digital I/O Programing-Input &Output Registers, Function Select Register, Port Interrupts, Pull Up/Down Registers, GPIO control, Interrupt, ISR and Interrupt Programming, Clock System in MSP430, Low power modes of operation.

**Unit-III**

**Timers**: Timers, PWM and Microcontroller Fundamentals for Basic Programming -Timer Basics, Basic concept of delay generation, Hardware and software delays, Watch dog timer, Real Time Clock (RTC), Timer Block diagram and Operation, Timer Modes, Output Unit, Timer Interrupts, PWM control, Timing generation and measurements,

**Unit-IV**

**Mixed Signals Processing**: Comparator, General issues of analog and digital signal conversion,Analog-to-Digital Conversion: Successive Approximation Operation of ADC 10 and ADC 12 inMSP430 Microcontrollers, Timing and Triggering options of ADC, Low power and Interruptoperation with ADC, Conversion modes for Single and Repeated conversion, Special FunctionRegisters for ADC operation
**Case Study**: MSP430 based embedded system application using ADC, PWM for controlling application.

**Unit-IV**

**Communication protocols and Interfacing:** Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, I2C,), Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices.
**Case study**: Communication of temperature sensed from sensor from one controller to other using serial communication.

## Unit-V

**Embedded Networking and Internet of Things**:

Basics of wireless communication, Requirements for the wireless communication. Types of wireless communication. Advantages and limitations of wireless communication, IoT overview and architecture, Overview of wireless sensor networks and design examples. Various wireless connectivity: NFC, ZigBee, Bluetooth, Bluetooth Low Energy, Wi-Fi. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications.

Building IoT applications using CC3100 user API: connecting sensor devices.

**Text Books:**


1. MSP430 Microcontrollers Basics, John H Devis, 1st Edition, Reed Elsevier India Pvt. Ltd 2017
2. MSP430 Microcontrollers in Embedded System Projects, C P Ravikumar, 1st Edition, Elite Publishing House, 2012
3. Analog and Digital Circuits for Electronic Control System Applications: Using the TI MSP430 Microcontroller, Jerry Luecke, 1st Edition, Elsevier Science, 2005


**Course Outcomes (COs):**

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

1. Able to understand the basic building blocks of an embedded system and describe the architecture and programming model of MSP430.(PO-1, 2 &PSO-1)
2. Able to analyze the working of Timer unit of MSP430 and apply the concept for various applications. .(PO-1, 2 &PSO-1)
3. Able to apply and concepts of Data conversion units in MSP430 for various applications. (PO-1, 2 &PSO-1)
4. Able to apply the serial communication protocols of MSP430. (PO-1, 2 &PSO-1)
5. Able to understand the various modalities used for wireless communication.(PO-1&PSO-1)

## LINEAR INTEGRATED CIRCUITS LABORATORY

**Course Code : MLL47** **Credit: 0:0:1**
**Prerequisite: Nil** **Contact Hours: 28**
**Course coordinators: Prof.P.G.Kumaravelu, Mrs.Chandana.S**

**List of Experiments:**

1. General Linear Applications of Op-Amp:
    a. Summing Amplifier
    b. Difference Amplifier
    c. Integrator
    d. Differentiator
2. Design and Implementation of Instrumentation Amplifier.
3. Design, Implementation and Analysis of 1st order Butterworth Active Low Pass Filter.
4. Design, Implementation and Analysis of 1st order Butterworth Active High Pass Filter.
5. Design, Implementation and Analysis of 1st order Butterworth Active Band Pass Filter.
6. Design, and Implementation of Notch Filter.
7. Design and Implementation of Schmitt Trigger.
8. Design and Implementation of Astable Multivibrator using Op-Amp.
9. Design and Implementation of Monostable Multivibrator using Op-Amp.
10. Design and Implementation of Astable Multivibrator using555 Timer.
11. Design and Implementation of Half wave and Full wave precision rectifier
12. Design and Implementation of 4- bit, R-2R ladder type DAC using Op-Amp

**Text Book(s):**


1. Ramakant A. Gayakwad"Op - Amps and Linear Integrated Circuits" – Pearson In, 4th Edition,2015
2. Roy Choudhury and Shail B. Jain D "Linear Integrated Circuits" - New Age International, 5th Edition, 2018.
3. B Somanath Nair "Linear Integrated Circuits- Analysis, Design & Applications", Wiely India Pvt. Ltd, 1st Edition, 2009.


**Course Outcomes (COs):**

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

1. Design OP-Amp circuits for various applications.(PO-1,3,9,10&PSO-1)
2. Demonstrate the practical skills of building circuits. .(PO-1,3,5,9,10&PSO-1,2)
3. Analyze the Outcomes both theoretically and practically.(PO-1, 3, 9, 1 &PSO-2)

## MICROCONTROLLER- MSP430 LABORATORY

**Course Code : MLL48** **Credit: 0:0:1**
**Prerequisite: Nil** **Contact Hours: 28**
**Course coordinators: Mrs.Prabhu Ravikala Vittal, Mrs.Uma Arun**

**List of Experiments:**

1. Interfacing and programming GPIO ports in C using MSP430 (blinking LEDs , push buttons).
2. Usage of Low Power Modes: Use MSPEXP430 as hardware platform and demonstrate the low power modes and measure the active mode and standby mode current.
3. Interrupt programming examples through GPIOs.
4. PWM generation using Timer on MSP430 GPIO.
5. Interfacing potentiometer with MSP430.
6. PWM based Speed Control of Motor controlled by potentiometer connected to MSP430 GPIO.
7. Interfacing MSP430 to terminal on PC and echo back the data using ULP advisor in Code Composer Studio.
8. Master Slave Communication between 2 MSP430s using SPI.
9. A basic Wi-Fi application – Communication between two MSP430 based sensor nodes
10. Enable Energy Trace modes in CCS for experiments [exp. 4-7]
11. Enable Energy Trace ++ modes in CCS for experiments [exp. 4-7]
12. Compute Total Energy, and Estimated life time of a battery

**Text Books:**


1. MSP430 Microcontrollers Basics, John H Devis, 1st Edition, Reed Elsevier India Pvt. Ltd 2017
2. MSP430 Microcontrollers in Embedded System Projects, C P Ravikumar, 1st Edition, Elite Publishing House, 2012
3. Analog and Digital Circuits for Electronic Control System Applications: Using the TI MSP430 Microcontroller, Jerry Luecke, 1st Edition, Elsevier Science, 2005.
4. User Manual MSP430FR5969.from TI.com


**Course outcomes (COs):**

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

1. Use the CCS software and use it to operate the MSP430FR5969 GPIO using basic I/O operation.(PO-1, 3, 4&PSO-1,2)
2. Demonstrate the PWM techniques for control the external device using MSP430F5969.(PO-1, 3,4,5&PSO-1,2)
3. Demonstrate the serial &wireless communication techniques using MSP430FR5969.(PO1,PO3,PO4,PSO1,PSO2)