Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Biomedical Engineering

(Applicable from the academic session 2018-2019)

SEMESTER-III

Name of the Course	**MATHEMATICS – III (PROBABILITY & STATISTICS)**
Course Code: BS-M301	**Semester: Third**
L-T-P-C: 3-0-0-3	**Contact: 3 hrs/week**
Objectives:	
1	To familiarize the students with probability and statistical methods.
2	To equip the students with standard concepts and tools at an intermediate to advanced level for tackling various problems in the discipline.
Pre-Requisite: Mathematics (10+2)	

M#	Content	Hrs
1	**Basic Probability:** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	12
2	**Continuous Probability Distributions:** Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.	4
3	**Bivariate Distributions:** Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.	4
4	**Basic Statistics: Measures of Central Tendency:** Moments, skewness and Kurtosis-Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression - Rank correlation.	8
5	**Applied Statistics:** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	**Small Samples:** Test for single mean, difference of means and correlation coefficients, test for ratio of variances-Chi-square test for goodness of fit and independence of attributes.	4

COURSE OUTCOMES

At the end of the course, students should able to:

1. Demonstrate the ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
2. Apply the concept of testing of hypothesis for small and large samples in real life problems.
3. Apply statistical methods for studying data samples.

4. Apply the basic concepts of classifications of design of experiments in the field of engineering and statistical quality control.
5. Demonstrate the basic ideas of statistics including measures of central tendency, correlation and regression.
6. Apply the notion of sampling distributions and statistical techniques for solving engineering and management problems.

Text/Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9^{th} Edition, John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
8. Chandrika Prasad & Reena Garg, Advanced Engineering Mathematics, Khanna Publishing House, 2018.

Name of the Course	**ANALOG ELECTRONIC CIRCUITS**
Course Code: ES-EC301	**Semester: Third**
L-T-P-C: 3-0-0-3	**Contact: 3 hrs/week**
Objectives:	
1	To understand the structure & properties of different components of Analog Electronics.
2	To learn different techniques to analyze Analog electronic circuit.
3	To learn application of different components of Analog electronics.
4	To understand principle and operation of different Analog electronic circuits.
5	To acquire problem solving skills of electronic circuits.
Pre-Requisite: Physics (10 +2)	

M#	Content	Hrs
1	**Semiconductors and Signal Amplifiers:** Overview of semiconductors, PN junction diode-structure, operation and V-I characteristics, Rectifiers, Zener diode, BJT amplifiers: CE, CB and CC amplifiers, Gain and frequency response, designing of BJT amplifier networks, structure and characteristics of FET and MOSFET, CMOS basic principles.	10
2	**Filters and Regulators:** Capacitor filter, π-section filter, ripple factor, series and shunt voltage regulator, percentage regulation, 78xx and 79xx series, concept of SMPS.	4
3	**Operational Amplifiers and Applications:** Ideal OPAMP, Differential Amplifier, Constant current source, level shifter, CMRR, Open & Closed loop circuits, inverting & non-inverting amplifiers, voltage follower, adder, subtractor, integrator & differentiator, comparator, Schmitt Trigger, V-I & I-V converter, instrumentation amplifier.	8
4	**Feedbacks and Oscillator Circuits:** Feedback Circuits: Concept of feedback, effect of negative feedback, feedback connection types, practical feedback circuits, designing of feedback amplifiers, Oscillators circuits: Oscillation principles, LC oscillators, RC oscillators, crystal oscillators, designing of oscillator circuits.	8
5	**Power Amplifiers and Tuned Amplifiers:** Class A, B, AB & C amplifiers, conversion efficiency, heat sink, designing of power amplifier circuits, tuned amplifier, synchronously tuned and impedance matching gain control.	6
6	**Waveform Generators and Switching Circuits:** Types of waveforms, transistor switching times, multivibrator, astable, monostable and bistable multivibrator, design of multivibrator.	4

COURSE OUTCOMES

At the end of the course, students should able to:

1. Demonstrate and apply working principle of different electronic circuit in real life.
2. Explain the operation and performance of semiconductor devices.
3. Choose correct electronic devices to solve problems.
4. Analyse the effectiveness of electronic circuit used in day to day life.
5. Evaluate the feedback circuits and frequency response of amplifier.

6. Design and conduct experiments using analog electronic circuits to function as switch, regulator, clippers, clampers, oscillators, power amplifiers.

Text/ Reference Books:

1. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Prentice Hall, Sixth edition, 2009.
2. A.K. Maini, Analog Electronics, Khanna Publishing House, New Delhi 2018.
3. Franco-Design with Operational Amplifiers & Analog Int. Circuits,3/e,MGH.
4. Boylested & Nashelsky- Electronic Devices and Circuit Theory- Pearson/PHI
5. Millman & Halkias – Integrated Electronics, McGraw Hill.
6. Rashid-Microelectronic Circuits-Analysis and Design- Thomson.
7. Schilling & Belove—Electronic Circuit:Discrete & Integrated , 3/e , McGraw Hill
8. Razavi- Fundamentals of Microelectronic s- Wiley
9. Malvino—Electronic Principles , 6/e , McGraw Hill
10. Horowitz & Hill- The Art of Electronics; Cambridge University Press.
11. Bell- Operational Amplifiers and Linear ICs- Oxford UP
12. Tobey & Grame – Operational Amplifier: Design and Applications, Mc GrawHill.
13. Gayakwad R.A -- OpAmps and Linear IC's, PHI
14. L.K. Maheshwari, Analog Electronics, Laxmi Publications.

Name of the Course		**SIGNALS AND SYSTEMS IN BIOMEDICAL ENGINEERING**
Course Code: PC-BME301		**Semester: Third**
L-T-P-C: 3-0-0-3		**Contact: 3 hrs/week**
Objectives:		
1	To understand the basic properties of signal & systems in everyday life.	
2	To gain knowledge about various signal acquisition, analysis and feedback control mechanism.	
3	To familiarize with techniques suitable for analyzing and synthesizing both continuous-time and discrete time signals & systems.	
4	To develop the fundamental basis of signals and systems for biomedical engineering along with characterization and understanding of bio-signals & physiological systems.	
Pre-Requisite: Mathematics-IB (BS-M102) & Mathematics-IIB (BS-M202), Biophysics		

M#	Content	Hrs
1	**Classification of Signals and Systems** Signals and systems in everyday life, standard signals: step, ramp, impulse, exponential and sinusoids; Continuous Time (CT) and Discrete Time (DT) signals, Periodic and Aperiodic signals, Deterministic and Random signals, Energy and Power signals, Transformation in independent variable of signals: time scaling, time shifting and time inverting, LTI systems-convolution and stability, physiological signals and their properties, Time invariant and time varying physiological systems.	7
2	**Analysis of Time Signals** Laplace transform in analysis of continuous systems, Basic concepts and development of the Fourier Series, Determination of the Fourier series representation of Continuous and Discrete time periodic signal, Properties of continuous and discrete time Fourier series, Continuous Time Fourier Transform (CTFT) and Discrete Time Fourier Transform (DTFT), ECG signal analysis.	8
3	**Sampling Theorem and Z-Transforms** Representation of continuous time signals by its sample, Sampling theorem and its implications, Reconstruction of a Signal from its samples, aliasing, Basic principles of z-transform, z-transform definition, Properties of z-transform, Poles and Zeros, inverse z-transform.	8
4	**Noise and Feed Back System** Sources and types of noise, noise factor and temperature, equivalent noise resistance and noise factor in cascade amplifier, Basic Feedback concept, Positive and Negative Feedback, Sensitivity analysis, Distortion analysis by Feed Back, Control system, Open loop Control System, Control system with Feed Back, Application of feed back in physiological systems and its importance.	8
5	**Filtering Techniques** Types of filter (Active and Passive), General idea of L.P.F, H.P.F, B.P.F and N.F. First order Passive Filters (L.P, H.P, B.P & N.F), First order active filter (L.P, H.P, B.P & N.F), use of filter for biomedical signal analysis, design of	5

	filter suitable for Bio-medical signal analysis.	
6	**Application of Mathematical Transfer Function in Physiological System**: Cardiovascular System: Block diagram representation of cardio vascular system, Electrical circuit model of Blood Pressure, Electrical analog of blood vessels and its transfer function, model of coronary circulation ant its analysis. Immune response: system equation and transfer function of Germ, Plasma cell & Antibody.	4

COURSE OUTCOMES

At the end of the course, students should able to:

1. Analyze different types of signals and systems in everyday life.
2. Represent continuous and discrete systems in time and frequency domain using different transforms.
3. Describe and classify physiological signals and develop system for different signals.
4. Analyze and characterize physiological signals and systems.
5. Illustrate and explain the mode of operation of filtering techniques especially for physiological signals.
6. Proposed and solve engineering problems using transform techniques.

Text/ Reference Books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.
6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons,1995.
8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
9. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
10. Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.
11. Rishabh Anand, Signals and Systems, Khanna Publishing House, New Delhi

Name of the Course	**ENGINEERING PHYSIOLOGY & ANATOMY**
Course Code: PC-BME302	**Semester: Third**
L-T-P-C: 3-0-0-3	**Contact: 3 hrs/week**
Objectives:	
1	To understand structure and functions of the various organs of human body.
2	To understand structure-function relationship of physiological systems.
3	To develop knowledge of anatomical features and physiology of human system in order to make measurement and interpret data of physiological processes in living systems.
Pre-Requisite: Biology (10 +2)	

M#	Content	Hrs
1	**Cell, Tissue & Blood:** Structure of cell and functions of sub organelles, cell membrane, membrane receptors, cell-to-cell signaling, cell division, types of specialized tissues and functions, blood cells and functions, haemoglobin, plasma proteins, hematocrit, ESR, blood coagulation and factors, bleeding and clotting time, blood groups.	6
2	**Skeletal & Muscular System:** Structure of bone and function, anatomy of long bone, bone marrow, growth and repair, types of joints and function, types of muscles, microscopic structure of skeletal muscle, salient properties of muscles, muscles as energy transducer, muscle contraction-sliding filament theory.	6
3	**Nervous, Endocrine, Lymphatic & Immune System:** Structure and functions of neuron, synapse and impulse propagation, motor unit-neuromuscular junction, brain, spinal cord, reflex mechanism, classification of nerves, autonomic nervous system and functions, pituitary and thyroid glands, parts and functions of lymphatic system, lymphatic organs and vessels, component of immune system, immune response & physiological regulation.	8
4	**Cardiovascular & Respiratory Systems:** Structure of heart and role as pump, circulation types, heart valves, special junctional tissues, ECG, heart sounds, cardiac output, cardiac cycles, blood pressure, types of blood vessels, regulation of heart beat and blood pressure, diseases in cardiovascular systems, parts of respiratory system, types of respiration, mechanism of breathing, respiratory membrane and gaseous exchange, regulation of respiration, volumes and capacities of lung, types of hypoxia.	10
5	**Digestive & Excretory System:** Organization of GI System, digestion and absorption, stomach, intestine, liver, pancreas, structure of kidney and nephron, mechanism of urine formation, micturition, skin and sweat gland, temperature regulation.	6
6	**Vision, Auditory & Reproductive System:** Structure of eye, refractive medias of the eye, formation of image on the retina, physiology of middle and internal ear, auditory pathway, mechanism of hearing, male and female reproductive system, androgens, oestrogens and progresterone.	4

COURSE OUTCOMES

At the end of the course, students should able to:

1. Describe the structure and function of various organs of physiological systems.
2. Explain interconnection of various systems and mechanism of communication and integration.
3. Develop and apply critical reasoning skills in human physiology and anatomy.
4. Analyze and interpret the structural and functional aspects of living organisms.
5. Comprehend the probable causes of anomaly in organs and systems in human body and assess the situation technically.
6. Build knowledge to aid diagnosis and to simulate engineering systems.

Text/ Reference Books:

1. Essential of Medical Physiology, Anil Baran Singha Mahapatra, Current Books International
2. Huamn Physiology - C.C.Chatterjee, Medical Allied Agency
3. Essential of Human Anatomy and Physiology, Elaine.N. Marieb Eight Edition, Pearson Education, New Delhi
4. Anatomy and Physiology – Ross & Wilson, Churchill Livigstone publications.
5. Modern Physiology & Anatomy for Nurses - J Gibson, Black-well Scientific Publishers
6. Medical Physiology, Guyton & Hall, 13th Edition, Elsevier Saunders
7. Concise Medical Physiology-by Sujit K. Chaudhuri, 5th Edition, New Central Book Agency Pvt.Ltd.
8. Review of Medical Physiology, 22nd Edition, William F.Ganong, Mc Graw Hill, New Delhi

Name of the Course	**BIOPHYSICS & BIOCHEMISTRY**
Course Code: PC-BME303	**Semester: Third**
L-T-P-C: 3-0-0-3	**Contact: 3 hrs/week**
Objectives:	
1	To study and understand the biophysical phenomena/activities using physical principles.
2	To develop knowledge of the fundamental concepts in physics and chemistry that underlies biological processes.
3	To study structural and functional properties of carbohydrates, proteins, lipids and nucleic acids
4	To emphasize the role of biomolecules in providing basic information on specific metabolic process and disorders.
Pre-Requisite: Biology (10 +2)	

M#	Content	Hrs
1	**Biophysical Processes:** Diffusion, facilitated diffusion, active transport, phagocytosis and pinocytosis, absorption, reabsorption, osmosis, dialysis, ultrafiltration, ultracentrifugation, cellular fractionation, electrophoresis, plasmapherosis, radioimmunoassay.	4
2	**Biophysics of Membrane and Hemodynamics:** Microscopic structure & composition of cell membrane, Donnan membrane equilibrium, membrane potential, action potential, membrane permeability and transport, ion channel, electrical properties of excitable membranes, capacitance, resistance, conductance and dielectric properties of membrane, equivalent electrical circuit for membrane, biophysical properties of plasma, viscosity of blood, rheological properties of blood, laminar blood flow, turbulent blood flow and Reynold's number, vascular resistance.	9
3	**Biophysical Activities:** Biological rhythm and its significance, origin, nature and types of biosignals, stimuli, receptor potential, strength-duration relationship, skin impedance, total body impedance, patient safety, electrical shock and hazards, leakage current, ECG, EEG, EMG and EOG wave forms.	7
4	**Introduction to Biochemistry:** Chemical bonds, bio-fluids, electrolytes, weak acid and bases, pH, buffers, physiological buffers in living systems, Energy in living organism.	2
5	**Carbohydrates, Lipids & Enzymes:** Classification of carbohydrates, glycolysis, glycogenesis, TCA cycle, oxidative phosphorylation, Diabetes Mellitus and glycogen storage diseases, classification and functions of lipids, synthesis and degeneration of fatty acids, biosynthesis of cholesterol, disorders of lipid metabolism, chemical nature and classification of enzymes, M-M-Kinetics, Isozymes and Allosteric enzymes, measurement of enzyme activity and isolation techniques.	10
6	**Nucleic Acids and Proteins:** Structure of DNA, Genetic code, structure of RNA and its types, DNA replication, transcription & translation, Recombinant DNA, Structure and properties of proteins, protein biosynthesis, classification of amino acids, protein metabolism, urea cycle, separation of proteins.	8

COURSE OUTCOMES

At the end of the course, students should able to:

1. Demonstrate the consequence of different biophysical and biochemical processes.
2. Explain the biopotential and source of biosignals.
3. Make use of stimuli and experiments with biological signals.
4. Categorize the major biomolecules and infer their structure function relationships.
5. Describe the synthesis of macromolecules and their role in metabolic pathways along with their regulation.
6. Apply and evaluate the analytical techniques used in molecular biology.

Text/ Reference Books:

1. Bio-Physics – Roland Glaser- Springer; 2nd printing edition (November 23, 2004)
2. The Biomedical Engineering Hand Book 3rd Ed (Biomedical Engineering Fundamentals)- Joseph D. Bronzino, CRC, Tylor Francis–2006 (Section-III–Bio-Electrical Phenomena)
3. Lehninger Principles of Biochemistry, Edition 5 - by David L. Nelson & Michael M.Cox , - W. H. Freeman; 2008.
4. Text book of Medical Physiology- Guyton
5. Jain, J L, Jain, Nitin, Sunjay Jain, "*Fundamentals of Biochemistry*," S. Chand Group, ISBN: 8121924537
6. Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, "*Biochemistry*," Edition 7, W. H. Freeman, 2012
7. Fundamentals of Biochemistry: Life at the Molecular Level - by Donald J. Voet , Judith G. Voet & Charlotte W. Pratt. – Wiley
8. Robert Weaver, "*Molecular Biology*", MCGraw-Hill, 5th edition, 2012.
9. Outlines of Biochemistry,Conn, E.E; Stumpf, P.K; Bruening,G; Doi, R.H., John Wiley & Sons
10. Principles of Biochemistry (V Ed., By Nelson, D. L.; and Cox, M. M.W.H. Freeman & Co.
11. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
12. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Name of the Course	**TECHNICAL ENGLISH**
Course Code: HM-HU301	**Semester: Third**
L-T-P-C: 2-0-0-2	**Contact: 2 hrs/week**
Objectives:	
1	To gain familiarity with learning approaches connected to successful writing.
2	To foster the ability to write convincing job applications and effective reports.
3	To develop the speaking skills to make technical presentations and participate in group discussions.
Pre-Requisite: English (10+2), English (HM-HU201)	

M#	Content	Hrs
1	**Technical Writing, Grammar and Editing:** Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.	9
2	**Self-Development and Assessment:** Self-assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity.	8
3	**Communication and Technical Writing:** Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.	9

COURSE OUTCOMES

At the end of the course, students should able to:

1. Demonstrate the ability to read and comprehend engineering and technology texts.
2. Develop speaking skills to make technical presentation and participate in group discussion.
3. Express and exchange ideas effectively through various modes of communication.
4. Analyze content to identify main and subordinate ideas, distinguish various modes of argument and outline methods of development.
5. Evaluate technical reports and judge its authenticity.
6. Formulate strategies for persuasive arguments and tools for success.

Text/Reference Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.

4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
5. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi
6. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
7. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
8. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

PRACTICAL

Name of the Course	**ANALOG ELECTRONIC CIRCUITS LABORATORY**
Course Code: ES-EC391	**Semester: Third**
L-T-P-C: 0-0-2-1	**Contact: 2 hrs/week**
Objectives:	
1	To understand application of p-n junction Diode, Zener diode , Rectifier etc
2	To analyze the performance of multistage amplifier and power amplifier.
3	To study and analyze the performance of multivibrators.
4	To impart technical skills to construct and analyze transistor amplifiers & to understand application of OP AMP

LIST OF EXPERIMENTS:

1. Study of Diode as clipper & clamper.
2. Study of Zener diode as a voltage regulator.
3. Study of ripple and regulation characteristics of full wave rectifier without and with capacitor filter.
4. Study of characteristics curves of BJT & FET.
5. Construction of R-C coupled amplifier & study the gain and Bandwidth.
6. Study of class A & class B power amplifiers.
7. Study of class C & Push-Pull amplifiers.
8. Realization of current mirror & level shifter circuit using Operational Amplifiers.
9. Construction & study of astable multivibrator using NE 555.
10. Construction & study of monostable & Bistable multivibrator using NE 555.
11. Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.
12. Mandatory Design and Implementation of Mini Project.

COURSE OUTCOMES

At the end of the course, students should able to:

1. Choose electronic components to construct circuits for tailor made applications.
2. Conduct experiments and verify the results practically.
3. Assess and recommend an application device of their interest.
4. Design and test fundamental analog electronic circuits.

Name of the Course	**SIGNAL ANALYSIS LABORATORY**
Course Code: PC-BME391	**Semester: Third**
L-T-P-C: 0-0-2-1	**Contact: 2 hrs/week**
Objectives:	
1	To impart the fundamental knowledge and application of versatile types of signals in experimental point of view.
2	To gain clear knowledge about tools and techniques in signal processing and analyzing with firm understanding of physiological signals and systems.

LIST OF EXPERIMENTS:

1. Familiarization with MATLAB and generation of various types of waveforms (sine, cosine, square, triangular etc.).
2. Generation of different functions (unit impulse, unit step, RAMP, etc.)
3. Find out the signal energy and power
4. Analysis CTFT & DTFT
5. Study Z- transform of: a) Sinusoidal signals b) Step functions.
6. Compare Fourier and Laplace transformations of a signal.
7. Study sampling theorem for low pass signals and band pass signals.
8. Determine the components of: a) Square wave b) Clipped sine wave.
9. Generation of various types of noise (uniform white, Gaussian, coloured, etc.).
10. Study LPF &HPF, band pass and reject filters using RC circuits
11. ECG signal analysis / Equivalent electrical circuit analysis of blood vessels.
12. Mandatory Design and Implementation of Mini Project.

Note: An Institution/College may opt for some other software or hardware simulation wherever possible in place of MATLAB.

COURSE OUTCOMES

At the end of the course, students should able to:

1. Identify and select appropriate software tools for analyzing various signals.
2. Evaluate signal using mathematical transfer function.
3. Generate various types of signal and noise waveforms.
4. Analyze versatile biosignals and interpret the result clinically.

Name of the Course	**PHYSIOLOGY & BIOCHEMISTRY LABORATORY**
Course Code: PC-BME392	**Semester: Third**
L-T-P-C: 0-0-2-1	**Contact: 2 hrs/week**
Objectives:	
1	To understand the gross and microscopic approach to Anatomy & Physiology.
2	To quantify blood cells and identification of blood groups.
3	To estimate haematological parameters and measurement of pH, conductivity & viscosity of blood.
4	To estimate biomolecules and interpret the physiological parameter.

LIST OF EXPERIMENTS:

1. Identification and enumeration of various histological slides
2. Blood film making and identification of different blood corpuscles.
3. Measurement of total count for RBC & WBC & differential count for WBC.
4. Determination of ESR, BT, CT
5. Determination of Blood Group (ABO; Rh).
6. Estimation of Hemoglobin
7. Determination of blood pressure
8. Measurement of pH, and conductivity of body fluid.
9. Measurement of viscosity of Blood
10. Recording and analysis of ECG, EMG, EEG
11. Quantitative estimation of glucose (spectrophotometer / colorimeter)
12. Quantitative estimation of proteins (spectrophotometer / colorimeter)

COURSE OUTCOMES

At the end of the course, students should able to:

1. Identify and select appropriate tools for measurement of physiological and biochemical parameters.
2. Conduct experiments and analyze the outputs practically.
3. Evaluate the compatibility for any clinical measurements.
4. Propose analytical methods and plan for quantitative measurement.

Name of the Course		**INTERPERSONAL SKILL & REPORT WRITING [SESSIONAL]**
Course Code: HM-HU381		**Semester: Third**
L-T-P-C: 0-0-2-1		**Contact: 2 hrs/week**
Objectives:		
1	To inculcate a sense of confidence in the students.	
2	To help them to become a good communicators both socially and professionally.	
3	To assist them to enhance their power of Technical Communication.	
Pre-Requisite: English (10+2), English (HM-HU201)		

Detailed Course Outlines:

A. *Technical Report Writing*:
Report Types (Organizational / Commercial / Business / Project)
Report Format & Organization of Writing Materials
Report Writing (Practice Sessions & Workshops)

B. L*anguage Laboratory Practice*

1. *Introductory Lecture to help the students get a clear idea of Technical Communication & the need of Language Laboratory Practice Sessions*
2. *Conversation Practice Sessions: (To be done as real life interactions)*
   Training the students by using Language Lab Device/Recommended Texts/cassettes /cd's to get their Listening Skill & Speaking Skill honed
   Introducing Role Play & honing over all Communicative Competence
3. *Group Discussion Sessions:*
   Teaching Strategies of Group Discussion
   Introducing Different Models & Topics of Group Discussion
   Exploring Live /Recorded GD Sessions for mending students' attitude/approach & for taking remedial measure
4. *Interview Sessions:*
   Training students to face Job Interviews confidently and successfully
   Arranging Mock Interviews and Practice Sessions for integrating Listening Skill with Speaking Skill in a formal situation for effective communication.
5. *Presentation:*
   Teaching Presentation as a skill
   Strategies and Standard Practices of Individual /Group Presentation
   Media & Means of Presentation: OHP/POWER POINT/ Other Audio-Visual Aids.
6. *Competitive Examination:*
   Making the students aware of Provincial /National/International Competitive Examinations
   Strategies/Tactics for success in Competitive Examinations
   SWOT Analysis and its Application in fixing Target

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

1. Develop listening, speaking, reading and writing skills.
2. Develop self-confidence and able to reach corporate expectations.
3. Answer questions successfully in interviews and take international examination.

4. Develop interpersonal skills on current problems and events.
5. Make presentations and participate in Group Discussions.
6. Produce well versed technical report in recognized format.

Books/Reference– Recommended:

Nira Konar: English Language Laboratory: A Comprehensive Manual, PHI Learning, 2011

Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi, 2019

Sudharani: Advanced Manual for Communication Laboratories & Technical Report Writing Pearson Education (W.B. edition), 2011:

Adrian Duff et. al. (ed.): Cambridge Skills for Fluency

A) Speaking (Levels 1-4 Audio Cassettes/Handbooks)
B) Listening (Levels 1-4 Audio Cassettes/Handbooks)

Cambridge University Press 1998 Mark Hancock: English Pronunciation in Use
4 Audio Cassettes/CD'S OUP 2004