



Vishwavidyanilaya Karyasoudha
Crawford Hall, Mysore 570 005

(Re-accredited by NAAC at "A" Grade with a CGPA of 3.47)
(NIRF-2020 Ranked 27 in University Category & 47 in Overall Category)

No.: PMEB/AC10/759(3)/2019-20

Date:28-01-2021

NOTIFICATION

Sub.: Introduction of new courses under Specialized Programmes from the academic year 2020-21-reg.

Ref.: 1. Decision of the BOS Meeting held on 25-11-2020.
2. Decision of the Academic Council meeting held on 07-12-2020.

The Board of Studies in **B.Sc. (Hon's) (Advanced Agriculture)**, **B.Sc. (Biomedical Science)**, **B.Sc. (Artificial Intelligence & Data Analytics) (UG)** at its meeting held on 25-11-2020 has recommended to introduce **B.Sc. (Hons.) (Advanced Agriculture)**, **B.Sc. (Biomedical Science)**, **B.Sc. (Artificial Intelligence & Data Analytics)** courses in University of Mysore under specialized/specified programs. The Regulations, Syllabus and Scheme of Examination was approved from the academic year 2020-21.

The Academic Council has also approved the above said proposals at its meeting held on 07-12-2020 and the same is hereby notified.

The Regulations, Syllabus and Scheme of Examination of **B.Sc. (Hons.) (Advanced Agriculture)**, **B.Sc. (Biomedical Science)**, **B.Sc. (Artificial Intelligence & Data Analytics)** courses is uploaded in University website. The contents may be downloaded from the University website www.uni-mysore.ac.in.

To;

1. The Registrar (Evaluation), University of Mysore, Mysuru.
2. The Dean, Faculty of Science & Technology, DOS in Psychology, MGM.
3. Prof. Suresha, DOS in Computer Science, Manasagangotri, Mysuru.
4. Prof. K. Kemparaju, DOS in Bio-chemistry, Manasagangotri, Mysuru.
5. Prof. K.N. Amruthesh, DOS in Botany, Manasagangotri, Mysuru.
6. The Secretary, Fortuna Advanced Institute of Research & Studies(FAIR), Devinagar, 1st Main Road, Deveerammanahalli, Najanagud Taluk, Mysuru Dist.
7. The Deputy Registrar/ Asst. Registrar/ Superintendent, Examination Branch, UOM, Mysuru.
8. The Special Officer to Hon'ble Vice-Chancellor, University of Mysore, Mysuru.
9. The PA to Vice-Chancellor/Registrar/Registrar(Evaluation), University of Mysore, Mysuru.
10. Office Copy.


REGISTRAR
REGISTRAR
University of Mysore
MYSURU - 570 005

SYLLABUS – B.Sc. (BIOMEDICAL SCIENCE)

Academic Regulations for Specialized Programme

in

B. Sc. (Biomedical Science)



Recognized By

UNIVERSITY OF MYSORE
MANASAGANGOTHRI, MYSORE



OFFERED AT

FORTUNA ADVANCED INSTITUTE OF RESEARCH AND STUDIES (FAIR)
2707 / 3& 4, Devi Nagara, 1st Main Road, Deveerammanahalli, Mysore-Ooty Road
Nanjanagud – 571301, Mysore District

2020-21

SYLLABUS – B.Sc. (BIOMEDICAL SCIENCE)

Fortuna Advanced Institute of Research & Studies (FAIR)

**REGULATIONS &
SYLLABUS FOR
B.Sc. [Biomedical Science]
2020-21 ONWARDS**

RULES & REGULATIONS OF THE COURSE

1. Course title:

The program shall be called as **B.Sc. [Biomedical Science]**.

B.Sc. (BIOMEDICAL SCIENCE).

Candidates who have successfully passed Class XII (2nd PUC) or 10+2 examination conducted by Pre-University Board or equivalent with Mathematics / Physics/ Chemistry /Computer Science / Electronics as one of the optional subjects.

2. Eligibility, mode of selection

- a. A candidate who has passed 10 + 2 in science stream from a recognized board with overall 40% marks is eligible for admission to the program. Selection will be on the basis of merit.
- b. The lateral entry students who has passed diploma in Electrical Sciences (Computer Science / Electronics / Electrical/ Instrumentation) or equivalent with overall 45% marks is eligible for admission to the programme.
- c. There shall be a total intake of 40 candidates.

3. Course content:

The course of study for the B.Sc. (Biomedical Science) comprises subjects, internship project work as prescribed. The academic calendar shall be as notified by the university from time to time. Pedagogy includes PowerPoint Presentation, Lecturing, Case studies, group discussion, seminar, practical.

4. Medium of instruction: -English.

5. Attendance, progress and conduct

- Each semester shall be taken as a unit for the purpose of calculating attendance.
- The students shall attend practical and theory classes as prescribed by the University during each semester.

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- Minimum attendance of 75% of actual working hours is required in each paper, a student who doesn't satisfy the requirement of attendance shall not be permitted to write the examination in concern subject
- If the conduct/behavior of the student is not found to be satisfactory, action will be initiated as per the University regulations.
- A candidate can take a maximum of three years for completion as per double the duration norms of University of Mysore.

6. Formation of Board of Examiners

- Chairman Board of Studies shall form Board of Examiners members consisting of Principal Partnership Institution, Head of the Concerned Department, Subject Faculties and University Representatives. The duties of Board of Examiners include setting question papers, conducting the examinations, valuation of answer scripts and submitting the marks list to University for result announcement.
- **Question paper:** Three sets of question papers shall be submitted by the subject faculty one month in advance both in hard and soft copies.
- **Valuation:** Valuation will be conducted by respective subject experts selected by BOE.

7. Scheme of examination

- There shall be a University examination at the end of each semester.
- There shall be a term end examination of 3 hrs duration for each theory subject
- Repeaters has to take exam during respective semesters
- **Question paper:** 3 sets for each subject shall be set by faculty as per the panel of examiners approved by university prior to one month of exam, both in hard and soft copy.
- **Valuation:** valuation will be done by respective subject experts selected by BOE
- Each subject is divided into internal assessment and end term exam with marks allotted as shown below

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a) Total Marks -Theory papers 100 marks

- i. External examination: 70 marks
- ii. Continues Assessment 30 marks

(Continues Assessment Includes test, Presentation, Assignments)

Continues Assessment (1st to 8th week) 15 marks

Continues Assessment (9th to 16th week) 15 marks

- Each student has to score minimum of 40% in each papers.

b) Total marks –Project Work papers 100 marks

- i. External examination: 70 marks
- ii. Continues Assessment 30 marks

(Continues Assessment Includes Test, Presentation, Assignments and Portfolios)

Continues Assessment (1st to 8th week) 15 marks

Continues Assessment (9th to 16th week) 15 marks

- Each student has to score minimum of 40% in each papers.

c) Project work

- Project report (portfolio) completed during the semester will be evaluated, as follows
100 marks for project CA (portfolio) by internal guide, 100 marks for exam conducted by internal and external examiner appointed by BOE chairperson.

8. Declaration of results:

- The results and grades of the B.Sc (BIOMEDICAL SCIENCE) shall be declared as per the regulations of the Choice Based Credit System - Undergraduate courses of University .

SYLLABUS – B.Sc. (BIOMEDICAL SCIENCE)

VISION:

To coherently work with medical professionals in providing effective and affordable healthcare

MISSION:

M1: To produce Biomedical engineering graduates who can understand and apply basic engineering principles to solve the problems of the medical field.

M2: To develop Biomedical engineers to conceive innovative strategies for designing and developing medical equipment, implants, and other devices of immense use to the society.

PROGRAM EDUCATIONAL OBJECTIVES:

PEO1	Exhibit strong skills in problem solving, leadership, teamwork and enterprise management.
PEO2	Be able to effectively communicate with healthcare professionals to know their problems and provide effective solutions.
PEO3	Use the skills to contribute to the scientific and engineering needs of the society in general and the Biomedical field in particular.
PEO4	Pursue research degrees and practice technical competency as professionals in Biomedical Engineering or allied fields.
PEO5	Sustain professional development in their fields and advance to positions of greater responsibility with life-long learning.

B.E. PROGRAM OUTCOMES/PROGRAM SPECIFIC OUTCOMES

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.

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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	Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
PS01	To interact with health care professionals and medical R&D institutions in solving their problems
PS02	To indigenize medical products through start-ups so as to provide affordable health care.

SYLLABUS – B.Sc. (BIOMEDICAL SCIENCE)

Subject : Biomedical Science

Degree: B.Sc.

Choice Based Credit System (CBCS) Scheme 2020-21

Semester	Subject Code	Subjects	L	T	P	Total Credits
I	DSC 1	Fundamentals of Mathematics	6	0	0	6
	DSC 2	Bioorganic Chemistry	4	0	2	6
	DSC 3	Fundamentals of Cell Biology	4	2	0	6
	AECC - A1	Basic Communication Skill (English)	3	1	2	6
TOTAL CREDITS			17	3	4	24
II	DSC 4	Human Anatomy and Physiology	4	2	0	6
	DSC 5	Analog Electronics Circuits	4	0	2	6
	DSC 6	Scientific and Analytical Instrumentation	4	0	2	6
	AECC- A2	Nudi/Kali Kannada	3	1	2	6
TOTAL CREDITS			11	3	6	24
III	DSC 7	Fundamentals of Signals & DSP	4	0	2	6
	DSC 8	Clinical Instrumentation – I	4	0	2	6
	DSC 9	Biomedical Equipments	4	2	0	6
	AECC- A3	Rehabilitation Technology	4	2	0	6
TOTAL CREDITS			16	2	6	24

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IV	DSC 10	Principles of Genetics	4	2	0	6
	DSC 11	Biomedical Digital Signal Processing	4	0	2	6
	DSC 12	Clinical Instrumentation – II	4	0	2	6
	AECC-A4	Medical Microbiology	4	2	0	6
TOTAL CREDITS			16	4	4	24
V	DSC 13	Biomaterials and Artificial Organs	4	2	0	6
	DSE 14	Elective – I - Virtual Bio-Instrumentation Elective – II - Medical Informatics	4	0	2	6
	DSE 15	Elective – I - Database Management System in Healthcare Elective – II – Bio-MEMs Technology	4	2	0	6
	AECC - A5	Computational Biology and Drug Design	4	2	0	6
TOTAL CREDITS			16	6	2	24
VI	DSC 14	Medical Image Processing	4	2	2	8
	DSC 15	Hospital Design, Planning and Management	4	2	0	6
	DSE 16	Main Project - Work	0	0	8	8
TOTAL CREDITS			8	4	8	22

TOTAL CREDITS FOR THE COURSE: 146

Core Courses (Theory + Practical*)

Semester I

DSC 1: Fundamentals of Mathematics (L:T:P::6:0:0) 6 Credits

UNIT:1 Differential Calculus -1

Determination of nth order derivatives of Standard functions - Problems. Leibnitz's theorem (without proof) - problems. Polar Curves - angle between the radius vector and tangent, angle between two curves, Pedal equation of polar curves. Derivative of arc length - Cartesian, Parametric and Polar forms (without proof) - problems. Curvature and Radius of Curvature – Cartesian, Parametric, Polar and Pedal forms (without proof) –problems

UNIT:2 Differential Calculus -2

Taylor's and Maclaurin's theorems for function of one variable (statement only) - problems. Evaluation of Indeterminate forms. Partial derivatives – Definition and simple problems, Euler's theorem(without proof) – problems, total derivatives, partial differentiation of composite functions-problems. Definition and evaluation of Jacobians.

UNIT:3 Linear Algebra

Rank of a matrix by elementary transformations, solution of system of linear equations - Gauss-elimination method, Gauss –Jordan method and Gauss-Seidel method Eigen values and Eigen vectors, Rayleigh's power method to find the largest Eigen value and the corresponding Eigen vector.

UNIT:4 Differential Equations

Solution of first order and first degree differential equations – Exact, reducible to exact and Bernoulli's differential equations .Orthogonal trajectories in Cartesian and polar form.Simple problems on Newton's law of cooling.

TEXTBOOKS :

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013.
2. Erwin Kreyszig, "Advanced Engineering Mathematics I, Wiley, 2013

DSC 2: Bio-Organic Chemistry (LTP:: 4:0:2) 6 Credits

UNIT:1 INTRODUCTION TO BIO-ORGANIC CHEMISTRY

Overview of Bioorganic Chemistry- Historical Connection between Organic and Biological Chemistry, Weak Interactions in Organic and Biological World, Proximity Effect in Organic Chemistry, Molecular Recognition.

UNIT:2 INTRODUCTION TO BIOMOLECULES

(i) Carbohydrates - Monosaccharides- cyclization of aldoses and ketoses, conformations, concept of mutarotation, anomers, epimers, derivatives-sugar phosphate, sugar alcohol, sugar acids, deoxy and amino sugars, ascorbic acid (examples from biomolecules). (ii) Lipids Fatty acids, triacylglycerols, glycerophospholipids, sphingolipids, steroids (cholesterol and its derivatives). (iii) Amino Acids - Structure and classification of amino acids, ionization, chemistry of peptide bond, non-ribosomal peptide bond formation, essential and non-essential amino acids (iv) Nucleotide - Sugars and Bases, conformation of sugar phosphate backbone, hydrogen bonding by bases, Types of DNA (A, B and Z DNA) (v) Enzymes - Introduction to enzyme, concept of lock and key and induced fit theory, concept of activation energy and binding energy. Enzyme kinetics, the Michaelis-Menten equation and its physiological significances.

UNIT:3 BIOORGANIC CHEMISTRY OF ENZYMES

Introduction to Enzyme Catalysis and Kinetics; The Catalytic Triad, Enzyme Inhibitor and Drug design, Enzyme in Organic Chemistry; Antibody Catalyzed Organic Reaction, Enzyme Models, Biomimetic Polyene Cyclisation, Squalene Biosynthesis.

UNIT:4 BIOORGANIC CHEMISTRY OF NUCLEIC ACIDS

History, Sugars and bases; Conformation of sugar-phosphate backbone; hydrogen bonding by bases; the double helix; A, B, and Z double helices; Stability of Double Helix ; DNA intercalators; Chemical synthesis of DNA; Catalytic RNA, siRNA; micro RNA; Expanding the Genetic Alphabets: Background; Synthesis and Application of Unnatural Nucleosides.

Practical Experiments:

1. Experiment 1: Esterification reaction: Synthesis of n-butyl acetate
2. Experiment 2: Esterification reaction: Preparation of amino acids (Study Analysis)
3. Experiment 3: Synthesis of benzoic acid and benzyl alcohol
4. Experiment 4: Nitration of phenol

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TEXTBOOKS :

1. Concise Inorganic Chemistry, 5th edition (1999), J. D. Lee; Wiley-Blackwell, ISBN-13:9780632052936.
2. Organic Chemistry, 6th edition (1996), I L Finar; ELBS, Longman Higher Education. ISBN13: 978-0582305601.
3. Lehninger: Principles of Biochemistry, 5th edition (2008), David L. Nelson and Michael M. Cox; Prentice Hall Publishers, ISBN-13: 978-0321707338
4. Biochemistry, 4th edition (2003), Campbell, M. K. and Farrel, S. O.;Brooks/Cole, Cengage Learning (Boston), ISBN: 0030348498.

DSC 3: Fundamentals of Cell Biology (LTP:: 4:2:0) 6 Credits

UNIT:1 The Cell

Historical background, significant landmarks, cell theory, structure of prokaryotic and eukaryotic cells, mycoplasma, viruses, viroids, prions.

UNIT:2 Cell Fractionation

Centrifugation: types of centrifuges, principle and different types of centrifugation- differential, density gradient and equilibrium.

UNIT:3 Cell Membrane

Functions, different models of membrane structure, types of membrane lipids, membrane proteins: types, methods to study membrane proteins (detergents, RBC ghosts), RBC membrane as a model, membrane carbohydrates, membrane asymmetry and fluidity.

UNIT:4 Membrane Transport

Transport of small molecules: Passive transport (simple diffusion and facilitated diffusion) and active transport and their types (P, V, F and ABC transporter) with example of Na⁺ /K⁺ pump. Transport of macromolecules: Endocytosis (pinocytosis, phagocytosis), exocytosis.

TEXTBOOKS :

1. The Cell: A Molecular Approach, 5th edition (2009), Cooper and Hausman. Sinauer Associates, Inc. ISBN-13: 978-0878933976.
2. Cell and Molecular Biology: Concepts and Experiments, 6th edition (2009), Gerald Karp, Wiley. ISBN-978-0470483374.
3. Physical Biochemistry: Applications to Biochemistry and Molecular Biology, David Freifelder, 2nd edition (1983), W. H. Freeman and Company. ISBN: 0716714442 / 0-7167-1444-2.
4. An Introduction to Radiobiology, 2nd edition (1998), A. H. W. Nias, Wiley Blackwell, ISBN13: 978-0471975908.
5. The World of the Cell, 7 th edition (2008), Becker, Kleinsmith, Hardin and Bertoni. Benjamin Cummings, ISBN-13: 978-0805393934.

AECC-A1: Basic Communication Skill (English) (LTP:: 3:1:2) 6 Credits

UNIT:1 INTRODUCTION TO TECHNICAL COMMUNICATION

Fundamentals of Technical Communication Skills, Barriers to Effective Communication, Different styles in Technical Communication. Interpersonal Communication Skills, How to improve Interpersonal Communication Skills, Developing Interpersonal Skills. Grammar : Basic English Grammar and Parts of Speech – Nouns, Pronouns, Adjectives, Verbs, Adverbs, Preposition, Articles, Conjunctions.

UNIT:2 INTRODUCTION TO LISTENING SKILLS AND PHONETICS

Introduction to Phonetics, Sounds Mispronounced, Silent and Non silent Letters, Homophones and Homonyms, Aspiration, Pronunciation of The, wordsendingage, some plural forms. Articles: Use of Articles-Indefinite and Definite Articles.

UNIT:3 SPEAKING SKILLS (GRAMMAR AND VOCABULARY)

Extempore/Public Speaking, Difference between Extempore/Public Speaking, and Guidelines for Practice. Mother Tongue Influence (MTI) – South Indian Speakers, Various Techniques for Neutralisation of Mother Tongue Influence – Exercises, Listening Comprehension – Exercises. Information Transfer: Oral Presentation -Examples. Common Errors in Pronunciation

UNIT:4 SPEAKING SKILLS (GRAMMAR AND VOCABULARY)

Syllables, Structures, Strong and Weak forms of words, Words formation -Prefixes and Suffixes (Vocabulary), Contractions and Abbreviations. Spelling Rules and Words often Misspelt – Exercises on it. Word Pairs (Minimal Pairs) – Exercises, The Sequence of Tenses (Rules in use of Tenses) and Exercises on it.

TEXTBOOKS :

1. Communication Skills by Sanjay Kumar and PushpLata, Oxford University Press – 2018. Refer its workbook for activities and exercises – Communication Skills – I (A Workbook) published by Oxford University Press -2018.
2. English Language Communication Skills (Lab Manual cum Workbook), Cengage learning India Pvt Limited [Latest Revised Edition]-2018.
3. English for Technical Communication by N.P.Sudharshana and C. Savitha, Cambridge University Press – 2016

Semester II

DSC 4: Human Anatomy and Physiology (LTP:: 4:2:0) 6 Credits

UNIT : 1 INTRODUCTION

Homeostasis, Tissue, Cartilage: The internal environment and homeostasis, survival needs of the body, movement of substances within the body, body fluids, action potential, propagation of action potential, cell-structure and functions. Epithelial tissue- simple epithelium, stratified epithelium, connective tissue- cells of connective tissue, loose connective tissue, Adipose tissue, Dense connective tissue, Lymphoid tissue.

UNIT : 2 NERVOUS SYSTEM

Functional Components of nervous system, Neurons: Properties of neurons, Cell bodies, Axon and Dendrites, Types of nerves, Synapse and neurotransmitters, neuromuscular junction. Central nervous system:ventricles of the brain and CSF. Brain: Cerebrum, functions of cerebrum, functional areas of the cerebrum, Brainstem, Cerebellum, Spinal cord- grey matter, white matter, spinal reflex, Spinal nerves (in brief list & functions), Cranial nerves, Autonomic nervous system (in brief)- functions and effects. Pituitary gland and hypothalamus.

UNIT : 3 CARDIOVASCULAR SYSTEM

Introduction, Blood vessels- Arteries and Arterioles, Veins and Venules, capillaries, control of blood vessel diameter, blood supply- internal respiration, cell nutrition. Heart- position, structure pericardium, myocardium, endocardium, interior of the heart, flow of blood through the heart, blood supply to heart, Conducting system of the heart, factors affecting heart rate, control of blood pressure, pulse and factors affecting the pulse rate.

UNIT : 4 RESPIRATORY SYSTEM

Organs of respiration, Nose and Nasal cavity position, structure and functions, pharynx - position, structure, functions. Larynx - position, structure and functions. Trachea, bronchi, bronchioles and alveoli, lungs- position, associated structure, pleura and pleural cavity. Respiration - muscles of respiration, cycle of respiration, variables affecting respiration, lung volumes and capacity.

TEXTBOOKS :

1. Ross & Wilson's Anatomy and Physiology in Health and Illness – by Anne Waugh and Allison Grant, 9th Edition, Churchill Livingstone Publications.
2. Essentials of Medical Physiology - by K. Sembulingam and Prema Sembulingam, 3rd Edition, Jaypee Publications.
3. Human Physiology: From Cells to Systems – by Lauralee Sherwood, 6th Edition, Thomson India Edition, 2007.

DSC 5: Analog Electronics Circuits (LTP:: 4:0:2) 6 Credits

UNIT:1 BJT TRANSISTORS ANALYSIS

BJT modeling, re transistor model: Common Emitter Configuration, Voltage-Divider Bias, CE Emitter-Bias Configuration (Excluding Pspice Analysis), Emitter Follower Configuration, Determining Current Gain, Effect of RL and RS, Cascaded Systems, RC- Coupled BJT Amplifier, Cascade Connection, Darlington Connection.

UNIT:2 FET TRANSISTORS ANALYSIS

Field Effect Transistors Introduction, Construction and Characteristics of JFETs, Transfer Characteristics, Applying Shockley's Equation. Depletion Type MOSFET: Basic Construction, Basic Operation and Characteristics, P-Channel Depletion Type MOSFET and Symbols, Enhancement Type MOSFET: Basic Construction, Basic Operation and Characteristics, P-Channel Enhancement Type MOSFETs and Symbols.

UNIT:3 JFET & POWER AMPLIFIER ANALYSIS

Introduction, JFET Small Signal Model, JFET AC equivalent Circuit, Fixed- Bias Configuration, Self-Bias Configuration, Voltage-Divider Configuration, Source Follower Configuration. Power Amplifiers Introduction: Definitions and Amplifier Types, Series Fed Class A Amplifier, Transformer Coupled Class A Amplifier, Class B Amplifier operation.

UNIT:4 FEEDBACK CONCEPTS & OSCILLATORS CIRCUITS

Feedback and Oscillator Circuits Feedback Concepts, Feedback Connection Types, Effects of negative feedback, Oscillator operation, Phase Shift Oscillator: FET Phase Shift Oscillator, Transistor Phase Shift Oscillator, Wien Bridge Oscillator, Tuned oscillator Circuit: FET and Transistor Colpitts Oscillator, FET and Transistor Hartley Oscillator, Crystal oscillator.

Practical Experiments:

1. Experiment 1: To design and test Full Wave Rectifier (with center tap transformer) with and without filters.
2. Experiment 2: To design and test Full Wave Bridge Rectifier with and without filters.
3. Experiment 3: To design and test the common emitter amplifier (voltage divider bias) without feedback and determine input, output impedance, gain and bandwidth.
4. Experiment 4: To plot the Drain and Transfer characteristic for the given FET and to find the Drain Resistance and Transconductance.
5. Experiment 5: To plot the input and output characteristics of n-channel MOSFET and calculate drain resistance, mutual conductance and amplification factor.

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TEXTBOOKS :

1. Robert L. Boylestad and Louis Nashelsky, “Electronics devices and Circuit theory”, Pearson, 10th Edition, 2009, ISBN:9788131727003.
2. David A. Bell, “Electronic Devices and Circuits”, Oxford University Press.

DSC 6: Scientific and Analytical Instrumentation(LTP:: 4:0:2) 6 Credits

UNIT : 1 AN INTRODUCTION TO INSTRUMENTAL METHODS

Terms associated with Chemical analysis, Classification of instrumental techniques, A review of important consideration in analytical methods, Basic functions of instrumentation, Nature of EM radiation, EM spectrum. Atomic energy levels, Molecular electronic energy levels, vibrational energy levels, Fundamental Levels of photometry, IR Spectroscopy: Basic Components of IR Spectrophotometers, Fourier Transform IR Spectroscopy.

UNIT : 2 UV AND VISIBLE SPECTROMETERS –INSTRUMENTATION

Radiation Sources, Wavelength selection, Detector, Readout UNITS, Instruments for absorption photometry.

UNIT : 3 FLAME EMISSION AND ATOMIC ABSORPTION SPECTROSCOPY

Introduction, Instrumentation for flame spectrometric methods, Flame emission spectrometry, atomic absorption spectrometry, Atomic fluorescence spectrometry, Interferences associated with Flames & furnaces, applications, comparison of FES and AAS.

UNIT : 4 GAS CHROMATOGRAPHY

Chromatograph , Basics parts of a chromatograph, Methods of measurements of peak areas, HPLC : HPLC Instrumentation, Mobile –phase delivery system sample introduction, separation of columns, Detectors – Ultraviolet Photometers & Spectrophotometers, electro chemicals detector (amperometric detector), Differential refractometers.

Practical Experiments:

1. Experiment 1: IR Spectroscopy
2. Experiment 2: Flame emission spectrophotometry
3. Experiment 3: Analytical Instrumentation system (Model)

TEXTBOOKS :

1. Instrumental Methods of Analysis, 7th edition. – 2. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, CBS Publishing & Distribution.
2. Handbook of Instruments – R.S. Khandpur, Tata McGraw Hill.
3. Braun R.D., Introduction to Instrumental Analysis, McGraw –Hill Singapore, 2006.
4. Frank G. Kerry Industrial Gas Handbook: Gas Separation and Purification, Taylor and francis group, 2007.
5. Principles of Instrumental Analysis 5th Edition – Douglas A. Skoog, F. James Holler, Timothy A. Niemen, Thomason Brooks/ Cole.

AECC-A2: Nudi/Kali Kannada (LTP::3:1:2) 6 Credits

UNIT : 1

Introducing each other. Personal Pronouns, Possessive forms, Interrogative words, Possessive forms, Yes/No Type Interrogation.

UNIT : 2

Possessive forms of nouns, dubitive question, Relative nouns, Enquiring about a room for rent. Qualitative and quantitative adjectives.

UNIT : 3

Enquiring about the college. Predicative forms, locative case, verbs, Vegetable market. Numeral, plurals, Planning for a picnic. Imperative, Permissive, hortative.

UNIT : 4

Conversation between Doctor and the patient. Verb- iru, negation – illa, non – past tense, Potential forms, no – past continuous. Lesson 11: Discussing about a film. Past tense, negation. Lesson, Telephone conversation. Past and present perfect past continuous and their negation.

TEXTBOOKS :

1. Kannada Kali - A Text Book to Learn Kannada by Non – Kannadigas who come to study Diploma, Engineering and Health Sciences in Karnataka.
2. Spoken Kannada (Level 1) – by Raghavendra Prasad.

Semester III

DSC 7: Fundamentals of Signals & DSP (LTP:: 4:0:2) 6 Credits

UNIT : 1 INTRODUCTION TO SIGNALS AND SYSTEMS

Basic elements of a DSP System, Classification of Signals, Sampling Theorem (statement and problems on Nyquist rate), Discrete Time Signals (Representation, Standard Signals, Classification, and Operations), Discrete Time Systems, Convolution Sum, Cross correlation and Auto correlation of sequences.

UNIT : 2 Z- TRANSFORM AND ITS APPLICATION TO ANALYSIS OF LTI SYSTEMS

Direct Z-Transform, Properties of the Z-Transform, Examples, Inverse Z- Transform by Partial Fraction Expansion method only, System Function of a LTI System, Causality and Stability (from $H(z)$).

UNIT : 3 DFT: PROPERTIES AND APPLICATIONS

Definition and Problems on DFT & IDFT, DFT Properties – Periodicity, Linearity, Time Reversal, Circular Time Shift, Circular Frequency Shift, Circular Convolution, Multiplication of two DFTs & Circular Convolution, Parseval's Theorem.

UNIT : 4 IIR & FIR FILTERS: IIR FILTERS

Low-pass filter specifications, IIR filter Design by Impulse Invariance & Bilinear Techniques, Design of FIR filters – Symmetric and Antisymmetric FIR filters, Design of Linear phase FIR filters by Rectangular Hamming & Hanning windows.

Practical Experiments:

1. Experiment 1: Verify the Sampling theorem
2. Experiment 2: Determine linear convolution, Circular convolution and Correlation of two given sequences. Verify the result using theoretical computations
3. Experiment 3: Determine the linear convolution of two given point sequences using FFT algorithm.
4. Experiment 4: Design and test FIR filter using Windowing method (Hamming Hanning and Rectangular window)

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TEXTBOOKS :

1. Dimitris G Manolakis, John G. Proakis, “Digital Signal Processing: Principles, Algorithms, and Applications”, 4th Edition, Pearson India, 2007.
2. V.Udayashankara, “Modern Digital Signal Processing”, Third Edition, PHI 2016.
3. Simon Haykin and Barry Van Veen “Signals and Systems”, John Wiley & Sons, 2nd edition
4. S K Mitra, “Digital Signal Processing”, 4th Edition, McGraw-Hill, Year.

DSC 8: Clinical Instrumentation – I (LTP:: 4:0:2) 6 Credits

UNIT:1 ELECTROCARDIOGRAM

Action potentials in cardiac muscle, Characteristics of the normal ECG, Cardiac arrhythmias and their electrocardiographic interpretation- Abnormal sinus rhythms, Abnormal Rhythms by impulse conduction blocks, Premature contractions, Paroxysmal Tachycardia, Ventricular & Atrial Fibrillation, Atrial Flutter, Cardiac arrest.

UNIT:2 CATHETERIZATION LABORATORY INSTRUMENTATION

Arrhythmia monitor, Exercise stress testing, Ambulatory monitoring instruments, Foetal Monitoring Instruments: Cardiotocograph, Abdominal Foetal Electrocardiogram, Foetal Phonocardiogram.

UNIT:3 ANATOMY OF HUMAN EYE

Physiology of vision, Errors of refraction and their optical correction, Aqueous humor production and drainage, Strabismus. Clinical methods: Spectacles and contact lenses, Refractive surgery.

UNIT:4 TONOMETRY AND ITS TYPES

Perimetry - Peripheral Field Charting, Central Field Charting, Fundus Fluorescein Angiography, Electroretinography, Electro-oculography, Loupe & Lens Examination, Slit-Lamp Examination, Gonioscopy, Retinoscope- Principle, Procedure & Types.

Practical Experiments:

1. Experiment 1: Design and Test the bio-potential amplifiers for ECG/ or EEG/ or EMG
2. Experiment 2: Testing and analysis of the following by hardware circuit/simulation(i) DC Defibrillator (ii) Pacemaker

TEXTBOOKS :

1. "Textbook of Medical Physiology", Guyton & Hall, 11th Edition, Reed Elsevier Pvt. Ltd., 2007.
2. "Handbook of Biomedical Instrumentation", R S Khandpur, 2nd edition, McGrawHill Education, 2013.
3. "Comprehensive Ophthalmology", A. K. Khurana, 4 th Edition, New Age International Ltd., 2010.

DSC 9: Biomedical Equipments (LTP:: 4:0:2) 6 Credits

UNIT :1 ELECTROCARDIOGRAPH

Block Diagram Description of an Electrocardiograph, The ECG leads, Effects of Artefacts on ECG Recordings, Electroencephalograph, Block Diagram Description of an Electroencephalograph. Other Biomedical recorders.

UNIT :2 PULMONARY FUNCTION MEASUREMENTS

Respiratory Volumes, Respiratory Capacities, Compliance and Related pressures, Dynamic Respiratory Parameters. Spirometry: - Basic Spirometer, Wedge Spirometer, Ultra Sonic Spirometer.

UNIT :3 CARDIAC PACE MAKERS

Need for Cardiac pace maker. Types of pace makers:-external and Implantable pacemakers. Classification codes for Pacemakers.

UNIT :4 HEMODIALYSIS MACHINE

Function of the Kidneys.Changes in body fluids in renal disease.Artificial Kidney. Dialyzers: Parallel flow, coil, Hallow fibre type dialyzers. Performance analysis of dialyzers.Hemodialysis machine.

TEXTBOOKS :

1. "Handbook of Biomedical Instrumentation", R S Khandpur, 2nd edition, McGrawHill Education, 2013.
2. "Medical Instrumentation, Application and Design", John G. Webster, 3rd Edition, John Wiley & Sons.
3. "Biomedical Instrumentation and Measurements", Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, 2nd Edition, Prentice Hall of India Private Limited, 2001.
4. "Introduction to Biomedical Equipment Technology", Joseph J Carr, John M. Brown, 4th Edition, Pearson Education, 2004.

AECC-A3: Rehabilitation Technology (LTP:: 4:2:0) 6 Credits

UNIT :1 INTRODUCTION TO REHABILITATION

Introduction to Rehabilitation, Medical Rehabilitation, Preventive Rehabilitation, Impairment, Disability and Handicap, Sociovocational Rehabilitation.

UNIT:2 THERAPEUTIC EXERCISE TECHNIQUE

Coordination Exercises, Balance Training, Gait, Pathological Gaits, Gait Training – Crutch Walking: Patterns of Gait, Relaxation exercises, Methods for training Relaxation, Strengthening exercises, Mobilization exercises.

UNIT:3 ORTHOTIC DEVICES IN REHABILITATION ENGINEERING

Definition, General Principles of Orthosis, Biomechanics of Orthosis, Classification, Material and fabrication for lower limb Orthosis, Calipers – Foot Orthoses, Ankle-Foot Orthosis, Knee-Ankle-Foot Orthosis, Hip-Knee-Ankle-Foot Orthoses, Functional Electrical Stimulation, Spinal Orthosis- Cervical, Head cervical Orthosis, Head cervical thoracic orthosis, Thoraco lumbar sacral orthosis, Lumbosacro-orthosis, Splints-its functions & types.

UNIT:4 AMPUTATION

General Principles of Amputation Surgery, Levels of Amputation in Upper limb and Lower limb, Rehabilitation of Lower limb amputations Prosthetics: Classification, Components of Prosthesis, Upper limb Prosthetics – Terminal Devices, Myoelectric Prosthesis, Lower extremity Prosthesis – Transfemoral prosthesis, Prosthesis for hip disarticulation.

TEXTBOOKS:

1. Rehabilitation Medicine - By Dr. S. Sunder, 3rd Edition, Jaypee Medical Publications, Reprint 2004.

Semester IV

DSC10: Principles of Genetics(LTP:: 4:2:0) 6 Credits

UNIT : 1 OVERVIEW OF CHANGING PARADIGMS IN GENETICS

A brief overview of how genetic principles took shape, leading to the concept of a blueprint of life within the cell to the physical entity of DNA. Also mention the surprises we have from the genomics such as genetic variation between individuals. There are popular videos/presentations that can be used. The purpose is to ignite the curiosity of the students.

UNIT : 2 CONCEPT OF GENETIC INHERITANCE

Concept of alleles, haploid and diploid status, phenotype and genotype: Mendel's laws of inheritance, dominant and recessive inheritance, test, back and reciprocal crosses with two examples each.

UNIT : 3 PHYSICAL BASIS OF INHERITANCE

Chromosomal theory of inheritance, concept of linkage and crossing over, cytological proof of crossing over, genetic mapping: two and three point cross over. Distinguishing recombination and complementation. Allelic interactions- dominance relationships- complete, incomplete and co-dominance, gene-gene interaction.

UNIT : 4 INTRODUCTION TO DNA STRUCTURE AND REPLICATION

Basic structure of DNA, salient features of the double helix, semi-conservative replication– Messelson and Stahl experiment.

TEXTBOOKS :

1. Principles of Genetics, 6th edition (2011), Snustad DP and Simmons MJ, John Wiley and Sons, Inc; ISBN-13: 978-0470903599
2. Human Molecular Genetics, 3rd edition (2003) by Tom Strachan and Andrew Read; Garland Science Publishers, ISBN -13: 978-0815341826.
3. Concepts of Genetics, 10th edition, (2011). William S. Klug, Michael R. Cummings, Charlotte A. Spencer, Michael A. Palladino; Pearson Education, ISBN-13: 978-0321724120.
4. Principles of Genetics, 8th edition (2005), Gardner EJ, Simmons MJ, Snustad DP. John Wiley and Sons, Inc. ; ISBN-13: 978-9971513467.
5. An introduction to Genetic Analysis, 10th edition (2010), Griffith AJF, Miller JH, Suzuki DT, Lewontin RC, Gelbert WM., W. H. Freeman and Co. New York. ISBN-13: 978-429229432.
6. Principles of Genetics, 6 th edition (1998), Robert H. Tamarin Publisher: William C Brown Pub; ISBN-13: 978-0697354624.

DSC 11: Biomedical Digital Signal Processing (LTP:: 4:0:2) 6 Credits

UNIT : 1 OVERVIEW OF BIOMEDICAL SIGNALS

The nature of biomedical signals, objectives of biomedical signal analysis, difficulties encountered in biomedical signal analysis, Computer aided diagnosis. Neurological Signal processing: Brain and its potentials, Electrophysiological origin of Brain waves, EEG signal and its characteristics, EEG analysis, Linear prediction theory.

UNIT : 2 FILTERING FOR ARTIFACTS REMOVAL

Random noise, structured noise and physiological interference, stationary versus non-stationary processes, typical case study, Time domain filters with application: Synchronized averaging, moving-average filters Frequency domain filters with examples.

UNIT : 3 BASICS OF SIGNAL AVERAGING

Signal averaging as a digital filter, A typical average, Software for signal averaging, Limitations of signal averaging. Data Acquisition and classification of sleep stages, The Markov model and Markov chains.

UNIT : 4 ECG PARAMETERS AND THEIR ESTIMATION

A review of wiener filtering problem, Principle of an adaptive filter, the steepest descent algorithm, Adaptive noise canceller, Cancellation 60Hz Interference in ECG, Cancelling Donor heart Interference in Heart-transplant ECG, Cancellation of Electrocardiographic signals from the electrical activity of chest muscles.

Practical Experiments:

1. Experiment 1: Write a program to Display Static and Moving ECG signal.
2. Experiment 2: Write a program to Implement Low-Pass FIR filter for ECG
3. Experiment 3 Write a program to improve the SNR using signal averaging technique
4. Experiment 4: Write a program to Implement 50Hz notch filter for ECG signal and display PSD

SYLLABUS – B.Sc. (BIOMEDICAL SCIENCE)

TEXTBOOKS :

1. Biomedical signal analysis- A case study approach, RangayyanRangaraj, Wiley (IEEE Press)-2005.
2. Biomedical Signal Processing- Principles and Techniques - D.C.Reddy, Tata McGraw-Hill, 2005.
3. Biomedical Digital Signal Processing-Willis J.Tompkins, PHI, 2000.

DSC12: Clinical Instrumentation – II(LTP:: 4:0:2) 6 Credits

UNIT : 1 CLINICAL METHOD OF NEUROLOGY

Approach to the patient with Neurologic disease, Taking the history, Neurologic Examination - Testing of Higher Cortical Functions, Cranial nerves, Motor function, Reflex function, Sensory function, Gait and Stance, Shortcomings of Clinical methods, Indications and Technique of Lumbar puncture, Radiographic Examination of Skull and Spine, Clinical significance of EEG Abnormalities

UNIT : 2NEUROLOGY AND INSTRUMENTATION

Definition, Patterns of Paralysis and their diagnosis, Electrodiagnosis of Neuromuscular disease - Studies of Nerve conduction, Electrodiagnostic studies of Nerve roots and Spinal segments, Jolly test, Needle examination of muscle, Imaging of muscle and nerve, Biopsies of muscle and nerve.

UNIT : 3ANAESTHESIA AND INSTRUMENTATION

Cylinders, Pin Index System, Oxygen Concentrators, Bulk store, Liquid Oxygen, Nitrous Oxide, Entonox, Medical Compressed Air, Piped Medical vacuum, Differential Pressure Flowmeters, Variable – Area Constant Differential Pressure Flowmeter.

UNIT : 4ORTHOPAEDICS AND INSTRUMENTATION

Classification, Closed and Open Fracture, Patterns of Fracture, Healing of Fractures, Repair of Tubular Bone, Repair of Cancellous Bone, Rate of Union, Fatigue or Stress Fractures, Pathological Fractures, Radiological Features, Treatment of Uncomplicated Closed Fractures – Reduction, Methods of Reduction, Methods of Immobilization, Treatment of Open Fractures.

Practical Experiments:

1. Experiment 1: Study Experiments: DC defibrillator, baby incubator, ventilator, heartlung machine, pacemaker. pulse& oxygen saturation using pulse oximeter
2. Experiment 2: Recording & Display of ECG / EMG / EEG / PCG
3. Experiment3 : Evoked Potential estimation analysis.

SYLLABUS – B.Sc. (BIOMEDICAL SCIENCE)

TEXTBOOKS :

1. “Adams and Victor“s Principles of Neurology”, Allan H. Ropper and Robert H. Brown, 8th Edition, McGraw-Hill, 2005.
2. “Handbook of Biomedical Instrumentation”, R S Khandpur, 2nd Edition, McGraw-Hill Education, 2013.
3. “Ward“s Anaesthetic Equipment”, Andrew Davey, John T. B. Moyle, Crispian S. Ward, 3rd Edition, W. B. Saunders Company Ltd.
4. “Outline of Fractures”, John Crawford Adams, David Hamblen, 11th Edition, Churchill Livingstone, 1999.

AECCA4: Medical Microbiology(LTP:: 4:2:0) 6 Credits

UNIT : 1 FUNDAMENTAL CONCEPTS

History of microbiology, Discovery of microorganisms, Contributions of Louis Pasteur and Robert Koch in Medical Microbiology. Molecular methods of assessing microbial phylogeny- molecular chronometer, phylogenetic trees, rRNA, DNA and proteins as indicator of phylogeny. Major Divisions of life Domains, Kingdoms.

UNIT : 2 BACTERIAL CELLS - FINE STRUCTURE AND FUNCTION

Size, shape and arrangement of bacterial cells. Cell membrane, cytoplasmic matrix, inclusion bodies (egmagnetosomes), nucleoid, Ultrastructure of Gram +ve and Gram –ve bacterial cell wall, Pili, Capsule, Flagella and motility.

UNIT : 3 MICROBIAL GENETICS

Mutations, Bacterial recombination: general and site specific and replicative, bacterial plasmids fertility factor, col plasmid, bacterial conjugation (Hfr, F', F+, F-), transformation, transduction generalized and specialized.

UNIT : 4 PRINCIPLES OF DISEASES AND EPIDEMIOLOGY

Relationship between Normal microbiota and host, Opportunistic microorganisms, nosocomial infections, Development and spread of infectious disease: invasion, pathogen, parasite, pathogenicity, virulence, carriers and their types.

TEXTBOOKS :

1. Microbiology: An Introduction, 9th edition (2008), Gerard J. Tortora, Berdell R. Funke, Christine L. Case; Benjamin Cummings. ISBN-13: 978-0321733603.
2. Prescott, Harley, and Klein's Microbiology, 8th edition, (2011), Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, McGraw Hill International. ISBN-13: 978- 0071313674.
3. Bailey and Scott's Diagnostic Microbiology, 12th edition (2007), Betty A. Forbes, Daniel F. Sahn and Alice S. Weissfeld; Mosby Elsevier Publishers, ISBN-13: 978-0808923640.
4. Microbiology, 6th edition (1993), Pelczar, Chan and Krieg; McGraw Hill International, ISBN-13: 978-0070492585.

SEMESTER V

DSC 13: Biomaterials and Artificial Organs(LTP:: 4:2:0) 6 Credits

UNIT :1 BIOMATERIALS

Introduction to biomaterials, uses of biomaterials, biomaterials in organs & body systems, materials for use in the body, performance of biomaterials. Metallic Biomaterials: Introduction, Stainless steel, Cobalt- Chromium alloy, Titanium alloys, Titanium-Nickel alloys, Dental metals, Corrosion of metallic implants, Manufacturing of implants.

UNIT :2 POLYMERIC BIOMATERIALS

Introduction, polymerization and basic structure, polymers used as biomaterials, sterilization, surface modifications to for improving biocompatibility. Composite Biomaterials: Structure, bounds on properties, anisotropy of composites, particulate composites, fibrous composites, porous materials, biocompatibility.

UNIT :3 HARD TISSUE REPLACEMENTS

Bone repair and joint implants-long bone repair and joint replacements, dental implants- effects of material selection, effects of surface properties, surface chemistry. Preservation Techniques for Biomaterials: Phase behavior, nonfreezing storage-hypothermic, freeze-thaw technology, freeze-drying, and vitrification.

UNIT :4 ARTIFICIAL HEART AND CIRCULATORY ASSIST DEVICES

Engineering design, Engg design of artificial heart and circulatory assist devices, blood interfacing implants – introduction, total artificial hearts & ventricular assist devices, vascular prostheses, Non-blood interfacing implants for soft tissuesutures and allied augmentation devices, percutaneous and skin implants, maxillofacial implants, eye and ear implants.

TEXTBOOKS :

1. Biomedical Engineering Handbook-Volume1 (2nd Edition) by J.D.Bronzino (CRC Press / IEEE Press, 2000).
2. Biomedical Engineering Handbook-Volume 2 (2nd Edition) by J.D.Bronzino (CRC Press / IEEE Press, 2000)
3. Handbook of Biomedical Instrumentation (2nd Edition) by R.S.Khandpur (Tata McGraw Hill, 2003).

DSE 14: Elective – I - Virtual Bio-Instrumentation(LTP:: 4:0:2) 6 Credits

UNIT :1 GRAPHICAL SYSTEM DESIGN (GSD)

Introduction, GSD model, Design flow with GSD, Virtual Instrumentation, Virtual Instrumentation and traditional instrumentation, Hardware and software in virtual instrumentation, Virtual Instrumentation for test, control and design, GSD using LabVIEW, Graphical programming and textural programming.

UNIT :2 MODULAR PROGRAMMING

Introduction, Modular Programming in LabVIEW, Build a VI front panel and block diagram, ICON and connector pane, Creating an icon, Building a connector pane, Displaying subVIs and express Vis as icons or expandable nodes, Creating subVIs from sections of a VI, Opening and editing subVIs, Placing subVIs on block diagrams, Saving subVIs, Creating a standalone application.

UNIT :3 GENERAL GOALS OF VIRTUAL BIO-INSTRUMENTATION (VBI)

Definition of VBI and importance, General Goals of VBI applications. Basic Concepts: DAQ basics, LabVIEW basics, BioBench basics. Neuromuscular Electrophysiology (Electromyography): Physiological basis, Experiment set up, Experiment descriptions, Trouble shooting the nerve –Muscle Preparation.

UNIT :4 MEDICAL DEVICE DEVELOPMENT APPLICATIONS

The Endotester – A Virtual Instrument –Based Quality control and Technology, Assessment System for surgical video Systems: Introduction, Materials and Methods, Endoscope Tests, Results, Discussion.

Practical Experiments:

1. Experiment 1: To analyze VI UNITs
2. Experiment 2: Recording & Display of ECG / EMG / EEG / PCG using DAQ
3. Experiment3 : Simulation neuro physiological parameters

SYLLABUS – B.Sc. (BIOMEDICAL SCIENCE)

TEXTBOOKS :

1. Virtual Instrumentation using LabVIEW by Jovitha Jerome, PHI Learning Private Limited, 2010.
2. “Virtual Bio-Instrumentation” Biomedical, Clinical, and Healthcare Applications in Lab VIEW. ,by Jon B. Olansen and Eric Rosow, Prentice Hall Publication, 2002.

DSE 14: Elective – II -Medical Informatics(LTP:: 4:2:0) 6 Credits

UNIT : 1 MEDICAL INFORMATICS

Aim and scope, salient feature, Introduction, history, definition of medical informatics, bio-informatics, online learning, introduction to health informatics, prospectus of medical informatics. Hospital Management And Information Science: Introduction, HMIS: need, Benefits, capabilities, development, functional areas.

UNIT :2 HOSPITAL MANAGEMENT AND INFORMATION SYSTEMS-STRUCTURE AND FUNCTIONS

Central Registration UNIT, OPD / Consultant Clinic / Polyclinic UNIT, Indoor Ward UNIT, Patient Care UNIT, Procedure UNIT, Diet Planning UNIT, MLC Register UNIT, Pathology Laboratory UNIT, Blood Bank UNIT, Operation Theatre UNIT, Medical Stores UNIT, Pharmacy UNIT, Radiology UNIT.

UNIT : 3 COMPUTER ASSISTED MEDICAL EDUCATION

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

UNIT :4 TELECOMMUNICATION BASED SYSTEMS

Tele-Medicine, Need, Advantages, Technology- Materials and Methods, Internet Tele-Medicine, Applications. Tele-Surgery: Tele-surgery, Robotic surgery, Need for Tele-Surgery, Advantages, Applications.

TEXTBOOKS FOR REFERENCES:

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

DSE 15: Elective – I -Database Management System in Healthcare (LTP:: 4:2:0) 6 Credits

UNIT :1 DATABASE AND DATABASE USERS

Introduction, Characteristics of the Database Approach, Advantages of Using the DBMS Approach. Database System Concepts and Architecture: Data models, Schemas, and Instances, Three – Schema Architecture and Data Independence, Database Languages and Interfaces, Classification of Database Management Systems.

UNIT :2 DATA MODELING USING THE ENTITY – RELATIONSHIP (ER) MODEL

Using High – Level Conceptual Data Models for Database Design, An Example Database Application; Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database, ER Diagrams, Naming Conventions and Design Issues.

UNIT :3 RELATIONAL ALGEBRA AND RELATIONAL CALCULUS

Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations. SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema Change Statements in SQL, Basic Queries in SQL, More Complex SQL Queries.

UNIT :4 DATABASE DESIGN THEORY AND METHODOLOGY

Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

TEXTBOOKS FOR REFERENCES:

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

DSE 15: Elective – II - Bio-MEMs Technology(LTP:: 4:2:0) 6 Credits

UNIT :1 OVERVIEW OF MEMS AND MICRO SYSTEMS

MEMS and Microsystems, Typical MEMS and Microsystem Products, Evolution of Microfabrication, Micro systems and Microelectronics, Multidisciplinary nature of Microsystem design and Manufacture, Microsystems and Miniaturization, Applications of Microsystem in Health-care Industry.

UNIT :2 MICROACTUATION

Principal means of Microactuation, MEMS with Microactuators, Microaccelrometer, Microfluidic, Engineering Science for Microsystem Design and Fabrication: Ions and Ionization, The Diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics.

UNIT :3 ENGINEERING MECHANICS FOR MICROSYSTEM DESIGN

Static Bending of Thin plates – Circular Plates, Rectangular Plates, Square Plates with all Edges Fixed, Mechanical vibrations – General Formulation, Resonant Vibration, Design theory of Accelerometers.

UNIT :4 MATERIALS FOR MEMS AND MICROSYSTEMS

Substrates and wafers, Active Substrate materials, Silicon as a Substrate material – Ideal Substrate, Crystal Structure, Mechanical Properties of Silicon, Silicon Compounds, Silicon Peizoresistors, Gallium Arsenide, Quartz, Polymers, Packaging Materials.

TEXTBOOKS :

1. “MEMS & Microsystems: Design and Manufacture”, Tai-Ran Hsu, Tata McGraw-Hill, 2002.
2. “Fundamentals of Bio-MEMS and Medical Microdevices”, Steven S. Saliterman, Wiley Interscience, 2006.
3. “Introduction to Bio-MEMS”, Albert Folch, CRC Press, 2012.
4. “Bio-MEMS: Technologies and Applications”, Wanjun Wang, Steven A. Soper, CRC Press, 2006

AECC-A5: Computational Biology and Drug Design(LTP:: 4:2:0) 6 Credits

UNIT :1 INTRODUCTION TO COMPUTATIONAL BIOLOGY

Computational biology and bioinformatics, internet and bioinformatics, cheminformatics. Introduction to linux and common terminal commands.

UNIT : 2 BIOLOGICAL DATABASES AND GENOME BROWSERS

Introduction to various databases and their classification (primary and secondary databases) e.g. NCBI, DDBJ, EMBL, ENSEMBL, UCSC and their use in laboratories: literature, sequence, structure, medical, enzymes and metabolic pathways databases.

UNIT : 3 SEQUENCE ALIGNMENT AND VISUALIZATION

Local and global sequence alignments (Needleman-Wunsch and Smith-Waterman algorithms), pair-wise (BLAST and FASTA algorithms) and multiple sequence alignment (Clustal W) and its importance. Theory behind BLAST- how Hidden Markov Model (HMM) can be used to model a family of unaligned sequences or a common motif within a set of unaligned sequences and further be used for discrimination and multiple alignment, BLAST score, amino acid substitution matrices, s-value and e-value, calculating the alignment score and significance of e and p value.

UNIT : 4 PHYLOGENETIC ANALYSIS

Basics and tools for phylogenetic analysis, cladistics, tree-building methods (character and distance based methods), construction of phylogenetic trees (PHYLIP) and identifying homologs.

TEXTBOOKS :

1. Bioinformatics: Sequence and Genome analysis, 2nd edition (2004), David W. Mount, Cold Spring Harbour Laboratory Press. ISBN-13: 978-0879697129.
2. Bioinformatics: A practical guide to the analysis of genes and proteins, 3rd edition (2004), Andreas D. Baxevanis and B.F. Francis Ouellette, John Wiley and Sons. ISBN-13: 978-0471478782.
3. Introduction to Medicinal Chemistry, 4th edition (2009), Graham I. Patrick, Oxford University Press. ISBN-13: 978-0199234479.
4. The Process of New Drug Discovery and Development, 2nd edition (2006), C.G. Smith and J.T. O'Donnell, Informa Healthcare, ISBN-13: 978-0849327797.

SEMESTER VI

DSC 14: Medical Image Processing (LTP::4:2:0) 06 Credits

UNIT -1

Introduction: Background, Examples of fields that use DIP, Fundamental steps in Digital Image Processing (DIP), Components of DIP system, Image sensing and acquisition, A simple image formation model, Image sampling and quantization. Basic relationship between pixels, Color image processing fundamentals and models.

UNIT -2

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

UNIT -3

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

UNIT -4

Image Restoration: Model of the Image degradation/restoration process, Noise models, Restoration using spatial filtering: Mean filters, Order statistic filters - Median filter, Min and Max filters, Midpoint filter.

Textbook:

1. Digital Image Processing - Rafael. C. Gonzalez and Richard. E. Woods, Third Edition, Pearson Education, 2008.
2. Fundamentals of Digital Image Processing - Anil K. Jain, 5th Indian Print, PHI, 2002.
3. Digital Image Processing and Computer Vision - Milan Sonka, India Edition, Cengage Learning.

DSC 15: Hospital Design, Planning and Management(LTP::4:2:0) 06 Credits

UNIT-1

Planning & Building a New Hospital: Role of Hospital in Health Care, Hospital Planning & Design, Guiding principle in Hospital facilities & services, Functional Plans for Hospital construction, Design items, Functional program & design stage, Planning the Hospital building.

UNIT-2

Effective Hospital Management: Planning, Organization, Directing & Leading, Controlling, Financial Management

Administrative Service: Medical Record, Hospital Infection, Hospital Utilization Statistics, Material Management, Evaluation of Hospital services.

UNIT-3

Planning & Designing Medical Services: Out Patient service, Emergency service, Clinical laboratories, Radiology services, Radiation Therapy Department, Surgical Department, Nursing Department, Operation Theater, CSSD Nursing services.

UNIT-4

Planning & Designing Engineering Services: Engineering Department, Maintenance management, Clinical [Bio-medical] Engineering, Electrical System, Air Condition System, Water supply & sanitary system, Centralized Medical Gas System, Telecommunication System, Environmental Control, Safety & Security System, Disposal of Hospital Wastes.

Textbook:

1. Principles of Hospital Administration & Planning - by B. M. Sakharkar, Jaypee Publications, 1998.
2. Hospital Facilities, Planning & Management - by G. D. Kunders, TataMcGraw Hill, 2004.