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Item No. 4.57

UNIVERSITY OF MUMBAI



**Revised Syllabus for the
TE Biomedical Engineering
(Third Year - Semester V and VI)**

(As per Choice Based Credit and Grading System
with effect from the academic year 2018–2019)

**Program Structure for
TE Biomedical Engineering
University of Mumbai
(With effect from academic year 2018 - 19)**

Scheme for Semester V

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
BMC501	Diagnostic & Therapeutic Instruments	04	----	----	04	----	----	04
BMC502	Analog and Digital Circuit Design	04	----	----	04	----	----	04
BMC503	Principles of Communication Engineering	04	----	----	04	----	----	04
BMC504	Biomedical Digital Signal Processing	04	----	----	04	----	----	04
BMDLO501X	Department Level Optional Course – I	04	----	----	04	----	----	04
BML501	Business Communication and Ethics	----	02*+02	----	----	02	----	02
BML502	Diagnostic and Therapeutic Instruments	----	02	----	----	01	----	01
BML503	Integrated and Communication Circuit Design	----	02	----	----	01	----	01
BML504	Biomedical Digital Signal Processing	----	02	----	----	01	----	01
BMDLL501X	Department Level Optional Course Laboratory – I	----	02	----	----	01	----	01
Total		20	12	----	20	06	----	26

***2 hrs theory shall be taught to the entire class.**

Examination Scheme for Semester V

Course Code	Course Name	Examination Scheme												Total Marks
		Theory				Term work		Practical		Oral		Pract./Oral		
		External (UA)		Internal (CA)										
		Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
BMC501	Diagnostic & Therapeutic Instruments	80	32	20	8	---	---	---	---	---	---	---	---	100
BMC502	Analog and Digital Circuit Design	80	32	20	8	---	---	---	---	---	---	---	---	100
BMC503	Principles of Communication Engineering	80	32	20	8	---	---	---	---	---	---	---	---	100
BMC504	Biomedical Digital Signal Processing	80	32	20	8	---	---	---	---	---	---	---	---	100
BMDLO 501X	Department Level Optional Course – I	80	32	20	8	---	---	---	---	---	---	---	---	100
BML501	Business Communication and Ethics	---	---	---	---	50	20	---	---	---	---	---	---	50
BML502	Diagnostic and Therapeutic Instruments	---	---	---	---	25	10	---	---	25	10	---	---	50
BML503	Integrated and Communication Circuit Design	---	---	---	---	25	10	25	10	---	---	---	---	50
BML504	Biomedical Digital Signal Processing	---	---	---	---	25	10	---	---	---	---	25	10	50
BMDLL 501X	Department Level Optional Course Laboratory – I	---	---	---	---	25	10	---	---	25	10	---	---	50
Total		400	160	100	40	150	60	25	10	50	20	25	10	750

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMC501	Diagnostic and Therapeutic Instruments (Abbreviated as DTI)	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme									
		Theory					Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment			End sem	Duration (hrs)					
		Test 1	Test 2	Av g.							
BMC501	Diagnostic and Therapeutic Instruments (DTI)	20	20	20	80	03	--	--	--	--	100

Course Code	Course Name	Credits
BMC501	Diagnostic and Therapeutic Instruments	04
Course Objective	<ul style="list-style-type: none"> To understand the basic principles and working of diagnostic and therapeutic equipment. To develop skills enabling Biomedical Engineers to serve the health care industry To develop core competency and skill in the field of Biomedical Engineering, to design and develop new health care systems. 	
Course Outcome	Learner will be able to... <ul style="list-style-type: none"> Understand principles of various analytical instruments used in hospital laboratories. Demonstrate the knowledge about various blood cell counting systems and blood gas analyzers. Demonstrate the knowledge about various automated drug delivery systems. Understand the basic mechanism of ventilation and analysis of pulmonary functions and demonstrate the use of ventilation therapy. Understand the basic principle and applications of physiotherapy and electrotherapy techniques. Understand the basic principle and working of hemodialysis machine. 	

Module	Contents	Hours
1	Analytical Instruments 1. Colorimeter 2. Spectrophotometer 3. Auto Analyzer 4. Electrophoresis apparatus 5. Chromatography 6. Chromatography 7. ELISA concepts (direct and indirect), reader & washer.	12
2	Blood cell counter and Blood Gas Analyzer Blood cell counter (Coulter and Pico-scale) Blood gas analyzer principle, pH, pO ₂ and pCO ₂ Electrodes and complete block diagram of Blood gas analyzer.	6
3	Automated drug delivery systems Infusion pumps, components of drug infusion systems, syringe and peristaltic pumps, Implantable infusion system and insulin pumps.	4
4	Pulmonary Function Analyzer Respiration measurement technique: Lung volume and capacities, Spirometry, pneumotachometers, Pulmonary function measurement, measurement of volume Ventilators Artificial ventilation, ventilator terms and its types, modes of ventilators, classification of ventilators, pressure volume flow and time diagrams. Microprocessor controlled ventilator	16
5	Physiotherapy equipments Basic principle, working and technical specifications of 1. Shortwave Diathermy 2. Ultrasonic therapy unit 3. Microwave therapy unit 4. Nerve and Muscle Stimulator.	6
6	Hemodialysis machine Basic principle of Dialysis and its type. Different types of dialyzer membrane, Portable type. Various monitoring circuits.	4

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

Books Recommended:

Text books:

1. Handbook of Biomedical Instrumentation (Third edition): R S. Khandpur. (PH Pub)
2. Medical Instrumentation, Application and Design: J G. Webster. (John Wiley)
3. Biomedical Instrumentation and measurements : Leislie Cromwell, Fred J. Weibell, Enrich A. Pfeiffer. (PHI Pub)

Reference books:

1. Introduction to Biomedical Equipment Technology: Carr –Brown. (PH Pub)
2. Encyclopedia of Medical Devices and Instrumentation: J G. Webster. Vol I- IV (PH Pub)
3. Various Instruments Manuals.
4. Various internet websites.

Theory Examination:

1. Question paper will comprise of total 06 questions, each carrying 20 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of marks will be asked.
4. Remaining questions will be randomly selected from all the modules.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMC502	Analog and Digital Circuit Design (Abbreviated as ADCD)	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme									
		Theory					Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment			End sem	Duration (hrs)					
		Test 1	Test 2	Avg.							
BMC502	Analog and Digital Circuit Design (ADCD)	20	20	20	80	03	--	--	--	--	100

Course Code	Course Name	Credits
BMC502	Analog and Digital Circuit Design	04
Course objective	<p>Students will be able to:</p> <ul style="list-style-type: none"> To understand and provide knowledge of various Analog And Digital Circuits Such as Timer IC 555, PLL IC, VCO, 723 voltage regulator . To understand different types of filters and design them for the given specifications. To understand, learn and analyze fundamentals of Electronics and Digital circuits. To develop analytical aptitude and to understand basic electronic concepts related to engineering profession. To develop competency in terms of logical thinking and application skills. To design and develop various circuits for biomedical applications and to develop logical thinking of students. 	
Course Outcome	<p>Learner will be able to:</p> <ul style="list-style-type: none"> Understand various waveform generation IC's and their applications and use it in projects. Apply the knowledge of various special function IC's and special purpose diodes for designing. Design active filters and their application in biomedical field and electronic circuit design Understanding power devices like power diode, SCR, DIAC and TRIAC, UJT and power MOSFET's and their applications in industry Applying the knowledge of voltage regulators, power supplies, and switches. Understand different types of ac and dc motors and how to select them for project design. 	

Module	Contents	Hours
1.	Waveform Generation IC's: <ul style="list-style-type: none"> • IC 555 Functional Block diagram, Circuit diagram. • IC 555 in Astable Multivibrator(AMV) functional diagram, circuit diagram with application • IC 555 in Monostable Multivibrator (MMV) functional diagram, circuit diagram with application • PLL (IC 565 or equivalent) circuit diagram and applications • VCO(IC 566) Circuit diagram and applications Function Generator (IC 8038 or equivalent) Circuit diagram and its applications	12
2.	Special Function IC's and Special function diodes: <ul style="list-style-type: none"> • F-V convertors and V-F convertors: Circuit diagram and its applications • Instrumentation Amplifier (AD 624 /AD 620) Circuit diagram and its applications, • Monolithic Isolation Amplifier module • Opto-couplers and Opto-isolators • Diodes (LED, photodiode, varactor, schottky) PWM (SG 3525 or equivalent) Circuit diagram and its applications	06
3.	Active Filters: <ul style="list-style-type: none"> • Frequency response, design of first order (Notch, LP, HP, BP) filter and applications. • Frequency response, design of 2nd order (Chebyshev, Butterworth, Elliptical filters) LP, HP, BP, All pass, Notch, band reject • Capacitor filter, switched capacitor filter. Generalized Impedance Convertor (GIC)	08
4.	Power Devices and Circuits: <ul style="list-style-type: none"> • SCR's: Basic structure, characteristics, Two transistor and Operations. series and parallel connections of SCRs. • DIAC and TRIAC: Basic Structure and characteristics, applications • Power diode • UJT: Operation, characteristics, parameters and UJT as a relaxation oscillator Power MOSFET : Device structure, equivalent circuit and characteristics	06
5.	Voltage Controllers and Regulators : <ul style="list-style-type: none"> • Analog switches, Relays : Basic Types • Functional block diagram of Voltage Regulators • Types of voltage regulators: Fixed voltage regulators (78XX and 79XX), Adjustable voltage regulator LM317, linear voltage regulator IC 723, Design of low voltage regulator and high voltage regulator using 723. Switching Mode Power Supply (SMPS)	10
6.	Motors And Drivers : Stepper, Servo, DC/AC Motors drivers and geared motors (Basic operation and application)	06

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

Books Recommended:*Text books:*

1. Op-Amps and linear integrated circuits – R. Gayakwad
2. Design with operational amplifiers and analog integrated circuits. Sergio Franco,
3. Integrated Circuits K.R.Botkar.
4. Power Electronics, Ned Mohan.
5. Power Electronics, M.H.Rashid.
6. Power Electronics, M.D.Singh and K.B.Khanchandani,

Reference Books:

1. Integrated Electronics –Millman & Halkias
2. Linear Integrated Circuits: Roy Chaudhary
3. Opamps and linear integrated circuits, Theory and Applications- James Fiore.
4. Power Electronics, P.C.Sen.
5. Power Electronics, Dr.P.S.Bimbhra,

Theory Examination:

1. Question paper will comprise of total 06 questions, each carrying 20 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of marks will be asked.
4. Remaining questions will be randomly selected from all the modules.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMC503	Principles of Communication Engineering (Abbreviated as PCE)	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme									
		Theory					Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment			End sem	Duration (hrs)					
		Test 1	Test 2	Avg.							
BMC503	Principles of Communication Engineering (PCE)	20	20	20	80	03	--	--	--	--	100

Course Code	Course Name	Credits
BMC503	Principles of Communication Engineering	04
Course Objective	<ul style="list-style-type: none"> To provide concepts, principles and techniques used in analog and digital communications. To cover a range of digital modulation techniques which are frequently used in modern communication systems. 	
Course Outcome	<p>Learner will be able to:</p> <ul style="list-style-type: none"> Demonstrate concept of electronic communication system with effect of noise and modeling of noise Have in depth knowledge of amplitude modulation and be able to compare different types of AM transmitters with analysis Analyze efficiently different types of AM receivers with characteristics, merits and demerits Exhibit basic operation of FM transmitter and receiver with types, analysis, advantages and disadvantages Apply sampling theorem and quantization process in digitizing analog signal with different types of analog and digital pulse modulation Understand and compare different types of digital transmission techniques and multiplexing techniques 	

Module	Contents	Time
1	Introduction to communication system and noise: <ul style="list-style-type: none"> • Elements of communication system, types of communication system • Noise definition, types, Signal to Noise ratio, Noise factor, Noise figure, Noise Temperature 	04
2	Amplitude Modulation Transmission: <ul style="list-style-type: none"> • Definition, Mathematical analysis of AM wave, Different types of AM, Spectrum, Bandwidth, • AM transmitter: High and low level AM transmitter • Generation: DSBFC AM (Grid, plate and collector modulated AM generator, DSBSC AM (Ring and FET balanced modulator) and SSB AM (Filter, phase shift and Third method) • Introduction to ISB and VSB transmitter 	10
3	Amplitude Modulation Receiver: <ul style="list-style-type: none"> • Receiver characteristics: sensitivity, selectivity, fidelity, double spotting, Image frequency and its rejection, dynamic range • Types: TRF receiver, superretrodyne receiver, double conversion receiver • AM detectors –Simple and Practical Diode detector, Principles and types of tracking and AGC, SSB detector 	08
4	Frequency Modulation Transmission and Receivers : <ul style="list-style-type: none"> • Principles of FM waveform, spectrum, Bandwidth • FM generation: Direct and Indirect FM transmitter • Principles of AFC, Effect of noise in FM, Noise Triangle, Pre-emphasis and De-emphasis • FM Receivers: Block diagram • Types: Simple Slope detector, Balanced slope detector, Foster Seeley discriminator, Ratio detector, Quadrature detector • Capture effect in FM receivers, Difference between AM and FM system 	10
5	Analog and Digital Pulse Modulation Techniques : <ul style="list-style-type: none"> • Sampling Theorem for low pass signals and band pass signals, Proof of Sampling theorem, Concept of Aliasing, Quantization, Companding, • Analog modulation techniques: PAM, PWM,PPM – Generation, Detection, Advantages, disadvantages • Digital pulse modulation techniques: PCM, DPCM, DM and ADM– Generation, Detection, Advantages, disadvantages 	08
6	Digital Transmission Techniques and Multiplexing : <ul style="list-style-type: none"> • Digital transmission types: ASK, FSK, PSK - Generation, Detection, Advantages Disadvantages • Multiplexing techniques: Concept of multiplexing, FDM, TDM, Hierarchy, Applications, Advantages Disadvantages 	08

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

Books Recommended:*Text books:*

1. Electronic communication system – Wayne Tomasi, Pearson Education
2. Electronic communication system – Roy Blake, Thomson Learning
3. Electronic communication system - Kennedy and Devis, TMH

Reference Books:

1. Digital and Analog communication system – Leon W Couch, Pearson Education
2. Principles of communication system – Taub and Schilling ,TMH

Theory Examination:

1. Question paper will comprise of total 06 questions, each carrying 20 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of marks will be asked.
4. Remaining questions will be randomly selected from all the modules.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMC504	Biomedical Digital Signal Processing (Abbreviated as BDSP)	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme									
		Theory					Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment			End sem	Duration (hrs)					
		Test 1	Test 2	Avg.							
BMC504	Biomedical Digital Signal Processing (BDSP)	20	20	20	80	03	--	--	--	--	100

Course Code	Course Name	Credits
BMC504	Biomedical Digital Signal Processing	04
Course Objective	<ul style="list-style-type: none"> To build a strong base for developing algorithms for signal processing systems and Imaging systems. To develop competency in terms of logical thinking, programming and application skills. To train and motivate students for pursuing higher education and research for developing cutting edge technologies. 	
Course Outcome	Learner will be able to, <ul style="list-style-type: none"> Understand the fundamental techniques and applications of digital signal Processing with emphasis on biomedical signals. 2. Implement algorithms based on discrete time signals. 3. Understand Circular and linear convolution and their implementation using DFT 4. Understand efficient computation techniques such as DIT and DIF FFT algorithms 5. Design FIR filters using window method, digital IIR filters by designing prototype analog filters and then applying analog to digital conversion. 	

Module	Contents	Hours
1.	Basic Elements of DSP, Discrete time signals and systems, DTFT, Z Transform(ZT) – Properties of ZT , Inverse ZT, solution of LCCDE with initial conditions – zero input response and zero state response -basic concept of BIBO stability, Application of ZT and IZT	08
2.	Introduction to DFT-Properties of DFT	08
3.	Introduction DIT and DIF FFT algorithms. Use of FFT in linear filtering,	07
4.	Review of Design of analog Butterworth and Chebyshev Filters, Frequency transformation in analog domain, Design of IIR Digital Filters using Impulse invariance method-Design of digital Filters using Bilinear transformation	11
5.	Structure of FIR filters-Linear phase filters –Filter design using window technique-Frequency sampling techniques . Realisation of FIR &IIR filters Direct ,cascade and parallel forms	10
6.	Introduction to Digital signal Processors–Architecture –Features-addressing formats –functional mode-introduction to commercial Processors. Application of DSP in Biomedical Applications	04

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

Books Recommended:*Text books:*

1. Digital signal processing Principles Algorithms and Application –Proakis &Manolakis –Third edition PHI
2. Digital Signal Processing –Sanjit K. Mithra Tata Mc-graw Hill
3. Digital Signal Processing – S. Salivahanan, C.Gnanapriya, 2/ed Tata McGraw Hill

Reference Books:

1. Digital signal processing – A.V. Oppenheim and R.W.Schafer- PHI
2. Understanding Digital Signal Processing –Richard G. Lyons-3/ed Pearson Publication

Theory Examination:

1. Question paper will comprise of total 06 questions, each carrying 20 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of marks will be asked.
4. Remaining questions will be randomly selected from all the modules.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDLO 5011	Department Level Optional Course – I Healthcare Database Management (Abbreviated as HCDM)	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme									
		Theory					Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment			End sem	Duration (hrs)					
		Test 1	Test 2	Avg.							
BMDLO 5011	Department Level Optional Course – I Healthcare Database Management (HCDM)	20	20	20	80	03	--	--	--	--	100

Course Code	Course Name	Credits
BMDLO5011	Healthcare Database Management	04
Course Objective	<ul style="list-style-type: none"> • Learn and practice data modelling using the entity-relationship and developing database designs. • Understand the use of Structured Query Language (SQL) and learn SQL syntax. • To create, display, validate and search XML files • To create windows applications using standard .NET controls. • To acquire knowledge of client side scripting language thereby to reduce the load on server and minimize the response time. • To create, validate and display web data. 	
Course Outcome	Learner will be able to, <ul style="list-style-type: none"> • Design data models and schemas in DBMS and apply the features of database management systems and Relational database. • Construct tables and retrieve data from the database by using SQL- the standard language of relational databases. • Implement client side scripting and validation. • Create XML documents using XML schema and XSL elements. 	

	<ul style="list-style-type: none"> • Using operators, variables, and control structures in JavaScript • Designing of windows applications using VB.NET
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Module	Contents	Hours
1	Introduction Database Concepts and Entity Relationship Data Model: Introduction, Characteristics of databases, File system V/s Database system, DBMS system architecture, Database Administrator, Types of Models, Phases of Database Modelling, The Entity-Relationship (ER) Model, Generalization, specialization	05
2	Structured Query Language (SQL) : Overview of SQL , Data Definition Commands, Set operations , aggregate function , null values, , Data Manipulation commands, Data Control commands , Views in SQL, Nested and complex queries	10
3	Transactions Management and Concurrency: Transaction concept, Transaction states, ACID properties	06
4	JavaScript Introduction, Variables and its Scope, Comments, Operators (Arithmetic and Assignment), Data Types, JavaScript language constructs (if, if-else, while, do-while, for, switch), Functions, Objects (Properties, Methods and Events), Built-in Objects (Array, Number, Date, Math, String, RegEx), Browser Objects (Window, Document, Location, History, Cookies) DOM (Document Object Model), Manipulation, Form Validation	08
5	Web Extensions: XML Documents, XML Elements, Attributes XML Schema, Namespaces , Style Sheets, XPath, Introduction to X-Query	08
6	Programming with VB.Net : Variables, Comments, Constants, Keywords, DataTypes, Conditional Statements, Select Case Statement, Loops (For Loop, while Loop, do Loop, For Each Loop), Arrays, Option Explicit, Option Strict, Standard Controls - Windows Application	11

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

Books Recommended:*Text books:*

1. G. K. Gupta :”Database Management Systems”, McGraw – Hill.
2. Korth, Sliberchatz,Sudarshan, :”Database System Concepts”, 6th Edition, McGraw – Hill
3. Elmasri and Navathe, “ Fundamentals of Database Systems”, 5thEdition, PEARSON Education.
4. Peter Rob and Carlos Coronel, “ Database Systems Design, Implementation and Management”, Thomson Learning, 5th Edition
5. Crockford, Douglas, “JavaScript: The Good Parts”, Shroff
6. Heather Williamson, “XML: The Complete Reference”, McGraw Hill Education

7. Imar Spaanjaars, "Beginning ASP.NET 4.5.1 in C# and VB", Wiley

Reference Books:

1. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press
2. Mark L. Gillenson, Paulraj Ponniah, "Introduction to Database Management", Wiley
3. Sharaman Shah, "Oracle for Professional", SPD.
4. Raghu Ramkrishnan and Johannes Gehrke, "Database Management Systems", TMH
5. Debabrata Sahoo "Database Management Systems" Tata McGraw Hill, Schaum's Outline

Theory Examination:

1. Question paper will comprise of total 06 questions, each carrying 20 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of marks will be asked.
4. Remaining questions will be randomly selected from all the modules.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDLO 5012	Department Level Optional Course – I Biostatistics (Abbreviated as BIOSTATS)	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme									
		Theory					Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment			End sem	Duration (hrs)					
		Test 1	Test 2	Avg.							
BMDLO 5012	Department Level Optional Course – I Biostatistics (BIOSTATS)	20	20	20	80	03	--	--	--	--	100

Course Code	Course Name	Credits
BMDLO5012	BIOSTATISTICS	04
Course Objective	<ul style="list-style-type: none"> To cover basic concepts and theory related to statistics. To focus on various statistical abilities such as analysis of variance, hypothesis testing, estimation, etc. 	
Course Outcome	A learner will be able to <ul style="list-style-type: none"> Apply statistical methods to sample data and analyse it. Develop a strong foundation for designing algorithms for computation. 	

Module	Contents	Hours
1.	Descriptive statistics and probability Frequency distribution, Measures of central tendency, Measures of dispersion Basic probability and Bayes theorem.	04
2.	Probability and Sampling Distributions Discrete probability distributions Continuous probability distributions - Binomial, poisson and normal distributions Sampling distributions – sample mean, difference between two sample means, sample proportions, difference between two sample proportions	10
3.	Estimation t- distribution Confidence intervals for - population mean, difference between two population means, population proportion, difference between two population proportions, variance of normally	07

	distributed population, ratio of variances of two normally distributed populations Determination of sample size for estimating mean and proportions	
4.	Hypothesis testing Hypothesis testing for – Population mean, difference between two population means, population proportions, difference between two population proportions, population variance, ratio of two population variances Type – I and II error and power of test	07
5.	Analysis of variance Completely randomized design, Randomized complete block design, repeated measures design, factorial experiment. Regression and Correlation Simple linear regression, correlation model, correlation coefficient, multiple regression, multiple correlation	13
6.	Chi square distribution and analysis of frequency Chi-square distribution – properties Test of goodness of fit, independence and homogeneity	07

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

Books Recommended:*Text books:*

1. Biostatistics – A foundation for analysis in health sciences by Wayne W. Daniel, Seventh edition, Wiley India
2. Fundamentals of mathematical statistics by S. C. Gupta and V. K. Kapoor, second edition, Sultan Chand Publisher
3. Probability and statistics for engineers by J. Ravichandran, Wiley /india

Reference Books:

1. Biostatistics – How it works by Steve selvin, Pearson education
2. An Introduction to Biostatistics by Sunder Rao and J. Richard, Third Edition, Prentice Hall of India
3. Probability and Statistics by Schaum's series

Theory Examination:

1. Question paper will comprise of total 06 questions, each carrying 20 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of marks will be asked.
4. Remaining questions will be randomly selected from all the modules.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDLO 5013	Department Level Optional Course – I Rehabilitation Engineering (Abbreviated as RE)	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme									
		Theory					Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment			End sem	Duration (hrs)					
Test 1	Test 2	Avg.									
BMDLO 5013	Department Level Optional Course – I Rehabilitation Engineering (RE)	20	20	20	80	03	--	--	--	--	100

Course Code	Course Code	Credits
BMDLO5013	Rehabilitation Engineering	04
Course Objectives	To introduce learners to basics of Kinetics and Kinematics, Flow properties of blood and give overview of Rehabilitation Engineering.	
Course Outcomes	A learner will be able to Build foundation for learners enabling the learners to pursue higher studies with specialization in Rehabilitation Engineering.	

Module	Contents	Hours
1.	Introduction and socio-legal aspects of Rehabilitation Engineering: Medical Rehabilitation, Epidemiology of Rehabilitation, preventive Rehabilitation, Impairment Disability and Handicap. Delivery of Rehabilitation Care: The team-Medical, Paramedical , Socio-vocational	06
2.	Orthotics, Amputation, and Prosthetics, Activities of Daily Living (ADL): Orthotics: General Principles of Orthotics, Biomechanics of orthotics, Classification: Upper & Lower Extremity orthotics, spinal Orthotics Amputation & Prosthetics: Causes of Amputation, Types of Amputation, and Levels of Amputation for upper and lower Extremity. Preoperative and post-operative period. Pre-prosthetic stage. Endo & Exo-skeletal Prosthetics. Classification: Upper & lower limb Prosthetics Activities of Daily Living: ADL grouping, Barthel's Index of ADL. Functional	13

	Independence, Measures, Environmental control system, communication, ADL training.	
3.	Mechanical principles of Kinematics and Kinetics: Planar classification of position and motion, Rotary and translatory motion, Degree of freedom, Kinematic Chain Theories of motion, Levers, Torque, Parallel force, Resolution of force, Calculation of muscle and joint forces Clinical application on weight and center of gravity ,applied weights and resistance, muscle force and leverage, joint forces, Clinical application on stretching versus joint mobilization	08
4.	Flow properties of blood: An outline of Blood Rheology, Constitutive equation of blood based viscometric Data and Casson's equation, laminar flow of blood in a tube, fluid mechanical interaction of RBCs with a solid wall, thrombus formation and dissolution, medical application of Blood Rheology	08
5.	Common deformities and role of surgery in rehabilitation engineering. Types of deformities, Management of 1 st and 2 nd degree deformities. Common deformities of lower limb. Treatment for partial foot deformities. Deformities of the foot. Arm deformities. Torticollis	05
6.	An overview of rehabilitation of muscular dystrophy, paraplegia, and quadriplegia: Muscular Dystrophy, Duchenne Muscular Dystrophy, Rehabilitation, facioscapulohumeral Muscular Dystrophy Paraplegia: Etiology, mechanism of injury, Identification of level of lesion, Management of active spinal cord injury, Rehabilitation, Gait training Quadriplegia: Mobility, Training, Level of injury & outcome, Management	08

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

Books Recommended:*Text books:*

1. BRUNNSTROM'S CLINICAL KINESIOLOG, By Laura K Smith, Elizabeth Laurance Weiss; Jaypee brothers Publication
2. Mechanical properties of living tissues by Y. C. Fung

Reference Books:

1. Textbook of Rehabilitation by S. Sundar,3rd edition Jaypee publication

Theory Examination:

1. Question paper will comprise of total 06 questions, each carrying 20 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub-questions of marks will be asked.
4. Remaining questions will be randomly selected from all the modules.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BML501	Business Communication and Ethics (Abbreviated as BCE)	--	04	--	--	02	--	02

Course Code	Course Name	Examination Scheme								
		Theory				Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment			End sem					
		Test 1	Test 2	Avg.						
BML501	Business Communication and Ethics (BCE)	--	--	--	--	50	--	--	--	50

Course Code	Course Name	Credits
BMC501	Business Communication and Ethics	02
Course Objective	<ol style="list-style-type: none"> 1. To inculcate professional and ethical attitude at the workplace. 2. To enhance effective communication and interpersonal skills. 3. To build multidisciplinary approach towards all life tasks. 4. To hone analytical and logical skills for problem-solving. 	
Course Outcome	<p>A learner will be able to</p> <ol style="list-style-type: none"> 1. Design a technical document using precise language, suitable vocabulary and apt style. 2. Develop the life skills/ interpersonal skills to progress professionally by building stronger relationships. 3. Demonstrate awareness of contemporary issues knowledge of professional and ethical responsibilities. 4. Apply the traits of a suitable candidate for a job/higher education, upon being trained in the techniques of holding a group discussion, facing interviews and writing resume/SOP. 5. Deliver formal presentations effectively implementing the verbal and non-verbal skills. 	

Module	Detailed Contents	Hrs.
01	Report Writing	05
1.1	Objectives of Report Writing	
1.2	Language and Style in a report	
1.3	Types : Informative and Interpretative (Analytical, Survey and Feasibility)and Formats of reports (Memo, Letter, Short and Long Report)	
02	Technical Writing	03

2.1	Technical Paper Writing (IEEE Format)	
2.2	Proposal Writing	
03	Introduction to Interpersonal Skills	09
3.1	Emotional Intelligence	
3.2	Leadership and Motivation	
3.3	Team Building	
3.4	Assertiveness	
3.5	Conflict Resolution and Negotiation Skills	
3.6	Time Management	
3.7	Decision Making	
04	Meetings and Documentation	02
4.1	Strategies for conducting effective meetings	
4.2	Notice, Agenda and Minutes of a meeting	
4.3	Business meeting etiquettes	
05	Introduction to Corporate Ethics	02
5.1	Professional and work ethics (responsible use of social media - Facebook, WA, Twitter etc.)	
5.2	Introduction to Intellectual Property Rights	
5.4	Ethical codes of conduct in business and corporate activities (Personal ethics, conflicting values, choosing a moral response and making ethical decisions)	
06	Employment Skills	07
6.1	Group Discussion	
6.2	Resume Writing	
6.3	Interview Skills	
6.4	Presentation Skills	
6.5	Statement of Purpose	
		28

List of Assignments:

1. Report Writing (Theory)
2. Technical Proposal
3. Technical Paper Writing (Paraphrasing a published IEEE Technical Paper)
4. Interpersonal Skills (Group activities and Role plays)
5. Interpersonal Skills (Documentation in the form of soft copy or hard copy)
6. Meetings and Documentation (Notice, Agenda, Minutes of Mock Meetings)
7. Corporate ethics (Case studies, Role plays)
8. Writing Resume and Statement of Purpose

Term Work:

Term work shall consist of all assignments from the list. The distribution of marks for term work shall be as follows:

Book Report.....(10) Marks

Assignments	(10) Marks
Project Report Presentation.....	(15) Marks
Group Discussion.....	(10) Marks
Attendance	(05) Marks
TOTAL:	(50) Marks

The final certification and acceptance of term work ensures the satisfactory performance of work assigned and minimum passing in the term work.

References

1. Fred Luthans, “*Organizational Behavior*”, McGraw Hill, edition
2. Lesiker and Petit, “*Report Writing for Business*”, McGraw Hill, edition
3. Huckin and Olsen, “*Technical Writing and Professional Communication*”, McGraw Hill
4. Wallace and Masters, “*Personal Development for Life and Work*”, Thomson Learning, 12th edition
5. Heta Murphy, “*Effective Business Communication*”, Mc Graw Hill, edition
6. Sharma R.C. and Krishna Mohan, “*Business Correspondence and Report Writing*”, Tata McGraw-Hill Education
7. Ghosh, B. N., “*Managing Soft Skills for Personality Development*”, Tata McGraw Hill. Lehman,
8. Dufrene, Sinha, “BCOM”, Cengage Learning, 2nd edition
9. Bell, Smith, “Management Communication” Wiley India Edition, 3rd edition.
10. Dr. Alex, K., ”Soft Skills”, S Chand and Company
- 11 Subramaniam, R., “Professional Ethics” Oxford University Press.
12. Robbins Stephens P., “Organizational Behavior”, Pearson Education
13. <https://grad.ucla.edu/asis/agep/advsopstem.pdf>

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BML502	Diagnostic and Therapeutic Instruments (DTI)	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme									
		Theory				End sem	Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment									
		Test 1	Test 2	Avg.							
BML502	Diagnostic and Therapeutic Instruments (DTI)	--	--	--	--	25	--	25	--	50	

Course Code	Course Name	Credits
BML502	Diagnostic & Therapeutic Instrumentation	01
Course Objective	<ul style="list-style-type: none"> To demonstrate the application technique of diagnostic and therapeutic equipment. To implement the basic circuits used in diagnostic and therapeutic equipment. 	
Course Outcome	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Appreciate the importance of wavelength selection for measurement of various ions present in the sample. Understand principles of various analytical instruments used in hospital laboratories. Design and Implement power supply of regulated v Understand the basic principle and applications of physiotherapy and electrotherapy techniques. Compare the applications of various types of physiotherapy equipments. Understand the basic principle and working of hemodialysis machine. 	

Syllabus: Same as that of BMC501 Diagnostic and Therapeutic Instruments.

List of Experiments: (Any Seven)

1. Selection of wavelength for Colorimeter and spectrophotometer
2. Find out the concentration of unknown sample using colorimeter and spectrophotometer.
3. Design and Implementation of 6V , 1 Amp regulated power supply
4. Design and Implementation of temperature controller circuit for hemodialysis machine.
5. Demonstration of shortwave diathermy.
6. Demonstration of ultrasonic diathermy.
7. Demonstration of nerve and muscle stimulator.
8. Industry / Hospital visit to be conducted.

Any other experiment based on syllabus which will help learner to understand topic/concept.

Group Presentation on the latest technology in hospitals based on the topics covered in the syllabus.

Assessment:

Term Work:

Term work shall consist of minimum 7 experiments.

The distribution of marks for term work shall be as follows:

Laboratory work (Experiments) : 10 Marks

Laboratory work (Journal) : 05 Marks

Presentation : 05 Marks

Attendance : 05 Marks

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing in the term work.

Books Recommended:

Text books:

1. Handbook of Biomedical Instrumentation (Third edition): R S. Khandpur. (PH Pub)
2. Medical Instrumentation, Application and Design: J G. Webster. (John Wiley)
3. Biomedical Instrumentation and measurements : Leislle Cromwell, Fred J. Weibell, Enrich A. Pfeiffer. (PHI Pub)

Reference books:

1. Introduction to Biomedical Equipment Technology: Carr –Brown. (PH Pub)
2. Encyclopedia of Medical Devices and Instrumentation: J G. Webster. Vol I- IV (PH Pub)
3. Various Instruments Manuals.
4. Various internet websites

Oral examination will be based on suggested practical list and entire syllabus.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BML503	Integrated and Communication Circuit Design (ICCD)	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme								
		Theory				Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment			End sem					
		Test 1	Test 2	Avg.						
BML503	Integrated and Communication Circuit Design (ICCD)	--	--	--	--	25	25	--	--	50

Course Code	Course Name	Credits
BMC503	Integrated and Communication Circuit Design	01
Course Objective	<ul style="list-style-type: none"> To understand, analyze and design integrated circuits. To analyze various analog modulation techniques. 	
Course Outcome	Learner will be able to, <ul style="list-style-type: none"> Apply the knowledge of various special function IC's, filters, power devices, voltage regulators and motors for designing. Implement and design various analog modulator and demodulator circuits. 	

Syllabus: Same as that of BMC502 Analog and Digital Circuit Design (ADCD) and BMC503 Principles of Communication Engineering (PCE).

Suggested Experiments for Integrated Circuit Design (ICD): (Any four)

1. Design AMV and MMV and their applications.
2. To design a voltage regulator.
3. Function Generator IC 8038
4. VCO and PLL ICs and their applications.
5. Design for Band pass /Band reject
6. Design of Notch filter / Twin T filter
7. Design of Low Pass Filter/ High pas Filter
8. Experiments on SCR/DIAC/TRIAC/UJT relaxation oscillator.

Suggested Experiments for Communication Circuit Design (CCD): (Any four)

1. DSB-SC, DSB-FC, SSB AM generation and detection
2. FM generation and detection
3. Pre-emphasis and De-emphasis
4. Sampling and reconstruction
5. PAM generation and detection
6. PWM generation and detection
7. PPM generation and detection
8. Time/Frequency division multiplexing

Assessment:**Term Work:**

Term work consists of minimum eight experiments based on the syllabus (four experiments on “Integrated Circuit Design” and four experiments on “Communication Circuit Design”).

The distribution of the term work shall be as follows:

Laboratory work (Experiments and Journal on ICD) : 10 marks

Laboratory work (Experiments and Journal on CCD) : 10 marks

Attendance : 05 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and completion of journal. Term work assessment must be based on the overall performance of the learner.

Books Recommended:*Text books:*

1. Op-Amps and linear integrated circuits – R. Gayakwad
2. Linear Integrated Circuits: Roy Chaudhary
3. Design with operational amplifiers and analog integrated circuits. Sergio Franco,
4. Integrated Circuits K.R.Botkar.
5. Power Electronics, Ned Mohan.
6. Power Electronics, M.H.Rashid.
7. Power Electronics, M.D.Singh and K.B.Khanchandani,
8. Electronic communication system – Wayne Tomasi, Pearson Education
9. Electronic communication system – Roy Blake, Thomson Learning
10. Electronic communication system - Kennedy and Devis, TMH

Reference Books:

1. Integrated Electronics –Millman & Halkias
2. Opamps and linear integrated circuits, Theory and Applications- James Fiore.
3. Power Electronics, P.C.Sen.
4. Power Electronics, Dr.P.S.Bimbhra,
5. Digital and Analog communication system – Leon W Couch, Pearson Education
6. Principles of communication system – Taub and Schilling ,TMH

Practical examination will be based on suggested practical list.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BML504	Biomedical Digital Signal Processing (BDSP)	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme									
		Theory					Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment			End sem						
		Test 1	Test 2	Avg.							
BML504	Biomedical Digital Signal Processing (BDSP)	--	--	--	--	25	--	--	25	50	

Course Code	Course Name	Credits
BML504	Biomedical Digital Signal Processing	01
Course Objective	<ul style="list-style-type: none"> To build a strong base for developing algorithms for signal processing systems and Imaging systems. To develop competency in terms of logical thinking, programming and application skills. To train and motivate students for pursuing higher education and research for developing cutting edge technologies. 	
Course Outcome	<p>Learner will be able to,</p> <ul style="list-style-type: none"> Understand the fundamental techniques and applications of digital signal processing with emphasis on biomedical signals. Implement algorithms based on discrete time signals. Understand Circular and linear convolution and their implementation using DFT Understand efficient computation techniques such as DIT and DIF FFT algorithms Design FIR filters using window method, digital IIR filters by designing prototype analog filters and then applying analog to digital conversion. 	

Syllabus: Same as that of BMC504 Biomedical Digital Signal Processing (BDSP)

Suggested Experiments: (Any Seven)

1. Basics of Programming
2. Simulations of standard signals
3. Operations on Signals
4. Concept of Aliasing
5. Linear convolution circular convolution
6. Sampling Theorem
7. Z-Transform
8. Discrete Fourier Transform(DFT)
9. Fast Fourier Transform (FFT)
10. Design and simulation of FIR filter
11. IIR filters using Butterworth approximation
12. IIR filter using Chebyshev approximation

Assessment:***Term Work:***

Term work shall consist of minimum 7 experiments.

The distribution of marks for term work shall be as follows:

Laboratory work (Experiments) : 10 Marks

Laboratory work (Journal) : 10 Marks

Attendance : 5 Marks

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing in the term work.

Text books:

1. Digital signal processing Principles Algorithms and Application –Proakis &Manolakis –Third edition PHI
2. Digital Signal Processing –Sanjit K. Mithra Tata Mc-graw Hill
3. Digital Signal Processing – S. Salivahanan, C.Gnanapriya, 2/ed Tata McGraw Hill

Reference Books:

1. Digital signal processing – A.V. Oppenheim and R.W.Schafer- PHI
2. Understanding Digital Signal Processing –Richard G. Lyons-3/ed Pearson Publication

Practical and oral examination will be based on suggested practical list and entire syllabus.

Course Code	Course Name	Teaching scheme			Credits assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDLL 5011	Department Level Optional Course – I Healthcare Database Management (Abbreviated HCDM)	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme									
		Theory					Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment			End sem						
		Test 1	Test 2	Avg.							
BMDLL 5011	Department Level Optional Course – I Healthcare Database Management (HCDM)	--	--	--	--	25	--	25	--	50	

Course Code	Course Name	Credits
BMDLL5011	Healthcare Database Management	01
Course Objective	<ul style="list-style-type: none"> Learn and practice data modelling using the entity-relationship and developing database designs. Understand the use of Structured Query Language (SQL) and learn SQL syntax. To create, display, validate and search XML files To create windows applications using standard .NET controls. To acquire knowledge of client side scripting language thereby to reduce the load on server and minimize the response time. To create, validate and display web data. 	
Course Outcome	<p>Learner will be able to,</p> <ul style="list-style-type: none"> Design data models and schemas in DBMS and apply the features of database management systems and Relational database. Construct tables and retrieve data from the database by using SQL- the standard language of relational databases. Implement client side scripting and validation. Create XML documents using XML schema and XSL elements. Using operators, variables, and control structures in JavaScript Designing of windows applications using VB.NET 	

Syllabus: Same as that of BMDLO5011 Healthcare Database Management

List of Experiments:

1. To draw an ER diagram for a selected case study
2. Study of Basic SQL commands
3. Accessing & Modifying Data in Oracle
4. To study and implement Joins and Views
5. To study and implement Subqueries
6. Develop a simple calculator application in VB.Net using standard controls
7. Develop a console based application to demonstrate use of either conditional statements or loops
8. Create XML document, Schema and Validate it
9. X-Path

Any other experiment/tutorial/Assignment based on syllabus which will help learner to understand topic/concept.

Assessment:

Term Work:

Term work shall consist of minimum 7 experiments.

The distribution of marks for term work shall be as follows:

Laboratory work (Experiments) : 10 Marks

Laboratory work (Journal) : 10 Marks

Attendance : 5 Marks

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing in the term work.

Books Recommended:

Text books:

1. G. K. Gupta : "Database Management Systems", McGraw – Hill.
2. Korth, Silberchatz, Sudarshan, : "Database System Concepts", 6th Edition, McGraw – Hill
3. Elmasri and Navathe, " Fundamentals of Database Systems", 5th Edition, PEARSON Education.
4. Peter Rob and Carlos Coronel, " Database Systems Design, Implementation and Management", Thomson Learning, 5th Edition
5. Crockford, Douglas, "JavaScript: The Good Parts", Shroff
6. Heather Williamson, "XML: The Complete Reference", McGraw Hill Education
7. Imar Spaanjaars, "Beginning ASP.NET 4.5.1 in C# and VB", Wiley

Reference Books:

1. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press
2. Mark L. Gillenson, Paulraj Ponniah, " Introduction to Database Management", Wiley
3. Sharaman Shah, "Oracle for Professional", SPD.
4. Raghu Ramkrishnan and Johannes Gehrke, " Database Management Systems", TMH
5. Debabrata Sahoo "Database Management Systems" Tata McGraw Hill, Schaum's Outline

Oral examination will be based on suggested practical list and entire syllabus.

Course Code	Course Name	Teaching scheme			Credits assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDLL 5012	Department Level Optional Course – I Biostatistics (BIOSTATS)	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme								
		Theory				Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment			End sem					
		Test 1	Test 2	Avg.						
BMDLL 5012	Department Level Optional Course – I Biostatistics (BIOSTATS)	--	--	--	--	25	--	25	--	50

Course Code	Course Name	Credits
BMDLL5012	Biostatistics	01
Course Objective	<ul style="list-style-type: none"> To conduct statistical analysis using Statistical tools. 	
Course Outcome	Learner will be able to <ul style="list-style-type: none"> Apply statistical methods to sample data and analyse it using statistical tools. 	

Syllabus: Same as that of BMDLO 5012 Biostatistics (BIOSTATS)

Laboratory experiments may be conducted using SCILAB or any other statistical Software

List of Laboratory Experiments: (Any Seven)

1. Descriptive statistics and probability
2. Discrete probability distributions
3. Continuous probability distributions
4. Sampling distributions
5. Estimation
6. Hypothesis testing
7. Analysis of variance
8. Regression and Correlation
9. Chi square distribution and analysis of frequency

Any other experiment based on syllabus which will help learner to understand topic/concept

Assessment:

Term Work:

Term work shall consist of minimum 7 experiments.

The distribution of marks for term work shall be as follows:

Laboratory work (Experiments) : 10 Marks

Laboratory work (Journal) : 10 Marks

Attendance : 5 Marks

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing in the term work.

Books Recommended:

Text books:

1. Biostatistics – A foundation for analysis in health sciences by Wayne W. Daniel, Seventh edition, Wiley India
2. Fundamentals of mathematical statistics by S. C. Gupta and V. K. Kapoor, second edition, Sultan Chand Publisher
3. Probability and statistics for engineers by J. Ravichandran, Wiley /india

Reference Books:

1. Biostatistics – How it works by Steve selvin, Pearson education
2. An Introduction to Biostatistics by Sunder Rao and J. Richard, Third Edition, Prentice Hall of India
3. Probability and Statistics by Schaum's series

Oral examination will be based on suggested practical list and entire syllabus.

Course Code	Course Name	Teaching scheme			Credits assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDLL 5013	Department Level Optional Course – I Rehabilitation Engineering (RE)	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme								
		Theory				Term work	Pract.	Oral	Pract. / Oral	Total
		Internal Assessment			End sem					
		Test 1	Test 2	Avg.						
BMDLL 5013	Department Level Optional Course – I Rehabilitation Engineering (RE)	--	--	--	--	25	--	25	--	50

Course Code	Course Name	Credits
BMDLL5013	Rehabilitation Engineering	01
Course Objective	To introduce learners to basics of Kinetics and Kinematics, Flow properties of blood and give overview of Rehabilitation Engineering.	
Course Outcome	A learner will be able to Build foundation for learners enabling the learners to pursue higher studies with specialization in Rehabilitation Engineering.	

Syllabus: Same as that of BMDLO5013 Rehabilitation Engineering (RE)

Laboratory work:

1. Demonstrations in hospital / Industry.
2. Discussion on research articles and recent developments in the field of medicine.
3. Group presentations on the latest technology in hospitals based on the topics covered in the syllabus.
4. 5 Assignments based on the entire syllabus.

Assessment:***Term Work:***

Term work shall consist of minimum 7 experiments.

The distribution of marks for term work shall be as follows:

Laboratory work : 10 Marks

Laboratory work (Documentation) : 5 Marks

Presentation : 5 Marks

Attendance : 5 Marks

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing in the term work.

Books Recommended:*Text books:*

1. Handbook of Biomedical Instrumentation (Third edition): R S. Khandpur. (PH Pub)
2. Medical Instrumentation, Application and Design: J G. Webster. (John Wiley)
3. Introduction to Biomedical Equipment Technology: Carr –Brown. (PH Pub)

Reference books:

1. Encyclopedia of Medical Devices and Instrumentation: J G. Webster. Vol I- IV (PH Pub)
2. Various Instruments Manuals.
3. Various internet resources.

Oral examination will be based on suggested practical list and entire syllabus.