Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Scheme for Second Year Undergraduate Program in Biomedical Engineering : Semester IV (Autonomous)
(Academic Year 2019-2020)

Semester IV

Sr	Course Code	Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment (B)							Aggregate (A+B)	Credits earned	
																Termwork						
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (hrs.)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Avg (TT1 & TT2)	Laboratory Work	Tutorial / Mini project / Presentation/ Journal	Term Work Total	CA Total (B)			
1	DBMC401	Applied Mathematics IV	4	--	--	4	3	75	--	--	--	75	25	25	25	--	--	--	25	100	4	5
	DBMT401	Applied Mathematics IV Tutorial	--	--	1	1	--	--	--	--	--	--	--	--	--	--	25	25	25	25	1	
2	DBMC402	Biomedical Transducers and Measuring Instruments	4	--	--	4	3	75	--	--	--	75	25	25	25	--	--	--	25	100	4	5
	DBML402	Biomedical Transducers and Measuring Instruments Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	15	10	25	25	50	1	
3	DBMC403	Linear Integrated Circuits	4	--	--	4	3	75	--	--	--	75	25	25	25	--	--	--	25	100	4	5
	DBML403	Linear Integrated Circuits Laboratory	--	2	--	1	--	--	--	--	25	25	--	--	--	15	10	25	25	50	1	
4	DBMC404	Digital Electronics	4	--	--	4	3	75	--	--	--	75	25	25	25	--	--	--	25	100	4	5
	DBML404	Digital Electronics Laboratory	--	2	--	1	--	--	--	--	25	25	--	--	--	15	10	25	25	50	1	
5	DBMC405	Signals and Control Systems	4	--	--	4	3	75	--	--	--	75	25	25	25	--	--	--	25	100	4	5
	DBML405	Signals and Control Systems Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	15	10	25	25	50	1	
6	DBML406	Introduction to Simulations Tools Laboratory	--	2	--	1	--	--	--	25	--	25	--	--	--	15	10	25	25	50	1	1
		Total	**20**	**10**	**1**	**26**	--	375	50	25	50	500	**125**	**125**	**125**	**--**	**--**	**150**	**275**	**775**	**26**	

Syllabus for Second Year Biomedical Engineering - Semester III (Autonomous)
(Academic Year 2019-2020)

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	Laplace Transform: 1.1 Laplace Transform (LT) of Standard Functions: Definition of Laplace transform, Condition of Existence of Laplace transform, Laplace transform of ,e^{at}, sin(at),cos(at),sinh(at), cosh(at), t^n Heaviside unit step function, Dirac-delta function, Laplace transform of Periodic function . 1.2 Properties of Laplace Transform: Linearity, first shifting theorem, second shifting theorem, multiplication by t^n,Division by t, Laplace Transform of derivatives and integrals, change of scale, convolution theorem, Evaluation of integrals using Laplace transform.	**7**
2	Inverse Laplace Transform & its Applications: 2.1 Partial fraction method, Method of convolution, Laplace inverse by derivative. 2.2 Applications of Laplace Transform: Solution of ordinary differential equations, Solving RLC circuit differential equation of first order and second order with boundary condition using Laplace transform (framing of differential equation is not included)	6
3	Fourier Series: 3.1 Introduction: Orthogonal and orthonormal set of functions, Introduction of Dirichlet‘s conditions, Euler‘s formulae. 3.2 Fourier Series of Functions: Exponential, trigonometric functions of any period =2L, even and odd functions, half range sine and cosine series. 3.3 Complex form of Fourier series, Fourier integral representation, Fourier Transform and Inverse Fourier transform of constant and exponential function.	11
4	Vector Algebra & Vector Differentiation: 4.1 Review of Scalar and Vector Product: Scalar and vector product of three and four vectors, Vector differentiation, Gradient of scalar point function, Divergence and Curl of vector point function 4.2 Properties: Solenoidal and irrotational vector fields, conservative vector field.	**7**
5	Vector Integral: 5.1 Line integral 5.2 Green‘s theorem in a plane, Gauss‘ divergence theorem and Stokes‘ theorem.	**6**
6	Complex Variable & Bessel Functions: 6.1 Analytic Function: Necessary and sufficient conditions (No Proof), Cauchy Reiman equation Cartesian form (No Proof) Cauchy Reiman Equation in polar form (with Proof), Milne Thomson Method and it application, Harmonic function, orthogonal trajectories. 6.2 Mapping: Conformal mapping, Bilinear transformations, cross ratio, fixed points. 6.3 Bessel Functions: Bessel ‘s differential equation, Properties of Bessel function of order +1/2 and -1/2, Generating function, expression of. cos (xsinθ), sin (x sinθ) in term of Bessel functions.	11

Syllabus for Second Year Biomedical Engineering - Semester III (Autonomous)
(Academic Year 2019-2020)

Books Recommended:

Text books:

1. H.K. Das, ―Advanced engineering mathematics‖, S . Chand, 2008
2.A. Datta, "Mathematical Methods in Science and Engineering", 2012
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publication

Reference Books:

1. *B. V. Ramana, "Higher Engineering Mathematics", Tata Mc-Graw Hill Publication*
2. *Wylie and Barret, "Advanced Engineering Mathematics", Tata Mc-Graw Hill 6th Edition*
3. *Erwin Kreysizg, "Advanced Engineering Mathematics", John Wiley & Sons, Inc*
4. *Murry R. Spieget, "Vector Analysis", Schaum's outline series, Mc-Graw Hill Publication*

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Tutorials: (Details of Term work)

Term work shall consist of minimum eight tutorials and assignments (minimum 2).

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

i. Tutorials :15 marks
ii. Assignments :05 marks
iii. Attendance (Theory and Tutorial) :05 marks

The final certification and acceptance of term work will be subject to satisfactory performance of Tutorial work and upon fulfilling minimum passing criteria in the term work.

Syllabus for Second Year Biomedical Engineering - Semester III (Autonomous)
(Academic Year 2019-2020)

<table>
<tr><td colspan="8">Program: Second Year Biomedical Engineering</td><td colspan="2">Semester : III</td></tr>
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<tr><td colspan="8">Course : Basics of Human Physiology Laboratory</td><td colspan="2">Course Code:DBML302</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="6">Evaluation Scheme</td></tr>
<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="3">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
<tr><td colspan="3">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">50</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">2</td><td rowspan="2">--</td><td rowspan="2">5</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td>Tutorial / Mini project / presentation/ Journal</td></tr>
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Pre-requisite: Knowledge of

1. Basic Human Anatomy studied in Secondary school.
2. Basic Human Physiology studied in Secondary school.

Objectives:

1. To understand the human anatomy and functions of various body structures.
2. To understand different physiological processes taking place inside human body.

Outcomes: On completion of the course, learner will be able to:

1. Understand the structure and function of cell, the action potential and muscle physiology.
2. Distinguish the different anatomical parts of cardiovascular and respiratory system. Understand the physiology of heart, and other organs of cardiovascular system, concept of Blood pressure and use of ECG. Understand the exchange in gases taking place in body and use of spirometer.
3. To analyze the composition of blood, blood cells with their functions, basics of cell counting, blood grouping and coagulation of blood.
4. Distinguish different organs of digestive and urinary system. Understand the process of digestion, secretions and their functions. Understand the process of urine formation and micturition
5. Understand the anatomy of nervous system, working of different parts of brain, parasympathetic and sympathetic nervous system, reflex arc and reflex action. Distinguish different parts of eyes and ear, their structure and function. Understand the hearing mechanism and image formation on the retina, understand the use of ophthalmoscope and design of hearing aid
6. Understand the different parts of male and female reproductive system with their working, action of sex hormones. To know all the endocrine glands with their secretion and function, and control action.

Syllabus for Second Year Biomedical Engineering - Semester III (Autonomous)
(Academic Year 2019-2020)

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Organization of Human Body:** Cell, Tissue, Organ, Organ system, Structure and functions of cell, Polarization and Depolarization of Cell, Types of tissues, Homeostasis, Positive and Negative Feedback Mechanism **Muscle Physiology:** Muscle physiology and aspects of Skin Resistance	**05**
2	**Cardiovascular System**: Anatomy of Cardiovascular System, Heart, Conductive Tissues of Heart, Cardiac Cycle, Heart Valves, Systemic and Pulmonary Circulation, Transmission of Cardiac Impulse, Blood Pressure, ECG, Einthoven's Triangle, Twelve Lead System and ECG Waveforms. **Respiratory System:** Anatomy of Respiratory System, Ventilation, Exchange in gases in the alveoli, Spirometer (Forced Expiratory Volumes)	**12**
3	**Blood:** Composition of Blood – Blood cells and their functions, Haemoglobin, Blood Grouping, Coagulation, Wound Healing.	**05**
4	**Alimentary System:** All organs of the Digestive System, other secretions and main Functions, Deglutition and Defecation. **Urinary System:** Structure of Nephron, Function of Kidney, Urinary Bladder, Urethra, Internal/External Sphincters, Formation of Urine, Micturition	**08**
5	**Nervous System:** Different parts, their functions. Reflex actions and reflex are, Function of Sympathetic and Parasympathetic nervous system. Nerve conduction and action potentials. **Special Senses:** **Eyes**-Structure, Refractive Medias of the Eye, Formation of Image on the Retina. **Ear** – Structure of Cochlea, Hearing mechanism	**10**
6	**Reproductive System:** (Male and Female) Different Organs and their functions. Main actions of Androgens, Oestrogens and Progesterone. **Endocrine System:** All glands, their Secretions and functions. Control of secretions.	**08**

List of Laboratory Experiments: (Any Seven)

1. To measure Blood Pressure using sphygmomanometer using occlusive cuff method.
2. To determine hemoglobin count in the blood by Sahli's method.
3. In-vitro recognition of A, B, O blood groups by slide test.
4. To analyze the total Red Blood Cell count using Neubauer's haemocytometer.
5. To analyze the total White Blood Cell count using Neubauer's haemocytometer.
6. To study the working of ECG Machine and measure the electrical activity of heart.
7. To study the working Patient monitor
8. To measure heart-beats using PQRST Waveform of ECG for arrhythmia detection.
9. Visit to the anatomy department of medical college for organ identification in cadavers.
10. Presentations on the relevant topics.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMC402	Biomedical Transducers and Measuring Instruments (Abbreviated as BTMI)	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.							
BMC402	Biomedical Transducers and Measuring Instruments (BTMI)	20	20	20	80	03	--	--	--	--	100

Course Code	Course Name	Credits
BMC402	Biomedical Transducers and Measuring Instruments	04
Course Objectives	• To provide the knowledge of basic concepts such as measuring instruments and generalized instrumentation system, general properties of input transducers, static and dynamic characteristics of transducers and sensors. • To provide a thorough understanding of principle and working of transducers and sensors used for displacement, motion, pressure and temperature measurement, bio-potential electrodes, chemical sensors, biosensors, fiber optic sensors, and radiation sensors. • To study the biomedical applications of the above transducers and sensors. • To perform experiments based on some of the above transducers and sensors.	
Course Outcomes	• To clearly understand generalized medical instrumentation system, general properties of transducers, static and dynamic characteristics of transducers and sensors. • Understand the fundamental principles and applications of various types of sensors including motion, displacement and pressure sensors. • Present different transduction methods for measuring temperature. • To understand principle of various biopotential electrodes • Understand principle and working of chemical sensor • To understand principle of various biosensors, and differentiate various amperometric and potentiometric sensors.	