

**SCHEME**

**OF**

**STUDIES AND**

**EXAMINATIONS**

**Deenbandhu Chhotu Ram University of Science & Technology, Murthal (Sonapat)**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B.Tech. 1<sup>ST</sup> YEAR (SEMESTER – I) (Common for all branches)**  
**Credit Based Scheme w.e.f. 2012-13**

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam	
			L	T	P		Theory	Practical				
1	HUM 101B	COMMUNICATIVE ENGLISH	3	1		25	75	-	100	4	3	
2	MATH 101B	MATHEMATICS-I	3	1		25	75	-	100	4	3	
3	PHY 101B	ENGINEERING PHYSICS-I	3	1		25	75	-	100	4	3	
4	ME101B	MANUFACTURING PROCESSES (Gr-A)	3	1		25	75	-	100	4	3	
	CH101 B	OR ENGINEERING CHEMISTRY (Gr-B)	3	1		25	75	-				
5	EE101B	PRINCIPLES OF ELECTRICAL ENGINEERING (Gr-A)	3	1		25	75	-	100	4	3	
	CSE101B	OR INTRODUCTION TO COMPUTERS & PROGRAMMING (Gr-B)	3	1		25	75	-				
6	ME103B	ENGINEERING GRAPHICS & DRAWING (Gr-A)	1	-	4	40	-	60	100	3	3	
	ME105B	OR ELEMENTS OF MECHANICAL ENGINEERING (Gr-B)	3	1	-	25	75	-	100	4		
7	PHY103B	PHYSICS LAB-I	-	-	2	20	-	30	50	1	3	
8	ME 107B	WORKSHOP PRACTICE (Gr-A)	-	-	4	40	-	60	100	2	3	
	CH103B	OR CHEMISTRY LAB (Gr-B)	-	-	2	20	-	30	50	1		
9	EE103B	PRINCIPLES OF ELECTRICAL ENGINEERING LAB (Gr-A)	-	-	2	20	-	30	50	1	3	
	CSE103B	OR COMPUTER PROGRAMMING LAB (Gr-B)	-	-	2	20	-	30	50	1		
10	ME109B	ELEMENTS OF MECHANICAL ENGINEERING LAB (Gr-B)	-	-	2	20	-	30	50	1	3	
<b>Total</b>			<b>Gr-A</b>	<b>16</b>	<b>5</b>	<b>12</b>	<b>245</b>	<b>375</b>	<b>180</b>	<b>800</b>	<b>27</b>	
			<b>Gr-B</b>	<b>18</b>	<b>6</b>	<b>8</b>	<b>230</b>	<b>450</b>	<b>120</b>	<b>800</b>	<b>28</b>	

**Note:**

- 1 Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of Sports is given in General Proficiency & Ethics Syllabus.
- 2 The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
- 3 Electronic gadgets including Cellular phones are not allowed in the examination.
- 4 All the branches are to be divided into group 'A' and 'B' as per the suitability of the institute/college, so that there is an equitable distribution of teaching load in odd and even semesters.

**Deenbandhu Chhotu Ram University of Science & Technology, Murthal (Sonapat)**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B.Tech. 1<sup>ST</sup> YEAR (SEMESTER – II) (Common for all branches)**  
**Credit Based Scheme w.e.f. 2012-13**

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P		Theory	Practical			
1.	MATH102B	MATHEMATICS-II	3	1		25	75	-	100	4	3
2	PHY102B	ENGINEERING PHYSICS-II	3	1		25	75	-	100	4	3
3	ME101 B	MANUFACTURING PROCESSES (Gr-B)	3	1		25	75	-	100	4	3
	CH101 B	ENGINEERING CHEMISTRY (Gr-A)	3	1		25	75	-			
4	EE101B	PRINCIPLES OF ELECTRICAL ENGINEERING (Gr-B)	3	1		25	75	-	100	4	3
	CSE101B	INTRODUCTION TO COMPUTERS & PROGRAMMING (Gr-A)	3	1		25	75	-			
5	ECE102B	BASICS OF ELECTRONICS ENGINEERING	3	1		25	75	-	100	4	3
	BT102B	BASICS OF BIO TECHNOLOGY OR									
	HUM102 B	ORAL COMMUNICATION SKILLS OR									
	CE102 B	BASICS OF CIVIL ENGINEERING									
6	ME103B	ENGINEERING GRAPHICS & DRAWING (Gr-B)	1	-	4	40	-	60	100	3	3
	ME105B	ELEMENTS OF MECHANICAL ENGINEERING (Gr-A)	3	1	-	25	75	-	100	4	
7	PHY104B	PHYSICS LAB-II	-	-	2	20	-	30	50	1	3
8	ME 107B	WORKSHOP PRACTICE (Gr-B)	-	-	4	40	-	60	100	2	3
	CH103B	CHEMISTRY LAB (Gr-A)	-	-	2	20	-	30	50	1	
9	EE103B	PRINCIPLES OF ELECTRICAL ENGINEERING LAB (Gr-B)	-	-	2	20	-	30	50	1	3
	CSE103B	COMPUTER PROGRAMMING LAB (Gr-A)	-	-	2	20	-	30	50	1	
10	ME109B	ELEMENTS OF MECHANICAL ENGINEERING LAB (Gr-A)	-	-	2	20	-	30	50	1	3
11	GP 102B	GENERAL PROFICIENCY & ETHICS				-		50	50	2	
<b>Total</b>											
			<b>Gr-B</b>	<b>17</b>	<b>5</b>	<b>12</b>	<b>245</b>	<b>375</b>	<b>230</b>	<b>850</b>	<b>29</b>
			<b>Gr-A</b>	<b>19</b>	<b>6</b>	<b>8</b>	<b>230</b>	<b>450</b>	<b>170</b>	<b>850</b>	<b>30</b>

**Note:**

- Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of Sports is given in General Proficiency & Ethics Syllabus.
- Each student has to undergo a workshop of at least 4 weeks (80-100 hours) at the end of II semester during summer vacations. Out of the four weeks, two weeks would be dedicated to general skills and two weeks training for specialized discipline/ department. The evaluation of this training shall be carried out in the III semester.
- The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
- Electronic gadgets including Cellular phones are not allowed in the examination
- Elective course HUM 102B Oral Communication Skills is deleted w.e.f. session 2013-14.
- All the branches are to be divided into group 'A' and 'B' as per the suitability of the institute/college, so that there is an equitable distribution of teaching load in odd and even semesters

**Deenbandhu Chhotu Ram University of Science & Technology, Murthal**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B. Tech. 2nd YEAR (SEMESTER – III) BIOMEDICAL ENGINEERING**  
**Credit Based Scheme w.e.f. 2013-14**

Sr. No.	Course No.	Course Title	Teaching Schedule			Marks of Class Work	Exam. Marks		Total Marks	Credit	Duration of Exam.
			L	T	P		Theory	Practical			
1.	BME201B	BIOCHEMISTRY	3	1	-	25	75	-	100	4	3
2.	BME203B	INTRODUCTION TO BIOMEDICAL ENGINEERING	3	1	-	25	75	-	100	4	3
3.	BME205B	HUMAN ANATOMY & PHYSIOLOGY	3	1	-	25	75	-	100	4	3
4.	BME207B	BIOMEDICAL MEASUREMENTS & INSTRUMENTATION	3	1	-	25	75	-	100	4	3
5.	ECE203B	ANALOG ELECTRONICS (Common for 3 <sup>rd</sup> sem ECE & BME, & 4 <sup>th</sup> sem AEI)	3	1	-	25	75	-	100	4	3
6.	EE251B	NETWORK ANALYSIS & DESIGN	3	1	-	25	75	-	100	4	3
7.	BME221B	BIOCHEMISTRY LAB	-	-	2	20	-	30	50	1	3
8.	BME223B	BASICS OF BIOMEDICAL ENGINEERING LAB	-	-	2	20	-	30	50	1	3
9.	BME225B	HUMAN ANATOMY & PHYSIOLOGY LAB	-	-	2	20	-	30	50	1	3
10.	ECE223B	ANALOG ELECTRONICS LAB (Common for 3 <sup>rd</sup> sem ECE & BME, & 4 <sup>th</sup> sem AEI)	-	-	2	20	-	30	50	1	3
11.	ME217B	WORKSHOP (Common for all branches except BT & AE)	--	--	2	50	--	--	50	2	-
<b>TOTAL</b>			<b>18</b>	<b>6</b>	<b>10</b>	<b>280</b>	<b>450</b>	<b>120</b>	<b>850</b>	<b>30</b>	<b>-</b>

**Note:**

1. Every student has to participate in the sports activities. A minimum 1 hour is fixed for sport activities either in the morning or evening. Weightage of Sports is given in General Proficiency & Ethics Syllabus.
2. The students will be allowed to use non-programmable scientific calculator however sharing or exchange of calculator is prohibited in the exam.
3. Electronic gadgets including cellular phones are not allowed in the examination hall.
4. Assessment of Workshop Training, undergone at the end of second semester, will be based on seminar, viva – voce, report and certificate of Workshop Training obtained by the student from the in-house workshop.
5. All the branches are to be divided into group ‘A’ and ‘B’ as per the suitability of the institute/college, so that there is an equitable distribution of teaching load in odd and even semesters

**Deenbandhu Chhotu Ram University of Science & Technology, Murthal**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B.Tech. 2nd YEAR (SEMESTER – IV) BIOMEDICAL ENGINEERING**  
**Credit Based Scheme w.e.f. 2013-14**

Sr. No.	Course No.	Course Title	Teaching Schedule			Marks of Class Work	Exam. Marks		Total Marks	Credit	Duration of Exam.
			L	T	P		Theory	Practical			
1.	BME202B	BIOMEDICAL SIGNAL PROCESSING	3	1	-	25	75	-	100	4	3
2.	BME204B	BIOMEDICAL EQUIPMENTS-I	3	1	-	25	75	-	100	4	3
3.	BME206B	BIOMEDICAL STATISTICS	3	1	-	25	75	-	100	4	3
4.	BME208B	MEDICAL INFORMATICS	3	1	-	25	75	-	100	4	3
5.	ECE201B	DIGITAL ELECTRONICS (Common for 4 <sup>th</sup> sem BME, AEI & 3 <sup>rd</sup> sem CSE, ECE, EE, IC & EEE)	3	1	-	25	75	-	100	4	3
6.	ECE206B	ANALOG ELECTRONICS CIRCUITS (Common for 4 <sup>th</sup> sem BME & ECE, 5 <sup>th</sup> sem AEI)	3	1	-	25	75	-	100	4	3
7.	GES201B*	ENVIRONMENTAL STUDIES (Common for all branches) (Gr-A)	3	-	-	-	75*	-	75*	-	3
8.	BME222B	BIOMEDICAL SIGNAL PROCESSING LAB	-	-	2	20	-	30	50	1	3
9.	BME224B	BIOMEDICAL EQUIPMENTS-I LAB	-	-	2	20	-	30	50	1	3
10.	ECE221B	DIGITAL ELECTRONICS LAB (Common for 4 <sup>th</sup> sem BME, AEI & 3 <sup>rd</sup> sem CSE, ECE, EE, IC, EEE)	-	-	2	20	-	30	50	1	3
11.	ECE226B	ANALOG ELECTRONICS CIRCUITS LAB (Common for 4 <sup>th</sup> sem BME, ECE & 5 <sup>th</sup> sem AEI)	-	-	2	20	-	30	50	1	3
12.	GES203B	ENVIRONMENTAL STUDIES FIELD WORK (Common for all branches) (Gr-A)	-	-	-	-	-	25*	25*	-	-
13.	GPBME202B	GENERAL PROFICIENCY & ETHICS	1	-	-	-	-	75	75	2	3
<b>TOTAL</b>			<b>22</b>	<b>6</b>	<b>8</b>	<b>230</b>	<b>450</b>	<b>200</b>	<b>875</b>	<b>30</b>	<b>-</b>

**Note:**

- Every student has to participate in the sports activities. A minimum 1 hour is fixed for sport activities either in the morning or evening. Weightage of Sports is given in General Proficiency & Ethics Syllabus.
- \*The environmental studies (GES-201B) and environmental studies field work (GES-203B) are compulsory and qualifying course only.
- The students will be allowed to use non-programmable scientific calculator however sharing or exchange of calculator is prohibited in the exam.
- Electronic gadgets including cellular phones are not allowed in the examination hall.
- Each student has to undergo Professional Training of 4 weeks from the industry, institute, research lab, training centre etc. during summer vacation and its evaluation shall be carried out in the V semester.
- All the branches are to be divided into group 'A' and 'B' as per the suitability of the institute/college, so that there is an equitable distribution of teaching load in odd and even semesters.

**Deenbandhu Chhotu Ram University of Science & Technology, Murthal**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B.Tech. 3<sup>rd</sup> YEAR (SEMESTER – V) BIOMEDICAL ENGINEERING**  
**Credit Based Scheme w.e.f. 2014-15**

Sr. No.	Course No.	Course Title	Teaching Schedule			Marks of Class Work	Exam. Marks		Total Marks	Credit	Duration of Exam.
			L	T	P		Theory	Practical			
1.	BME301B	BIOMECHANICS & REHABILITATION ENGINEERING	3	1	-	25	75	-	100	4	3
2.	BME303B	CLINICAL ENGINEERING	3	1	-	25	75	-	100	4	3
3.	BME305B	BIOMEDICAL EQUIPMENTS-II	3	1	-	25	75	-	100	4	3
4.	BME307B	TELEMEDICINE	3	1	-	25	75	-	100	4	3
5.	ECE 307 B	LINEAR INTEGRATED CIRCUITS (Common for BME & ECE)	3	1	-	25	75	-	100	4	3
6.	ECE 309 B	MICROPROCESSOR & INTERFACING (Common for BME, CSE, ECE & AEI)	3	1	-	25	75	-	100	4	3
7.	BME321B	BIOMECHANICS & REHABILITATION LAB.	-	-	2	20	-	30	50	1	3
8.	BME325B	BIOMEDICAL EQUIPMENTS-II LAB.	-	-	2	20	-	30	50	1	3
9.	BME327B	TELEMEDICINE LAB	-	-	2	20	-	30	50	1	3
10.	ECE 329 B	MICROPROCESSOR & INTERFACING LAB (Common for BME, CSE, ECE & AEI)	-	-	2	20	-	30	50	1	3
11.	BME311B	PROFESSIONAL TRAINING – I	-	-	2	50	-	-	50	2	-
<b>TOTAL</b>			<b>18</b>	<b>6</b>	<b>10</b>	<b>280</b>	<b>450</b>	<b>120</b>	<b>850</b>	<b>30</b>	<b>-</b>

**Note:**

1. Every student has to participate in the sports activities. A minimum 1 hour is fixed for sport activities either in the morning or evening. Weightage of Sports is given in General Proficiency & Ethics Syllabus.
2. Students are allowed to use single memory, non-programmable scientific calculator during exam. However, sharing of calculator and any other materials is not allowed.
3. Assessment of Professional Training – I, undergone at the end of fourth semester, will be based on seminar, viva – voce, report and certificate of Professional Training obtained by the student from the industry / institute / research lab / training center, etc.

**Deenbandhu Chhotu Ram University of Science & Technology, Murthal**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B.Tech. 3<sup>rd</sup> YEAR (SEMESTER – VI) BIOMEDICAL ENGINEERING**  
**Credit Based Scheme w.e.f. 2014-15**

Sr. No.	Course No.	Course Title	Teaching Schedule			Marks of Class Work	Exam. Marks		Total Marks	Credit	Duration of Exam.
			L	T	P		Theory	Practical			
1.	EE 312 B	CONTROL SYSTEM ENGINEERING (Common for 6 <sup>th</sup> sem BME, ECE & 5 <sup>th</sup> sem AEI)	3	1	-	25	75	-	100	4	3
2.	BME302B	INTRODUCTION TO BIOMATERIALS	3	1	-	25	75	-	100	4	3
3.	BME304B	MODELLING & SIMULATION	3	1	-	25	75	-	100	4	3
4.	BME306B	FIBRE OPTICS AND LASERS IN MEDICINE	3	1	-	25	75	-	100	4	3
5.	BME308B	MEDICAL IMAGING- I	3	1	-	25	75	-	100	4	3
6.	ECE310B	MICRO CONTROLLER BASED SYSTEM DESIGN (Common for BME & ECE)	3	1	-	25	75	-	100	4	3
7.	HUM302B	REPORT WRITING SKILLS (Common for all branches)	1	-	-	25	50	-	75	1	2
8.	BME322B	BIOMATERIAL LAB.	-	-	2	20	-	30	50	1	3
9.	BME324B	HEALTHCARE TECHNOLOGY & ENTREPRENEURSHIP WORKSHOP	-	-	2	20	-	30	50	1	3
10.	ECE 330 B	MICRO CONTROLLER LAB (Common for BME & ECE)	-	-	2	20	-	30	50	1	3
11.	HUM304B	ORAL PRESENTATION SKILLS (Common for all branches)	-	-	2	20	-	30	50	1	2
12.	GPBME302B	GENERAL PROFICIENCY & ETHICS	1	-	-	-	-	75	75	2	-
<b>TOTAL</b>			<b>20</b>	<b>6</b>	<b>8</b>	<b>255</b>	<b>500</b>	<b>195</b>	<b>950</b>	<b>31</b>	<b>-</b>

**Note:**

1. Every student has to participate in the sports activities. A minimum 1 hour is fixed for sport activities either in the morning or evening. Weightage of Sports is given in General Proficiency & Ethics Syllabus.
2. Students are allowed to use single memory, non-programmable scientific calculator during exam. However, sharing of calculator and any other materials is not allowed.
3. Each student has to undergo Professional Training of 4 weeks from the industry, institute, research lab, training centre etc. during summer vacation and its evaluation shall be carried out in the VII semester.

**Deenbandhu Chhotu Ram University of Science & Technology, Murthal**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B.Tech. 4<sup>th</sup> YEAR (SEMESTER – VII) BIOMEDICAL ENGINEERING**  
**Credit Based Scheme w.e.f. 2015-16**

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class Work	Examination Marks		Total Marks	Credits	Duration of Exam
			L	T	P		Theory	Practical			
1.	BME401B	BIOMEDICAL IMAGE PROCESSING	3	1	-	25	75	-	100	4	3
2.	BME403B	NUCLEAR MEDICINE RADIATION & SAFETY	3	1	-	25	75	-	100	4	3
3.	BME405B	MEDICAL IMAGING-II	3	1	-	25	75	-	100	4	3
4.	BME407B	HOSPITAL MANAGEMENT	3	1	-	25	75	-	100	4	3
5.		*OPEN ELECTIVE	4	0	-	25	75	-	100	4	3
6.	BME409B	BIOMEDICAL IMAGE PROCESSING LAB.	-	-	2	20	-	30	50	1	3
7.	BME411B	PROFESSIONAL TRAINING-II	-	-	2	50	-	-	50	2	-
8.	BME413B	PROJECT	-	-	4	100	-	-	100	4	-
<b>TOTAL</b>			<b>16</b>	<b>4</b>	<b>8</b>	<b>295</b>	<b>375</b>	<b>30</b>	<b>700</b>	<b>27</b>	

**\*LIST OF OPEN ELECTIVES**

1	MEI 623B	ENTREPRENEURSHIP	6	BT401B	BIOINFORMATICS
2	BME451B	MEDICAL INSTRUMENTATION	7	AE417B	MODERN VEHICLE TECHNOLOGY
3	ECE305B	CONSUMER ELECTRONICS	8	CE451B	POLLUTION & CONTROL
4	EE451B	ENERGY AUDIT	9	CSE411B	MANAGEMENT INFORMATION SYSTEM
5	EEE457B	ENERGY RESOURCES & TECHNOLOGY	10	IT413B	CYBER SECURITY

**Note:**

- Every student has to participate in the sports activities. A minimum 1 hour is fixed for sport activities either in the morning or evening. Weightage of Sports is given in General Proficiency & Ethics Syllabus.
- Students are allowed to use single memory, non-programmable scientific calculator during exam. However, sharing of calculator and any other materials is not allowed.
- Student will be permitted to opt for any one elective run by the other departments. However, the departments shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. The minimum strength of students should be 20 to run an elective course.
- Assessment of Professional Training-II, carried out at the end of VI semester, will be based on seminar, viva-voce, report and certificate of Professional Training obtained by the student from the industry / institute / research lab / training centre, etc.
- Project Coordinator will be assigned the project load of, maximum 2 hours per week including his own guiding load of 1 hour. However, the guiding teacher will be assigned maximum of 1 period of teaching load irrespective of number of students or groups under him / her. Project will commence in VII semester where the students will identify the Project problem, complete design, procure the material, start the fabrication, complete the survey etc., depending upon the nature of the problem. Project will continue in VIII semester.



**Deenbandhu Chhotu Ram University of Science & Technology, Murthal**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B.Tech. 4<sup>th</sup> YEAR (SEMESTER – VIII) BIOMEDICAL ENGINEERING**  
**Credit Based Scheme w.e.f. 2015-16**

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class Work	Examination Marks		Total Marks	Credits	Duration of Exam
			L	T	P		Theory	Practical			
1.	BME402B	INNOVATIVE BIOMEDICAL ENGINEERING	3	1	-	25	75	-	100	4	3
2.	BME404B	BIOLOGICAL CONTROL SYSTEMS	3	1	-	25	75	-	100	4	3
3.		DEPT. ELECTIVE-I	4	0	-	25	75	-	100	4	3
4.		DEPT. ELECTIVE-II	4	0	-	25	75	-	100	4	3
5.	BME424B	BIOLOGICAL CONTROL SYSTEMS LAB	-	-	2	20	-	30	50	1	3
6.	BME408B	SEMINAR	-	-	2	50	-	-	50	2	-
7.	BME413B	PROJECT	-	-	8	75	-	125	200	8	3
8.	GPBME402B	GENERAL FITNESS FOR THE PROFESSION	1	-	-	-	-	100	100	4	3
<b>TOTAL</b>			<b>15</b>	<b>2</b>	<b>12</b>	<b>245</b>	<b>300</b>	<b>255</b>	<b>800</b>	<b>31</b>	

DEPT. ELECTIVE – I			DEPT. ELECTIVE – II		
1.	BME442B	MEDICAL PHYSICS	1.	BME452B	NEURAL ENGINEERING
2.	BME444B	INTELLIGENT BIOINSTRUMENTATION	2.	BME454B	BIO-ELECTROMAGNETISM
3.	BME446B	PRINCIPLES OF BIOENGINEERING	3.	BME456B	BIONANOTECHNOLOGY
4.	BME448B	TISSUE ENGINEERING	4.	BME458B	BIO-MEDICAL ETHICS & DEVICE REGULATION

**Note:**

- Every student has to participate in the sports activities. A minimum 1 hour is fixed for sport activities either in the morning or evening. Weightage of Sports is given in General Fitness for the Profession Syllabus.
- Students are allowed to use single memory, non-programmable scientific calculator during exam. However, sharing of calculator and any other materials is not allowed.
- Project load will be treated as 2 hrs. per week for the project coordinator including his own guiding load of 1 hour. However, the guiding teacher will be assigned maximum of one period of teaching load irrespective of number of students / groups under him/her. Project involving design, fabrication, testing, computer simulation, case studies etc., which has been commenced by students in VII semester, will be completed in VIII semester.
- For the Course BME-428 (Seminar), a student will select a topic from emerging areas of Bio-Medical Engineering and study it thoroughly and independently. Later he will give a seminar talk on the topic.
- A team consisting of Dean of faculty, Chairperson of the Department and external examiner appointed by the University shall carry out the evaluation of the student for his/her General Fitness for the Profession.
- The minimum strength of students should be 20 to run an elective course.

**BME201B BIOCHEMISTRY**  
**B. Tech. Semester – III (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>

<b>Class Work</b>	<b>: 25 Marks</b>
<b>Examination</b>	<b>: 75 Marks</b>
<b>Total</b>	<b>: 100 Marks</b>
<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**Unit-I**

**Introduction to Biochemistry and Medicine:** Cell, Eukaryotic cell structure, functional role of each Organelle, Sub cellular Fractionation: Differential Centrifugation, Redox potentials & Oxidative phosphorylation, Transport of substances across biological membrane function.

**Unit-II**

**Enzymes (Proteins):** Chemical nature of enzymes (Proteins). Spectrophotometric measurement of enzymes (proteins), isolation methods, Study of enzyme properties, Diagnostic enzymes, Enzyme biotechnology

**Nucleic Acids:** Composition and functions of nucleic acids (A brief account) Genes, Outlines of DNA structure, Recombinant DNA and its applications

**Unit-III**

**Urine chemistry:** Chemical composition of urine under normal and abnormal conditions.

**Instrumentation:** Principles and applications of photometry, spectrophotometry fluorometry, Nephelometry and turbidimetry, Biochemical analysis carried out in the estimation of blood constituents like glucose, urea, creatinine, protein, cholesterol, bilirubin etc., Separation of Serum Proteins by electrophoresis, Automation in biochemical analysis.

**Unit-IV**

**Acid base homeostasis:** Acids, bases, measurement of pH and glass electrodes, Role of kidney and lungs in acid base balance, Biochemical measurement of acid base status of patients, Blood gas analyzer, disorders of acid-base balances.

**Isotopes:** Definitions, Units, radioactive isotopes, Applications of isotopes in life sciences and medicine.

**TEXT BOOKS**

1. Biochemistry- Dr. U. Satyanarayana (Books & Allied pvt. Ltd.)
2. Instant Notes on Biochemistry-Hooper et.al. (BIOS Scientific Publishers)
3. Enzymes-Biochemistry, Biotechnology, Clinical chemistry-Trenor Palmer (Woodhead Publication 2007)

**REFERENCE BOOKS**

1. Organic Analytical chemistry-Theory and Practice by Jagmohan. (Narosa Publishing house)
2. Harper's Biochemistry, 25<sup>th</sup> edition (McGraw Hill Publications)
3. Fundamentals of Biochemistry-J.L. Jain, Sanjay Jain (S.Chand Publications)
4. Organic Spectroscopy-Principles and Applications by Jagmohan, (Narosa Publishing House)
5. A textbook of Biochemistry-A.V.S.S. Rama Rao (UBS Publishers & Distributors)

**Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.



## BME205B HUMAN ANATOMY AND PHYSIOLOGY

### B. Tech. Semester – III (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit-I

**Introduction to the Human Body:** Eleven systems of the human body, Homeostasis, Human body planes and sections. Polarization & depolarization of cell. Types of tissues & their origins with functions in brief. Membranes – Epithelial, Mucous, Serous, Cutaneous and Synovial.

#### Unit-II

**Cardiovascular, Respiratory & Alimentary System:** Heart, conductive tissue of heart, cardiac cycle, heart valves, systemic & pulmonary circulation, Transmission of cardiac impulse, blood pressure. Blood: composition of blood-blood cells & their functions, Respiratory system: respiration external (ventilation), Exchange in gases in the alveoli, artificial respiration. Alimentary system: all organs of the digestive system, other secretions & main functions.

#### Unit-III

**Nervous & Excretory System:** Different parts, their functions, reflex action & reflex arc. Function of sympathetic nervous system, nervous conduction & action potentials. Excretory system: Structure of Nephron, formation of urine & function of kidneys, urinary bladder, urethra, internal/external sphincters.

#### Unit-IV

**Reproductive, Endocrine & Sensory System:** (male & female). Endocrine system: all glands, their secretions, control of secretions. Sense organs: Eye, Ear, Integumentary system: structure, type and functions of skin.

#### TEXT BOOKS

1. Anatomy and physiology in health and illness by: Ross and Wilson (ELBS Publishers)
2. Human Physiology by A. Vander, J. Sherman and D. Luciano (Mc Graw Hill Publishers)

#### REFERENCE BOOKS

1. Manual of Human Dissection by Charles E Tobin (Mc Graw Hill, Edition 4, 1961)
2. Modern Physiology and Anatomy of Nurses by J Gibson (Black Well, 1981)
3. Physiology of human body by Guyton. (Prism books)
4. Principles of Anatomy and Physiology by Tortora and Grabowski. (Haper Collin publishers)
5. Biosimulation: simulation of living systems by Daniel. A. Beard Cambridge texts in Biomedical Engineering, 2012 (Cambridge University Press)

#### Note:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

## BME207B BIOMEDICAL MEASUREMENTS & INSTRUMENTATION

### B. Tech. Semester – III (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

#### Unit-I

**Biomedical Instrumentation:** Introduction and classification of biomedical instrumentation systems, components and design considerations of a biomedical instrumentation system, desirable characteristics in designing of biomedical instrumentation system, performance parameters of instruments.

**Neuromuscular and Sensory systems:** Description of Human Brain, Electroencephalogram (EEG) and Electromyogram (EMG) measurement and recording, Block diagram description, evoked potentials, nerve conduction studies (NCS), biofeedback instrumentation, galvanic skin response (GSR) measurements.

#### Unit-II

**Blood Pressure measurement:** Characteristics of blood pressure measurement, types: Direct and Indirect methods of blood pressure measurement

**Patient monitoring system:** Objective of patient monitoring system, Types: Cardiac Monitors, bedside monitors, central monitors. Computer assisted patient monitoring system, apnea detectors.

#### Unit-III

**Electrical Stimulators for Human Body:** Stimulators, types of stimulators: galvanic, faradic, surge faradic, interrupted galvanic, strength duration curve (S-D curve), respirators and their types.

**Biomedical Recorders:** Principles and Characteristics of a recording system, ECG recorders and their types: single channel, three channel, stress test (TMT) vector cardiograph, Holter monitors, Strip charts recorder, stylus recorders, single point recorder, UV recorder, X-Y recorder, thermal recorders, and Magnetic tape recorder.

#### Unit-IV

**Electrical Safety of Medical Equipment and Patient:** Patient safety, classification of medical devices and their safety standards, leakage current, micro, macro shock, different types of safety circuits for medical equipments, measures to reduce shock hazards.

**Special Techniques for measurement of Non-electrical biological parameters:** Electrical Impedance Plethysmography (EIP), Photoplethysmograph (PPGs), respirometers.

#### TEXT BOOKS

1. Principles of Medical Electronics and Biomedical Equipments: C Raja Rao and SK Guha, (University Press India Limited)
2. Biomedical Instrumentation and Measurements: R Anandanrajan (Prentice Hall of India)

#### REFERENCE BOOKS

1. Principles of Biomedical Instrumentation and measurement: Richard Aston (Merill Publishers)
2. Handbook of Biomedical Instrumentation: RS Khandpur (Tata McgrawHill publishers)
3. Introduction to Biomedical Instrumentation: Mandeep Singh (Prentice Hall of India)

#### Note:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

**ECE203B ANALOG ELECTRONICS**  
**B. Tech. Semester – III (Biomedical Engg.)**

**L T P Credits**  
**3 1 - 4**

**Class Work : 25 Marks**  
**Examination : 75 Marks**  
**Total : 100 Marks**  
**Duration of Examination : 3 Hours**

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**Section I**

**Unit 1: BASIC SEMICONDUCTOR AND PN-JUNCTION THEORY:**

Introduction, Atomic Structure, Covalent Bond, Metals, Insulators & Semiconductors, Effect of Temperature on Conduction, Drift Current, Donor & Acceptor Impurities in Semiconductor, Law Of Mass Action, Hall's Effect, Hall Coefficient & Mobility, Numerical.

**Unit 2: CHARACTERISTICS OF DIODE:**

PN-Junction, Construction Types, Unbiased Junction, Biased Junction, Space Charge Region, Diode Characteristics & Parameters, Diode Capacitance, Diode Resistance, DC And AC Load Lines, Diode Testing, Zener And Avalanche Breakdown Diodes, Tunnel Diode, Temperature Characteristics of Diode, Reverse Recovery Time, Switching Characteristics of Diode.

**Section II**

**Unit 3: DIODE APPLICATIONS:**

Half Wave, Full Wave Center Tapped, Full Wave Bridge (Rectification), Series Clipping Circuit, Shunt Clipping Circuit, Clamping Circuit, Bridge Voltage Doubler, Filtering Circuit Using Capacitor & Inductor.

**Unit 4: JUNCTION TRANSISTOR:**

Introduction, Construction Of Junction Transistor, Circuit Symbols, Transistor Operation, Unbiased Transistor, Operation Of Biased Transistor, Transistor Current Components, DC & AC Load Line, Operating Point, Transistor Configuration CB, CE, CC, Input/Output Characteristics, Early Effect (Base Width Modulation), Eber's-Moll-Model of Transistor, Maximum Rating of Transistor, Transistor Testing, Transistor as an Amplifier, Transistor as Oscillator.

**Section III**

**Unit 5: BJT BIASING:**

Bias Stability, Instability Due To  $\beta$ , Thermal Stability, Stability Factor, Fixed Biased Circuits, Effect of Emitter Resistor, Collector to Base Bias, Voltage Divide Biasing, Advantage & drawbacks of Biasing Techniques, Stability Factor calculation of Biasing Techniques, Bias Compensation by various device, Thermal Runway, Transistor Dissipation, Thermal Resistance, Condition of Thermal Stability

**Unit 6: SMALL SIGNAL CIRCUIT:**

Two Port Network, Hybrid (H-Parameter) Model, Typical Values of H-Parameter Model, Conversion of CE, CB, CC Configuration to Equivalent Hybrid Model, CB Circuit Analysis, CE circuit with & without  $R_E$  analysis, CC circuit analysis, Analysis of CE, CB & CC Configuration with approximate Hybrid Model, Miller's Theorem, Dual of Miller Theorem.

**Section IV**

**Unit 7: HIGH FREQUENCY ANALYSIS:**

Hybrid Pi Model, CE Short Circuit Gain, Frequency Response, Alpha Cut off Frequency, Gain Bandwidth Product, Emitter Follower at High Frequencies..

**Unit 8: FET:**

Low Frequency FET Amplifiers, Transfer Characteristics of FET, MOSFET, Enhancement Mode, Depletion Mode of FET, Circuit Symbol of MOSFET, V Introduction, The Junction FET, Basic Construction, Operation, P- Channel FET, N-Channel FET, High Frequency Model of FET, -MOSFET.

**Reference Books:**

- |                                  |                                       |
|----------------------------------|---------------------------------------|
| 1. Basic Electronics             | By Debashion DE. -- Pearson.          |
| 2. Electronics Device & Circuit, | By Robert Boylestad, Louis Nashelsky. |
| 3. Electronics Device Circuit    | By David.A.Bell -- Oxford             |
| 4. Integrated Electronics        | By Millman Halkias -- TMH.            |
| 5. Electronics Device & Circuit  | By Dharam Raj Cheruku -- Pearson.     |

**NOTE:**

In the Semester examination, the examiner will set 08 questions in all selecting two from each Section & one from each unit. The candidates will be required to attempt five questions in all atleast one from each section. All questions carry equal marks.

## EE251B NETWORK ANALYSIS AND DESIGN

### B. Tech. Semester – III (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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- UNIT 1:** **CIRCUIT ANALYSIS:** Fundamentals of Circuits, methods of analysis of DC & AC circuits. Network Theorems in DC & AC circuits: Mesh analysis, nodal Analysis, thevenin's & Norton's theorem, Superposition Theorem, Maximum Power transfer theorem.
- UNIT 2:** **TRANSIENT RESPONSE:** Laplace Transform: Review of properties and applications of Laplace transform of complex waveform. Transient Response of RC, RL, RLC to various excitation signals such as step, ramp, impulse and sinusoidal excitations using Laplace transform.
- UNIT 3:** **TWO-PORT NETWORKS:** Characteristics and parameters of two port networks, Network Configurations, short-circuit Admittance parameters, open-circuit impedance parameters, Transmission parameters, hybrid parameters, Inter-relationships between parameters of two-port network sets, Inter-connection of two port networks.
- UNIT 4:** **FILTERS:** Filter fundamentals, classification of Filter, Analysis & design of prototype high-pass, prototype low-pass, prototype band-pass, and prototype band-reject Filter.  
**TOPOLOGY:** Principles of network topology, graph matrices, network analysis using graph theory

#### TEXT BOOKS

1. Network Theory Analysis & Synthesis: Smarajit Ghosh; PHI.
2. Network Analysis & Synthesis: F.F.Kuo; John Wiley & Sons Inc.

#### REFERENCE BOOKS

1. Introduction to modern Network Synthesis: Van Valkenburg; John Wiley
2. Network Analysis: Van Valkenburg; PHI
3. Basic circuit theory:Dasoer Kuh; McGraw Hill.
4. A Course in Electrical Circuit Analysis by Soni & Gupta; Dhanpat Rai Publication.
5. Circuit Analysis: G.K. Mithal; Khanna Publication.
6. Networks and Systems: D.Roy Choudhury; New Age International
7. Engineering Circuit Analysis; Hayat & Kemmerley TMH.

**Note:** Eight questions are to be set - at least two from each unit. Students have to attempt five questions in all, restricting at least one from each unit.

**BME221B    BIOCHEMISTRY LAB**  
**B. Tech. Semester – III (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**LIST OF EXPERIMENTS**

1. Carbohydrates: Estimation of Blood Glucose
2. Proteins: Test for Albumin and globulin.
3. Estimation of Blood Urea
4. Estimation of Blood Cholesterol
5. Liver function test: *Serum Glutamic Oxaloacetic Transaminase* (SGOT)
6. Liver function test: *Serum Glutamic Pyruvic Transaminase* (SGPT)
7. Alkaline phosphates test
8. Study of abnormal urine content :bile pigment, bile salt
9. Estimation of total serum bilirubin
10. Estimation of pH and acidity test for the given biological solution

**Note:** Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the department as per the scope of the syllabus.



## BME223B BASICS OF BIOMEDICAL ENGINEERING LAB

### B. Tech. Semester – III (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### LIST OF EXPERIMENTS

1. Introduction to different type of electrodes – surface, suction, floating, disposable, needle and microelectrodes.
2. To study the placement of EEG electrodes, recording of EEG waveform and its interpretation using 32 channel PSG system.
3. Recording of ECG waveform from 12 limb leads and the interpretation of ECG waveform.
4. To study the placement of EMG electrodes, recording of EMG waveform and its interpretation
5. Demonstration of sphygmomanometer and stethoscope. Measurement of systolic and diastolic arterial blood pressure using sphygmomanometer.
6. Realization of Nerve Muscle Stimulator
7. Realization of Wheatstone bridge transducers of strain gauge.
8. To study Troubleshooting of ECG machine
9. Realization of thermistor, its characteristics and its linearization.
10. Hospital visit for various imaging modalities (X ray, CT, MRI and PET)

**Note:** Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the department as per the scope of the syllabus.

**BME225B HUMAN ANATOMY AND PHYSIOLOGY LAB****B. Tech. Semester – III (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**LIST OF EXPERIMENTS**

1. To study the
  - a) T.S. of Pancreas Gland
  - b) T.S. of Liver Gland
  - c) T.S. of Thyroid Gland
  - d) T.S. of Adrenal Gland
  - e) T.S. of Spinal cord
2.
  - a) To study the effects of various trends of solution on RBCs
  - b) To study the effect of acid and alkali on RBCs
  - c) Effect of chloroform on RBCs
3. To study estimation of erythrocyte sedimentation rate(ESR)
4. Estimation of hemoglobin percentage by haemometer
5. To determine the total no. of RBCs in Human blood
6. To determine the total no. of WBCs in Human blood
7. To prepare the blood film of your own blood. Stain it and study the blood picture and identify the various blood cells
8. To determine your own blood group
9. To determine the bleeding and clotting time of blood
10. To study models of sensory organs available in the lab

**Note:** Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the department as per the scope of the syllabus.

**ECE223B      ANALOG ELECTRONICS LAB**

**B. Tech. Semester – III (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>Practical</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Exam.</b>	<b>: 3 Hours</b>

**LIST OF EXPERIMENTS:**

- 1 Study of half wave and full wave rectifiers
- 2 Study of power supply filter.
- 3 Study of diode as a clipper and clamper.
- 4 Study of zener diode as a voltage regulator.
- 5 Study of CE amplifier for voltage,current and Power gains input,output impedances.
- 6 Study of CC amplifier as a buffer.
- 7 To study the frequency response of RC coupled amplifier.
- 8 Study of transistor as a constant current source in CE configuration .
- 9 To study characteristics of FET.
- 10 Study of FET common source amplifier.
- 11 Study of FET common drain amplifier.
- 12 Graphical determination of small signal hybrid parameter of bipolar junction transistor.
- 13 Study and design of a DC voltage doubler.

**Note:**

- 1 Total ten experiments are to be performed in the semester.
- 2 At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed and set by the concerned institution as per the scope of the syllabus.

**ME 217 B WORKSHOP**  
**B. Tech. Semester – III (Common for all branches)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 50 Marks</b>
-	-	2	2	<b>Total</b>	<b>: 50 Marks</b>

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Each student has to undergo a workshop atleast 4 weeks (80-100 hours) at the end of II semester during summer vacations. **Out of the four weeks, two weeks would be dedicated to general skills and two weeks training for specialized discipline/department.** The evaluation of this training shall be carried out in the III semester

**LIST OF JOBS TO BE CARRIED OUT DURING THIS PERIOD**

1. To study and prepare different types of jobs on machine tools (lathe, shaper, planer, slotter, milling, drilling machines).
2. To prepare lay out on a metal sheet by making and prepare rectangular tray, pipe shaped components e.g. funnel.
3. To prepare joints for welding suitable for butt welding and lap welding.
4. To study various types of carpentry tools and prepare simple types of wooden joints.
5. To prepare simple engineering components/ shapes by forging.
6. To prepare mold and core assembly, to put metal in the mold and fettle the casting.
7. To study of CNC lathe, CNC Milling and EDM Machines.
8. Any work assigned in electrical workshop, computer hardware/language lab, electronics workshop, biomedical hardware, automobile workshop etc.

**This student will prepare job(s)/project as an individual or in a group using workshop in house infrastructure.**

The student shall submit a typed report.

Training will be evaluated on the spot out of 20 marks.

The report will be evaluated in the III Semester by a Committee consisting of two teachers.

The student will interact with the committee through presentation to demonstrate his/her learning. The basis of evaluation will primarily be the knowledge and exposure of students on different kinds of Machines/instruments/tools/ skills etc. The committee will evaluate out of 30 marks.

The committee shall submit the awards out of 50 marks.

## BME202B BIOMEDICAL SIGNAL PROCESSING

### B. Tech. Semester – IV (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Theory</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit-I

**Bio-Signals:** Introduction, Characteristics of Bio - Signals, Types of Signals, Measurement, Transformation and reduction, computation of signal parameters that are diagnostically significant, stationary and non - stationary bio - signals, Application areas of Bio - Signals analysis - EEG, ECG, Phonocardiogram, Spiro Gram, Evoked Signals.

#### Unit-II

**Laplace and Z Transform:** Laplace transform introduction, definition, convergence. Inverse laplace transform and their application to system analysis Z transform introduction, definition, convergence. Inverse Z transform, Analysis of discrete time systems using Z transforms. Solutions of differential equations. Transfer functions and stability.

**Fourier transform:** Energy spectrum, Properties (without proof), Gibbs phenomena, Auto and cross correlation. Discrete Fourier transforms. Properties (without proof), Inverse DFT, FFT, Decimation in time and decimation in frequency.

#### Unit-III

**Systems:** Classification of systems, Impulse response, transfer function and frequency response of first- and second order systems, characteristics of linear time invariant systems. Convolution, Auto-correlation and Cross-correlation.

**Digital signals and systems:** Classification of systems causal; time varying, time invariant, lumped. Discrete time system, impulse and frequency response. Pulse transfer function Introduction to digital signals systems. Convolution, Auto-correlation and cross-correlation

#### Unit-IV

**Biomedical Signal Processing:** Data reduction Techniques, Data acquisition and conversion system, Power spectrum analysis, Sampling Theorem, aliasing Nyquist criteria, ADC's and DAC's. Use of Matlab signal processing toolbox on various real bio-medical signals.

**Digital Filters:** Digital filter design, introduction, Realization of Digital system, canonical form, direct form & Cascade Realization of IIR & FIR Filters. Design of IIR & FIR Filters, Low pass, High Pass, Band Pass Filters using windows – Kaiser Windows.

#### TEXTBOOKS

1. Digital signal processing, Proakis (PHI Publishers)
2. Signal Analysis By R. P. Singh, Second edition (Tata McGraw – Hill Publishers)

#### REFERENCE BOOKS

1. Biomedical Signal Processing by Metin Akay (Academic press)
2. Biomedical Signal Processing by Tompkins (Academic press)
3. Theory and Application of Digital Signal Processing by Rabiner and Gold (EEE pub)
4. Engineering Electronics by Mauro R (Prentice – Hall Publisher)
5. Malmivuo, J. and Plonsey, R. Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields, (Oxford University Press, New York, 1995)

#### Note:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

## BME204B BIOMEDICAL EQUIPMENTS-I

### B. Tech. Semester – IV (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Theory</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit -I

**Patient Safety and monitoring systems:** Electric Shock Hazards, Leakage Currents, and Safety Codes for Electro Medical Equipments, Electrical Safety Analyzer, and Testing of Biomedical Equipment. System concepts, Cardiac monitor, selection of system parameters, Bedside monitors, Central monitors, Heart and Pulse rate meter, Catheterization laboratory instrumentation.

#### Unit -II

**Oximeters & Blood Flow meters:** Oximetry, Ear Oximeter, Pulse Oximeter, Skin Reflectance Oximeters, Intravascular Oximeter. Spirometry, Electromagnetic Blood flow meters, Types of electromagnetic Blood Flow meters, Ultrasonic Blood Flow meters, Blood Flow meter and Laser Doppler Blood Flow meter.

#### Unit -III

**Clinical Laboratory Instruments and Audiometers:** Medical Diagnosis with chemical tests, Spectrophotometry, Spectrophotometer Type instruments, Colorimeters, Automated Biochemical Analysis Systems, Clinical Flame photometers, Mechanism of Hearing, Measurement of sound, Basic Audiometer, Pure Tone Audiometer, Speech Audiometer, Audiometer System Bekesy, Evoked Response Audiometry System, Calibration of Audiometers.

#### Unit -IV

**Blood -Cell Counters & Gas Analyzers:** Types of Blood cells, Methods of Cell Counting, Coulter Counters, Automatic Recognition and Differential Counting of Cells. Blood pH; pCO<sub>2</sub>; PO<sub>2</sub> measurement, blood gas analyzer.

#### **TEXT BOOKS**

1. Handbook of Biomedical Instrumentation by R. S. Khandpur (Tata McGraw - Hill, New Delhi)
2. Biomedical Instrumentation and Measurements by Leslie Cromwell, Fred J. Weibell (Erich A. Pfeiffer)

#### **REFERENCE BOOKS**

1. Encyclopedia of Medical Devices and Instrumentation by John G. Webster Vol. I, II, III, IV.
2. Introduction to Biomedical Equipment Technology by Carr Brown (Pearson Education Publications)
3. Medical Instrumentation. Application and Design by John Webster (John Wiley and Sons. Inc., New York)

#### **Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

## BME206B BIOMEDICAL STATISTICS

### B. Tech. Semester – IV (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
3	1	-	4

<b>Class Work</b>	<b>: 25 Marks</b>
<b>Theory</b>	<b>: 75 Marks</b>
<b>Total</b>	<b>: 100 Marks</b>
<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit-I

**Introduction to probability:** random experiments, concept of probability, axioms and theorem of probability, conditional probability, Bayes' theorem, fundamental principle of counting, continuous & discrete distributions, special probability distributions.

#### Unit-II

**Sampling and estimation theory:** Scope & Purpose of statistics, population and sample, sample mean and variance, frequency distributions, computation of mean, variance and moments for grouped data. Estimation theory: point estimates and interval estimates, confidence interval estimates, maximum likelihood estimates.

**Tests of hypotheses and significance:** statistical hypothesis, null hypothesis, type I and type II errors, level of significance, one tailed and two tailed tests, P value, special test of significance for large and small samples, relationship between estimation theory and hypothesis testing, quality control charts, Chi-square test for goodness of fit, students t-test, relationship between F &  $X^2$  test

#### Unit-III

**Curve fitting, regression and correlation:** regression, method of least squares, multiple regression, generalized correlation coefficient, probability interpretation of regression and correlation, sampling theory of regression and correlation.

**Analysis of variance:** purpose of analysis of variance, one-way classifications & two way classifications, experimental design.

#### Unit-IV

**Experimental design:** Clinical trials-study design, organization and planning, randomized clinical trials, sample sizes for observational studies, monitoring surveys, event survival analysis.

#### TEXTBOOKS

1. Fundamentals of Biostatistics by Bernard Rosner 7<sup>th</sup> ed., 2010, (BROOKS/ COLE Cengage learning)

#### REFERENCE BOOKS

1. Modern Medical Statistics: A Practical Guide by Brian S. Everitt, (Edward Arnold, 2003)
2. Biostatistics by S. Prasad, (S.Chand Publishers)
3. Biostatistics by Negi, K.S., (Rastogi Publisher)
4. Introduction to Biostatistics by P.K. Banerjee, (S.Chand Publishers)
5. Statistics : A Biomedical Introduction by Byron Wm. Brown, and Myles Hollander, (Wiley - Interscience, 1977)
6. Statistical Methods for the Analysis of Biomedical Data, 2nd Edition by Robert F. Woolson, and William R. Clarke, (Wiley - Interscience, 2nd edition, 2002)
7. An Introduction to Medical Statistics, Third Edition, Martin Bland, (Oxford Medical Publications)

#### Note:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

## BME 208B MEDICAL INFORMATICS

### B. Tech. Semester – IV (Biomedical Engg.)

L	T	P	Credits
3	1	-	4

Class Work	: 25 Marks
Theory	: 75 Marks
Total	: 100 Marks
Duration of Examination	: 3 Hours

#### Unit-I

**Introduction to Medical Informatics:** Introduction to medical informatics, historical review of development of computers and informatics, structure of medical informatics, Application and importance of Medical informatics, Natural language processing, Knowledge and Models, Information and Communication Systems, Medical Computer Systems - Systematization of Computer Applications.

#### Unit-II

**Management of Medical data:** Classification of medical data and information, uncertainty of medical data, examples of classification systems. Database management, development of database management system for a hospital environment, Security Issues in Computer and Internet: Different types of security hazards and methods for prevention of these hazards. Information Safety and Security in Health Care Information Systems.

#### Unit-III

**Applications of Computers in Medical Field:** Computers in Clinical Laboratory: Role and Applications of different equipments employing computer in medical laboratory. Computers for Critically ill/handicapped: Role and Applications of different devices for handicaps and severely ill patients.

Health Care Information Systems: Introduction, Electronic Patient Record, Electronic referral - consulting system, Primary Care Systems, Clinical Departmental Information Systems, Clinical Support Systems, Nursing Information Systems.

Evaluation of health information systems and Technology. Introduction to Bio-informatics and computational biology.

#### Unit-IV

**Computers & Artificial Intelligence:** Medical decision - support systems, Medical Expert System. Rationales for computer - aided decision making, Decision models - quantitative models, qualitative models, Knowledge Based systems - characteristic features of KBS, knowledge representation in KBS, Artificial intelligence methods

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#### TEXTBOOKS

1. Computers in Medicine: Progress in medical informatics by R.D.Lele, (Tata McGraw Hill 2005)
2. Handbook of Medical Informatics by Bohn Stafleu, J. H. van Bommel and M. A. Musen (eds.) (Van Loghum, Houten 1997)

#### REFERENCE BOOKS

1. Guide to Medical Informatics, the Internet and Telemedicine by Enrico Coiera (Chapman & Hall Medical, London 1997)
2. The Biomedical Engineering Handbook by Bronzino JD (IEEE Press, 2000)

#### Note:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.



## ECE201B DIGITAL ELECTRONICS

### B. Tech. Semester – IV (Biomedical Engg.)

**L T P Credits**  
**3 1 - 4**

**Class Work : 25 Marks**  
**Theory : 75 Marks**  
**Total : 100 Marks**  
**Duration of Exam. : 3 Hours**

#### Section I

##### Unit 1: FUNDAMENTALS OF DIGITAL TECHNIQUES:

Digital signal, logic gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Boolean algebra. Review of Number systems. Binary codes: BCD, Excess-3, Gray, EBCDIC, ASCII, Error detection and correction codes.

##### Unit 2: COMBINATIONAL DESIGN USING GATES:

Design using gates, Simplifications of SOP and POS Boolean Expressions, Karnaugh map up to four variables.

#### Section II

##### Unit 3: COMBINATIONAL DESIGN USING MSI DEVICES :

Multiplexers and Demultiplexers and their use as logic elements, Decoders, Adders / Subtractors, BCD arithmetic circuits, Encoders, Code Converters, Decoders / Drivers for display devices.

##### Unit 4: SEQUENTIAL CIRCUITS:

Flip Flops : S-R, J-K, T, D, master-slave, edge triggered, shift registers, sequence generators, Counters, Asynchronous and Synchronous Ring counters and Johnson Counter, Design of Synchronous and Asynchronous sequential circuits.

#### Section III

##### Unit 5: DIGITAL LOGIC FAMILIES:

Switching mode operation of p-n junction, bipolar and MOS. devices. Bipolar logic families:RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families. Tristate logic, Interfacing of CMOS and TTL families.

##### Unit 6: SEMICONDUCTORS MEMORY DEVICES:

Memory organizations, Characteristics of memory devices, Classifications of semiconductors memories.

#### Section IV

##### Unit 7: A/D AND D/A CONVERTERS:

Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters : Quantization, parallel -comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs.

##### Unit 8: PROGRAMMABLE LOGIC DEVICES:

PLA, PAL, FPGA and CPLDs.

#### TEXT BOOKS

1. Modern Digital Electronics(Edition III) : R. P. Jain; TMH
2. Digital Electronics: Green; Pearson

#### REFERENCE BOOKS

1. Digital Integrated Electronics : Taub & Schilling; MGH
2. Digital Principles and Applications : Malvino & Leach; McGraw Hill.
3. Digital Design : Morris Mano; PHI.

#### Note:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each Section & one from each unit. The candidates will be required to attempt five questions in all atleast one from each section. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However , sharing/exchange of calculator are prohibited in the examination.
3. Electronics Gadgets including Cellular Phones are not allowed in the examination.

## ECE206B ANALOG ELECTRONICS CIRCUITS

### B. Tech. Semester – IV (Biomedical Engg.)

L T P Credits  
3 1 - 4

Class Work : 25 Marks  
Theory : 75 Marks  
Total : 100 Marks  
Duration of Exam. : 3 Hours

#### Section I

##### Unit 1: MULTISTAGE AMPLIFIER:

RC Coupled Transistor Amplifier, Lower & Upper Cut off Frequency, Frequency Response curve & Bandwidth, Transformer Coupled Amplifier, Direct Coupled Amplifier, Cascode Amplifier, Darlington Pair Amplifier, Distortion In Amplifiers.

##### Unit 2: FEEDBACK AMPLIFIERS:

Feedback concept , Transfer Gain with Feedback, General Characteristics of Negative Feedback, Advantages & disadvantages, Input And Output Resistance, Voltage Series Feedback topology, Voltage Shunt, Current Series & Current Shunt topology ,Equivalent circuit for each topology, Effects of Negative Feedback.

#### Section II

##### Unit 3: OSILLATORS:

Introduction, Barkhausen Criterion, Oscillator with RC Feedback circuit (RC Phase Shift, Wien Bridge), Tuned Collector, Tuned Base Oscillator, LC Feedback circuits (Hartley, Colpitts), Condition for Sustained Oscillations & Frequency of Oscillations, Crystal Oscillator.

##### Unit 4: POWER AMPLIFIER:

Definition, Application & Types of Power Amplifiers, Amplifier Classes of Efficiency (Class - A, B, AB, C), Push Pull Amplifiers, Distortion in Simple & Push Pull Amplifier, Complementary Push Pull Amplifier, Integrated Circuit Power Amplifier , Introduction to MOSFET & CLASS D Power Amplifier.

#### Section III

##### Unit 5: VOLTAGE REGULATORS:

Voltage Regulation, Basic Series Regulators, Basic Shunt Regulators, Power Supply Parameters, Basic Switching Regulators, Step up Configuration, Step down Configuration, IC Voltage Regulator, SMPS.

##### Unit 6: SWITCHING CIRCUIT:

Switching action & Characteristics of a Transistor, Switching Times in Transistor, Multivibrators, Astable Multivibrator, Monostable Multivibrator, Bistable Multivibrator, 555 Timer, Monostable & Astable Operation with 555 Timer

#### Section IV

##### Unit 7: A/D CONVERTERS:

Basic Principle of DAC & ADC, Types of DAC Circuits: Resistor Divider, R/2R Ladder network, Types of ADC circuits: Parallel Comparator, Counter type, Successive approximation & Dual Slope, Specifications.

##### Unit 8: SPECIAL SEMICONDUCTOR DEVICES:

Optoelectronic Devices, Photoconductors, Photo Diode, Photo Transistor, Photo Voltaic Sensor, Photo Emission, LED, LCD, Laser Diode, Schottky Diode, SCR, TRIAC, DIAC, UJT, Single Electron Transistor. Infrared LEDs, IGBT, Opto Coupler.

#### REFERENCE BOOKS

1. Electronics Device & Circuit, By David.A. Bell - Oxford University Press.
2. Electronics Device & Circuit, By Theodore F. Bogart, Jeffrey.S.Bealey,Guillermo Rico - Pearson.
3. Electronics Device & Circuit, By Robert Boylestad ,Louis Nashelsky.
4. Electronics Device, By Floyd , Pearson.
5. Intgrated Electronics, By Millman Halkias - TMH.
6. Electronics Device & Circuit, By Sanjeev Gupta.
7. Electronics Device & Circuit, By I. J. Nagrath - PHI
8. Electronic Principles, By Albert Malvino.

**Note:** In the Semester examination, the examiner will set 08 questions in all selecting two from each Section & one from each unit. The candidates will be required to attempt five questions in all atleast one from each section. All questions carry equal marks.

**GES 201B ENVIRONMENTAL STUDIES**  
**B. Tech. Semester – III/IV (Common for all Branches)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>	<b>Examination</b>	<b>: 75 Marks</b>
<b>3</b>	<b>--</b>	<b>--</b>	<b>0</b>	<b>Total</b>	<b>: 75 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

**UNIT – I** The Multidisciplinary nature of environmental studies, Definition, scope and importance.  
Need for Public awareness

**UNIT – II** **NATURAL RESOURCES:**

Renewable and non-renewable resources:

Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation: deforestation, case studies, Timber exploitation, mining, dams and their effects and forests tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources; case studies.
- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
  - Role of an individual in conservation of natural resources.
  - Equitable use of resources for sustainable lifestyles.

**UNIT- III** **ECOSYSTEMS:**

- Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following eco-system:
  - a) Forest ecosystem, Grassland ecosystem, Desert ecosystem.
  - b) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

**UNIT- IV** **BIODIVERSITY AND ITS CONSERVATIONS:**

- Introduction – Definition: Genetic, species and ecosystem diversity.
- Biogeographically classification of India.
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India.

**UNIT – V** **ENVIRONMENTAL POLLUTION:**

Definition, causes, effects and control, measures of:

- Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal Pollution, Nuclear hazards
- Solid waste management: Causes effects and control measures of urban and industrial wastes.
  - Role of an individual in prevention of pollution.
  - Pollution case studies.
  - Disaster management: Floods, earthquake, cyclone and landslides.

**UNIT – VI SOCIAL ISSUES AND THE ENVIRONMENT:**

- a) From unsustainable to sustainable development
- b) Urban problems related to energy
- c) Water conservation, rain water harvesting, watershed management
- d) Resettlement and rehabilitation of people; its problems and concerns, case studies
- e) Environmental ethics: Issues and possible solutions
- f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case studies
- g) Wasteland reclamation, Consumerism and waste products
- h) Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act
- i) Issues involved in enforcement of environmental legislation, Public awareness

**UNIT – VII** Human population and the Environment., Population growth, variation among nations.  
Population explosion – Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV/ AIDS, Woman and Child Welfare.  
Role of Information Technology in Environment and human health.  
Case Studies.

**REFERENCES:**

1. Agarwal, K.C. 2001, Environmental Biology, Nidi Pub. Ltd. Bikaner.
2. Bharucha, Franch, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380013, India .
3. Brunner R.C. 1989, Hazardous Waste Incineration, Mc. Graw Hill Inc. 480p.
4. Clark R.S., Marine Pllution, Slanderson Press Oxford (TB).
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Pub. House, Mumbai. 1195p.
6. De A.K., Environmenal Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment @.
8. Gleick, H.P., 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security, Stockholm Env. Institute, Oxford Univ., Press 473p.
9. Hawkins R.E. Encyclopedia of Indian Natural History, Bomaby Natural History Society, Bombay (R).
10. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
11. Jadhav, H & Bhosale, V.M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Helhi 284p.
12. Mckinney, M.L. & Schoch, RM 1996, Environmental Sciences Systems & Solutions, Web enhanced Edition 639p.
13. Mhaskar A.K., Mater Hazardous, Tekchno-Sciences Publications (TB).
14. Miller T.G. Jr. Environmental Science, Wadsoworth Publishing Co. (TB).
15. Odum, E.P. 1971, Fundamentals of Ecology, W.B. Saunders Co. USA, 574p.
16. Rao M.N. & Dutta, A.K. 1987, Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd., 345p
17. Sharma, B.K., 2001, Environmental Chemistry, Goel Publ. House, Meerut.
18. Survey of the Environment, The Hindu (M).
19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Sciences (TB).
20. Trivedi, R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II Enviro Mdiea (R).
21. Trividi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol I and II Enviro Media (R).
22. Trividi R.K. and P.K. Goel, Introduction to air pollution, Techno Sciences Pub. (TB).
23. Wagner K.D., 1998, Environmental Management, W.B. Saunders Co. Philadelohia, USA 499p.
24. A text bok environmental education G.V.S. Publishers by Dr. J.P. Yadav.

(M) Magazine (R) Reference (TB) Textbook

**Note:** 1. Examiner will set eight questions. Students will be required to attempt five Questions.  
2. The awards of this paper shall not be counted in the award of the Degree/DMC.

**BME222B BIOMEDICAL SIGNAL PROCESSING LAB**

**B. Tech. Semester – IV (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**LIST OF EXPERIMENTS**

1. Design a low pass filter and plot graph of gain versus frequency.
2. Design a high pass filter and plot graph of gain versus frequency.
3. Design a band pass filter and plot graph of gain versus frequency
4. Generate a Huffman code for a waveform using digiscope.
5. Using digiscope study waveform generation and power spectrum analysis.
6. Designing of IIR and FIR filters.
7. Realization of turning point compression of a noise signal.
8. Realization of the cross correlation, auto correlation and convolution functions using digiscope.
9. Develop a MATLAB program to perform synchronized averaging for a noisy signal.
10. Write a MATLAB program to compute RMS value at each instant for the EMG signal.

**Note:** Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the department as per the scope of the syllabus.

## BME224B BIOMEDICAL EQUIPMENTS-I LAB

### B. Tech. Semester – IV (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### LIST OF EXPERIEMENTS

1. Realization of pulmonary function analyzer using spirogram.
2. To study oximeters.
3. Designing of instrumentation amplifier
4. Realization of pressure changes using strain gauge.
5. To study a regulated power supply.
6. To determine Bradycardia and Tachycardia using ECG Training Kit.
7. To determine heart rate using ECG simulator Kit.
8. Realization of single beam / double beam.
9. Realization of spectrophotometer.
10. Study on autoanalyzer / cell counter/Blood gas analyzer.

**Note:** Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the department as per the scope of the syllabus.

## **ECE221B DIGITAL ELECTRONICS LAB**

### **B. Tech. Semester – IV (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### **LIST OF EXPERIMENTS:**

- 1 Study of TTL gates –AND,OR,NOT,NAND,NOR,EX-OR,EX-NOR
- 2 Design & realize a given function using K-maps and verify its performance.
- 3 To verify the operation of Multiplexer & De-multiplexer.
- 4 To verify the operation of Comparators.
- 5 To verify the truth table of S-R, J-K, and T & D Type flip flop.
- 6 To verify the operation of bi-directional shift register.
- 7 To design & verify the operation of 3 bit synchronous counter.
- 8 To design & verify the operation of synchronous UP/DOWN decade counter using JK flip flop & derive a seven segment display using the same.
- 9 To design & verify the operation of asynchronous UP/DOWN decade counter using JK flip flop & derive a seven segment display using the same.
- 10 To design and realize a sequence generator for a given sequence using JK flip- flop.
- 11 Study of CMOS, NAND & NOR gates and interfacing between TTL and CMOS gates.
- 12 Design a 4- bit shift register and verify its operation .verify the operation of a ring counter and a Johnson counter.

#### **Note:-**

- 1 Total ten experiments are to be performed in the semester.
- 2 At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed and set by the concerned institution as per the scope of the syllabus.

## ECE226B ANALOG ELECTRONICS CIRCUITS LAB

### B. Tech. Semester – IV (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>Practical</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Exam.</b>	<b>: 3 Hours</b>

#### LIST OF EXPERIMENTS

- 1 To Study frequency response of RC coupled amplifier.
- 2 To Study different types of feedback topology.
- 3 To Study RC phase shift oscillator.
- 4 To study Wein bridge oscillator.
- 5 To Study three terminal IC voltage regulator.
- 6 To draw characteristics of a transistor.
- 7 To study CE amplifier and calculate its gain.
- 8 To study 555 timer as a square wave generator.
- 9 To study SMPS power supply.
- 10 To study characteristics of SCR.
- 11 To study characteristics of DIAC.
- 12 To study UJT as a relaxation oscillator.

#### Note:-

- 1 Total ten experiments are to be performed in the semester.
- 2 At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed and set by the concerned institution as per the scope of the syllabus.



**GES 203B ENVIRONMENTAL STUDIES FIELD WORK**

**B. Tech. Semester –III/IV (Common for all Branches)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>	<b>Field Work</b>	<b>: 25 Marks</b>
--	--	--	<b>0</b>	<b>Total</b>	<b>: 25 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**FIELD WORK:**

- Visit to a local area to document environmental assets – river/ forest/ grassland/ hill/ mountain.
- Visit to a local polluted site-Urban/ Rural/ Industrial/ Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems – pond, river, hill slopes, etc. (Field work equal to 5 lectures hours).

**Note:** The awards of this paper shall not be counted in the award of the Degree/DMC.

**GPBME202B GENERAL PROFICIENCY & ETHICS**

**B. Tech. Semester – IV (Biomedical Engineering)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Examination</b>	<b>: 75 Marks</b>
<b>1</b>	<b>--</b>	<b>--</b>	<b>2</b>	<b>Total</b>	<b>: 75 Marks</b>

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The purpose of this course is to inculcate a sense of professionalism in a student along with personality development in terms of quality such as receiving, responding, temperament, attitude and outlook. The student efforts will be evaluated on the basis of his/ her performance / achievements in different walks of life.

A Faculty Counselor will be attached to a group of students which will remain associated with him /her during the entire period of the degree program in the University. Each faculty member will serve as a faculty counselor. They will act like a local guardian for the students associated with him / her and will help them in terms of career guidance, personal difficulties.

**A. The student will present a written report before the committee with following in view:**

The student will present before the committee his/her achievements during the current academic session in the form of a written report highlighting followings:

I.	Academic Performance	-----
II.	Extra Curricular Activities / Community Service, Hostel Activities	<b>(8 Marks)</b>
III	Technical Activities / Industrial, Educational tour	<b>(8 Marks)</b>
IV	Sports/games	<b>(14 Marks)</b>
V	Moral values & Ethics	<b>(15 Marks)</b>

**NOTE:** Report submitted by the students should be typed on both sides of the paper.

**B. A student will support his/her achievement and verbal & communicative skill through presentation before the committee. (30 Marks)**

**C. Moral values & Ethics**

Syllabus - Process for Value Education, self-evaluation concept and process.

A minor test will be conducted during the semester and It will be the duty of the concerned teacher assigned to teach Moral values & Ethics to submit the awards to respective chairman of the department / Director/Principal.

The evaluation of this course will be made by the following Committee.

**University Departments:**

1	Chairperson of the Department	Chairman
2	Senior Most Faculty Counselor	Member
3	Vice- Chancellor's Nominee	Member

**Affiliated Colleges:**

1	Director/Principal	Chairman
2	Head of the Department/Sr. Faculty	Member
3	External Examiner to be appointed by the University	Member

**Note:** Remuneration will be paid to the external examiner only (at par with the other practical examinations).

## BME301B BIOMECHANICS & REHABILITATION ENGINEERING

### B. Tech. Semester – V (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit-I

**General Principles:** Introduction to biomechanics, kinesiology, basic mechanical concepts, types of motion, movement terms. Basic kinematics concepts, vectors & trigonometry, Position of anatomical axis & corresponding movements of the body part, free body diagram.

#### Unit-II

**Tissue Biomechanics:** Solids and Structures: Biological Materials Properties, Viscoelasticity, Simple Structure, Hydrostatic Structure, Structural Systems, Biomechanical characteristic of bone & the soft tissue structure: tendons, ligaments, muscles, function & physiological factors, frequency of firing motor units, muscle recruitment

#### Unit-III

**Patterns: Push/Throw Continuum:** Biomechanics of push - like motions, Biomechanics of throw - like motions

**Movement Biomechanics:** Gait analysis, body & limbs: mass & motion characteristics actions, forces transmitted by joints. Joints forces results in the normal & disable human body, normal & fast gait on the level.

#### Unit-IV

**Prosthetics & Orthotics:** Principles in designing orthosis & prosthesis: Principles of three-point pressure, total constant and partial weight relieving, Design Considerations, Purpose for providing prostheses & orthosis: Various aspects regarding diagnosis, prognosis, stature & socio-economic condition, Classification in prosthetics & orthosis: Lower Extremity orthosis & prostheses, Upper Extremity orthosis & prosthesis, Spinal orthosis, Recent developments in prosthetics & orthosis.

#### **TEXTBOOKS**

1. Kinesiology: The Mechanics and Pathomechanics of Human Movement-Carol A. Oatis (Publisher-Lippincott Williams & Wilkins).
2. A textbook of Biomedical Engineering –Edited by R.M. Kennedy.

#### **REFERENCE BOOKS**

1. Human limbs & their substitutes – Atlas.
2. Biomechanics: - White & Puyator (Private publication UAE)
3. Text book of Rehabilitation- S.Sunder (Jaypee Publisher)
4. Biomedical Engineering Fundamentals- Joseph D. Bronzino

#### **Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

## BME303B CLINICAL ENGINEERING

### B. Tech. Semester – V (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit -I

**Nephrology:** Diseases of Kidney, Principles of dialysis: Types of dialyzers, controls and monitoring devices for dialyzers, Hemodialysis and peritoneal dialysis, portable kidney machines, High flux and High efficiency dialysis, Clearance, dialysance, Components of dialyzing system, Dialysate, composition of dialysate, Clinical significance. Renal transplantation: Basic principles.

#### Unit -II

**Neurology:** Diseases of nervous system, Electroencephalography, Pneumoencephalography, neuromuscular stimulation, Electromyography, Clinical applications. Motor neuron disorders, the electrical study of reflexes, the silent period. The F response, The H reflex, the axion reflexes, Disorders of neuromuscular transmission.

#### Unit -III

**General Surgery & Gastroenterology:** Pre- operative preparation for surgical patient, Study and operation of surgical equipment, safety aspects in electro-surgical units, Anatomy and physiology of G.I.T. Nutritional support and parenteral therapy, Height and weight estimations according to age. Intravenous cannulae, stomach wash tubes, Introduction to Hypertension and Diabetes.

#### Unit-IV

**Ophthalmology, Auditory study and Diathermy:** The genesis and basis of electroretinogram (ERG) diagnosis, the genesis of the electrooculogram (EOG) with applications, Color Vision testing equipments, Sneller's chart, keratometer, refractometer, Slit lamp biomicroscopy, ophthalmoscope, retinoscope, tonometer, perimeter, contact lenses, Basic outline of auditory receptors, cochlear implants, hearing aids, Electronystography, Short wave and Microwave Diathermy, Ultrasonic therapy unit.

#### • **TEXT BOOKS**

1. Approach to Clinical Neurology- James G. Mcleod, Physiological (Butterworth- Heinemann Ltd, 3<sup>rd</sup> edition).
2. Introduction to Biomedical Equipment Technology -J.J.Carr & J.M.Brown (Pearson Education, Asia).
3. System of Ophthalmology Vol VII- Duke Elder

#### **REFERENCE BOOKS**

1. Diseases of kidney- Strauss, Maurice B. & Louis G. Welt (vol. 1&2 Little Brown.1997).
2. Handbook of Bio-Medical Instrumentation- R. S. Khandpur (2nd Edition, Tata McGraw Hill).
3. Surgical Endoscopy- T.L Dent. W.E. Stodel, J.G.turcotte (year book Medical pub, 1985).

#### **Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronic gadgets including Cellular phones are not allowed in the examination.

## BME305B BIOMEDICAL EQUIPMENTS-II

### B. Tech. Semester – V (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit -I

**Cardiac Pacemakers:** Need for a pacemaker, External and Implantable pacemaker, types of implantable pacemaker, Asynchronous and Synchronous (demand) mode of operation. Working principles, Block diagram of ventricular demand synchronous pacemakers, programmable pacemaker, packaging of pacemakers, power sources for implantable pacemakers, Lead wires and electrodes with their problems, Susceptibility of implantable pacemakers to electrical interference and remedial measures, recent developments in implantable pacemakers.

#### Unit -II

**Prosthetic heart valves and Heart lung machine:** Qualitative requirements categories; Mechanical and tissue valves, types of medical valves, ball and cage, tilting disc, and bileaflet valves, types of tissue valves, homografts or allografts ( human cadaver) and heterografts or xenografts (procine or bovine). Governing principles and usage, main components, operational aspects, functional details of bubble, thin film, membrane type of blood oxygenators.

#### Unit -III

**Assist devices for the healthcare:** Principles of external counter pulsation techniques, intra-aortic balloon pump, Essentials of Hearing Aids-block diagram, Defibrillator machine, Nerve and Muscle stimulators, Lithotriptors: The stone disease problem, Lithotripter machine, modern systems, Extra Corporeal Shock Wave Therapy.

#### Unit -IV

**Anesthesia and Ventilator machine:** Need for Anesthesia and machine, Electronics in anesthesia machine, Mechanism of Respiration, Artificial Ventilation, Ventilators, Types of Ventilators, Classification, Modern and High frequency Ventilators, pressure-volume-flow diagrams.

#### • **TEXT BOOKS**

1. Biomedical Engineering and Instrumentation- Joseph Bronzino (PWS Engg . , Boston).
2. Introduction to Biomedical Equipment Technology- J.J.Carr & J.M.Brown (Pearson Education, Asia).
3. Biomedical Instrumentation & Measurement- Cromwell, Weibell & Pfeiffer (Prentice Hall, India).

#### **REFERENCE BOOKS**

1. **Bioinstrumentation- J.Webster (Wiley & Sons).**
2. **The Biomedical Engineering handbook- Joseph D.Bronzino (CRC Press).**
3. Handbook of Bio-Medical Instrumentation- R. S. Khandpur (2nd Edition, Tata McGraw Hill).

#### **Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronic gadgets including Cellular phones are not allowed in the examination.

## BME307B TELEMEDICINE

### B. Tech. Semester – V (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit-I

**Introduction:** Introduction to telemedicine, evolution of telemedicine, block diagram of telemedicine system, scope, benefits and limitations of telemedicine, applications: Tele-cardiology, tele-oncology, telesurgery, tele-care, tele-health, telemedicine, robotics and tele-surgery, introduction to RIS & PACS and HIS/RIS/PACS integration, PACS architecture.

#### Unit-II

**Communication infrastructure for telemedicine system:** Types of information: audio, video, still images, text and data, fax. Types of Communication and Network: PSTN, POTS, ISDN, Internet, Wireless Communication systems: GSM, satellite and Micro Wave. Basics of analog and digital modulation techniques, introduction to telemedicine based antennas, Integration and Operational issues: system integration, Store-and-forward operation, real-time Telemedicine. Data Exchanges: Network Configuration, Circuit and packet switching, Video Conferencing. Medical information storage and management for telemedicine- patient information medical history, test reports, medical images diagnosis and treatment.

#### Unit-III

**Internet technologies and ethical issues:** Data Security and Standards: encryption, cryptography, Internet Protocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7. Cyber laws related to telemedicine, ethical and legal aspects of telemedicine: patient rights and consent, access to medical records, consent treatment and jurisdictional issues.

#### Unit-IV

**Recent trends in telemedicine:** Tele radiology: Basic parts of tele-radiology system: Image Acquisition system, Display system, Communication network, Interpretation. Tele Pathology: color images of sufficient resolution: Dynamic range, spatial resolution, compression methods, security and confidentiality tools pertaining to laboratory testing, access to health care services – health education and self care, use of RF-ID in telemedicine.

#### **TEXTBOOKS**

1. Handbook of Telemedicine by Olga Ferrer-Roca, M.Sosa Ludicissa, (IOS press 2002)
2. Essentials of Telemedicine and Telecare by A.C.Norris, (John Wiley & Sons, 2002)

#### **REFERENCE BOOKS**

1. Computer in the Practice of Medicine by H.D. Covveyet et al (Addison Wesley. Edition -2001)
2. Computer Based Medical Consultation by Edward Shortliffe (Elsevier Scientific.Edition-1998)
3. Principles of Telemedicine by R.S.Khandpur (Tata McGraw Hill, New Delhi, Edition -1998)
4. Computers in Medicine by R.D. Lele (TataMcgraw Hill Publications, 2006)

#### **Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

## ECE307B LINEAR INTEGRATED CIRCUIT

### B. Tech. Semester – V (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit-I

**DIFFERENTIAL AMPLIFIER FUNDAMENTALS:** Differential Amplifier, Differential Amplifier Circuit Configuration: DC and AC Analysis of all Four Types of Configurations, FET Differential Amplifiers, Differential Amplifier with Swamping Resistor, Constant Current Bias, Current Mirror, Cascaded Differential Amplifier, Cascode Configurations.

**OPERATIONAL AMPLIFIER FUNDAMENTALS:** Amplifier Fundamentals, the Operational Amplifier, Block Diagram Representation, Ideal OP-AMP, OP-AMP Equivalent Circuit, Ideal Voltage Transfer Curve, Open Loop OP-AMP Configurations, OP-AMP with Negative Feedback: voltage series & voltage shunt feedback amplifiers, Current feedback Amplifiers.

#### Unit-II

**CHARACTERISTICS OF OP-AMP:** Input Offset Voltage, Input Bias Current, Input Offset Current, Output Offset Voltage, Thermal Drift, Effect of Variation in Power Supply Voltages on Offset Voltage, Common Mode Configuration and CMRR, Frequency Response of OP-AMP: Open Loop Response, Close Loop Response, Input and Output Impedances, Effect of Finite Gain Bandwidth Product, Slow Rate.

**LINEAR APPLICATIONS:** DC and AC Amplifier, Peaking Amplifier, Summing, Scaling And Averaging Amplifiers, Instrumentation Amplifier, Voltage to Current Converter, Current to Voltage Converter, Difference Amplifier, Integrator, Differentiator, very high input impedance circuit.

#### Unit-III

**NOISE AND STABILITY:** Noise Properties, Sources of Noise, OP-AMP Noise, Stability Problems, Stability in Constant GBP OP-AMP Circuits, Internal Frequency Compensation, External Frequency Compensation, Stability In CFA Circuits.

**ACTIVE FILTERS AND OSCILLATORS:** Transfer Function, Active Filters, First Order LP & HP Butterworth Filters, Second Order LP & HP Butterworth Filters, Higher Order Filters, Band Pass Filters, Band Rejection Filters, Oscillators: Phase Shift, Wein Bridge Oscillator, quadrature oscillator, Square Wave Generator, Triangular Wave Generator, saw tooth wave generator, Voltage Controlled Oscillator.

#### Unit-IV

**NON LINEAR CIRCUITS:** Voltage Comparator, Zero Crossing Defector, Schmitt Trigger, Peak Detector, Sample and Hold Circuit, Voltage To Frequency and Frequency To Voltage Converter, ADC and DAC, clippers and clampers, absolute value output circuit.

**SPECIALIZED IC APPLICATION:** Switched Capacitor Filter, 555 Timer: As Monostable Multivibrator, Astable Multivibrator. Phase-Locked Loops, Voltage Regulators: Fixed and Adjustable Voltage Regulator, power amplifiers, Switching Regulators.

#### **Reference Books:**

- 1.OPAMPS and Linear Integrated Circuit
- 2.Design with Operational Amplifiers and Analog Integrated Circuits
- 3.Integrated Circuits
- 4.Linear Integrated Circuits

By Ramakant A Gayakwad -- PHI  
By Sergio Franco -- MGH  
By K .R. Botker –Khanna pub.  
By D.Roy Choudhary & S.Jain—New Age

#### **NOTE:**

In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.

## ECE309B MICROPROCESSOR AND INTERFACING

### B. Tech. Semester – V (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>P/VV</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

#### Unit-I

**THE 8086 MICROPROCESSOR ARCHITECTURE:** Architecture, block diagram of 8086, details of sub-blocks such as EU, BIU; memory segmentation and physical address computations, program relocation, addressing modes, instruction formats, pin diagram and description of various signals.

**INSTRUCTION SET OF 8086 & PROGRAMING:** Instruction execution timing, assembler instruction format, data transfer instructions, arithmetic instructions, branch instructions, looping instructions, NOP and HLT instructions, flag manipulation instructions, logical instructions, shift and rotate instructions, directives and operators, programming examples.

#### Unit-II

**THE X86 FAMILY (80186, 80286, 80386, 80486) MICROPROCESSOR ARCHITECTURE AND PROGRAMMING:** Architecture, block diagram, details of sub-blocks, hardware features and description of various signals, interrupts, multitasking, addressing modes, instruction set and programming example.

**THE PENTIUM PROCESSOR AND OTHER ADVANCED PROCESSORS:** Enhanced features of Pentium, Pentium Pro, Pentium-II, Pentium-III, Pentium-IV, Multi-core Technology, Mobile Processor.

#### Unit-III

**INTERFACING DEVICE:** The 8255 PPI chip: Architecture, control words, modes and examples..

**PERIPHERAL DEVICES:** Introduction to DMA process, 8237 DMA controller, 8259 Programmable interrupt controller, Programmable interval timer chips.

#### Unit-IV

**COMMUNICATION INTERFACE:** Parallel interface, serial interface, PCI interface, PCMCIA, USB interface.

**PERSONAL COMPUTER:** Modern PC, motherboard, chipset, expansion buses, memory-SIMM and DIMM.

#### **Reference Books:**

1. "The Intel Microprocessors 8086- Pentium Processor", Brey, 4<sup>th</sup> Edition, 2005.
2. "Microprocessors and interfacing", D. V. Hall, Tata McGraw-Hill, 2<sup>nd</sup> Edition, 2006.
3. "Microcomputer Systems: The 8086/8088 Family: Architecture, Programming and Design", Liu Yu-Chang and Gibson Glenn A., Prentice Hall of India, 2003.
4. "Advanced Microprocessors and Peripherals Architectures, Programming and Interfacing", Ray A. K. and Burchandi, Tata McGraw Hill, 2002.
5. "Microprocessor based System Design UBS", Rafiquzzman, Wiley-Interscience, 5<sup>th</sup> Edition, 2005.
6. "The X86 PC: Assembly Language, Design and interfacing", M. A. Mazidi, J. P. Maizidi and Danny Causey, Pearson, 5<sup>th</sup> Edition, 2011.
7. "The X86 Microprocessor (Architecture, Programming and Interfacing)", L. B. Das, Pearson, 2010.
8. "Advanced Microprocessor", Daniel Tabak, Tata McGraw-Hill, 2<sup>nd</sup> Edition, 2012.
9. "Fundamentals of Microprocessor and Microcomputers", B. Ram, Dhanpat Rai Publications, 5<sup>th</sup> edition, 2008.
10. "Microprocessor & Interfacing", Singh & Singh, Satya Parakashan.

#### **NOTE:**

In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.



## **BME321B BIOMECHANICS & REHABILITATION LAB**

### **B. Tech. Semester – V (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### **LIST OF EXPERIMENTS**

1. To determine the coefficient of static friction between two given material surfaces with the help of an inclined plane.
2. To study the lever action by using 'Bell Crank Lever' of the human muscle.
3. Stress strain analysis of lower limb prosthesis using 16channel BIOPAC system.
4. To determine the hardness of given bone using hardness tester.
5. To determine the moment of Inertia of a stepped pulley or a flywheel.
6. To determine the effect of the principle of conservation of angular momentum on human body.
7. To determine the mechanical properties of bone using UTM.
8. To verify Bernaulli's Theorm, for fluid flow through pipes.
9. To study gate analysis and center of gravity on a plane figure.
10. To determine muscle force using dynamometer.

**Note:** Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the department as per the scope of the syllabus.

## BME325B BIOMEDICAL EQUIPMENTS-II LAB

### B. Tech. Semester – V (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### LIST OF EXPERIMENTS

1. To design and realize synchronous/ asynchronous pacemaker.
2. To realize the controls of Defibrillator machine.
3. Study of different types of oxygenators used in hemodialysis machine.
4. To realize the working of anesthesia and ventilator machine with different controls.
5. To realize and investigate the stimulator designs in the lab.
6. To realize and investigate the different modes of triggering in artificial pacemaker.
7. To realize and investigate the results of Advance Biofeedback system.
8. To investigate stress test analysis using TMT machine.
9. To study Nerve and muscle conduction using PC based Physiology system.
10. To realize the working of ENG machine.

**Note:** Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the department as per the scope of the syllabus.

**BME327B TELEMEDICINE LAB**  
**B. Tech. Semester – V (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**LIST OF EXPERIMENTS**

1. Realization of Amplitude Modulation and determination of Modulation index.
2. Investigation of Frequency Modulation and determination of Modulation index.
3. Study of Phase Modulation.
4. Study of Pulse Amplitude Modulation.
5. Realization of Pulse Width Modulation.
6. Study of Pulse Frequency Modulation.
7. Study of Pulse Code Modulation.
8. To investigate different digital modulation techniques: ASK, PSK, FSK.
9. Case study of Robotic and tele-surgery procedure.
10. Hospital visit to telemedicine center at AIIMS, Delhi or CSIO, Chandigarh.
11. Case study for use of RF-ID in telemedicine.

**Note:** Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the department as per the scope of the syllabus.

## ECE329B MICROPROCESSOR AND INTERFACING LAB

### B. Tech. Semester – V (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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### LIST OF EXPERIMENTS

1. To study the architecture of 8086 microprocessor and 8086 microprocessor kit
2. Write a program to add the contents of the memory location 3000:0400 H to the content of 4000:0700 H and store the result in 6000:0900 H
3. Write a program to add 16 bit number using 8086 instruction set.
4. Write a multiplication of two 16 bit number using 8086 instruction set.
5. Write a program for division of two 16 bit numbers using 8086 instruction set.
6. Write a program factorial of a number.
7. Write a Program to transfer a block of data without overlap.
8. Write a Program to transfer a block of data with overlap.
9. Write a program to find the average of two numbers.
10. Write a Program to check whether data byte is odd or even
11. Write a program to find maximum number in the array of 10 numbers.
12. Write a program to find the sum of the first 'n' integers.
13. Write a program to generate a square wave.
14. Write a program to generate a rectangular wave.
15. Write a program to generate a triangular wave.

#### Note:-

- 1 Total ten experiments are to be performed in the semester.
- 2 At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed and set by the concerned institution as per the scope of the syllabus.

**BME311B PROFESSIONAL TRAINING I**  
**B. Tech. Semester – V (Biomedical Engineering)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 50 Marks</b>
--	--	2	2	<b>Total</b>	<b>: 50 Marks</b>

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At the end of 4<sup>th</sup> semester each student would undergo four weeks Professional Training in an Industry/ Institute/ Professional Organization/ Research Laboratory etc. with the prior approval of the Training and Placement Officer of the University and submit in the department a typed report along with a certificate from the organization.

The typed report should be in a prescribed format.

The report will be evaluated in the V Semester by a Committee consisting of three teachers from different specialization to be constituted by the Chairperson of the department. The basis of evaluation will primarily be the knowledge and exposure of the student towards different processes and the functioning of the organization.

The student will interact with the committee through presentation to demonstrate his/her learning.

Teachers associated with evaluation work will be assigned 2 periods per week load.



**BME302B INTRODUCTION TO BIOMATERIALS**  
**B. Tech. Semester – VI (Biomedical Engg.)**

**L T P Credits**  
**3 1 - 4**

**Class Work : 25 Marks**  
**Examination : 75 Marks**  
**Total : 100 Marks**  
**Duration of Examination : 3 Hours**

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**Unit-I**

**Introduction:** Definition of biomaterials, requirements of biomaterials, classification of biomaterials, Comparison of properties of some common biomaterials. Effects of physiological fluid on the properties of biomaterials, Surface properties, physical properties and mechanical properties of materials. Host tissue reactions to biomaterials

**Metallic implant materials:** Stainless steel, Co-based alloys, Ti and Ti-based alloys. Importance of stress-corrosion cracking, corrosion behavior and the importance of passive films for tissue adhesion. Hard tissue replacement implant: Orthopedic implants and Dental implants. Soft tissue replacement implants: Percutaneous, skin implants and vascular implants,

**Unit-II**

**Polymeric implant materials:** Classification of polymers according to thermosets, thermoplastics and elastomers : Polyolefins, polyamides, acrylic polymers, fluorocarbon polymers, silicon rubbers, acetals. Physiochemical characteristics of biopolymers. Biodegradable polymers for medical purposes, Biopolymers in controlled release systems, Synthetic polymeric membranes and their biological applications.

**Ceramic implant materials:** Definition of bioceramics. Common types of bioceramics: Aluminium oxides, Glass ceramics, Carbons. Bioresorbable and bioactive ceramics

**Unit-III**

**Composite implant materials:** Mechanics of improvement of properties by incorporating different elements. Composite theory of fiber reinforcement (short and long fibers, fibers pull out). Polymers filled with osteogenic fillers (e.g. hydroxyapatite). Host tissue reactions to composite materials..

**Biocompatibility & toxicological screening of biomaterials:** Definition of biocompatibility, blood compatibility and tissue compatibility. Toxicity tests: acute and chronic toxicity studies (in situ implantation, tissue culture, haemolysis, thrombogenic potential tests, systemic toxicity, intracutaneous irritation test), sensitization, carcinogenicity, mutagenicity and special tests.

**Unit-IV**

**Sterilisation Techniques:** Definition of sterilization, Types of sterilization: autoclaving, ETO and gamma radiation. Effects of sterilization on the properties of materials.

**Testing of biomaterials/Implants:** In vitro testing (Mechanical testing): tensile, compression, wears, fatigue, corrosion studies and fracture toughness. In-vivo testing (animals studies): biological performance of implants. Ex-vivo testing: in vitro testing simulating the in vivo conditions. Standards of implant materials.

**TEXTBOOKS**

1. Biomaterials Science: An Introduction to Materials in Medicine, by Buddy D. Ratner, et. al. (Academic Press, San Diego, 1996)
2. Biomaterials - Science and Engineering by J B Park, (Plenum Press, 1984)

**REFERENCE BOOKS**

1. Biomaterials by Lawrence Stark & Gyan Agarwal
2. Biomaterials - An Interfacial approach by L. Hench & E. C. Ethridge
3. Biomedical Engineering Fundamentals by Joseph D. Bronzino (Publisher CRC)

**Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.

2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.



## BME304B MODELING AND SIMULATION

### B. Tech. Semester – VI (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit-I

**Modeling & Simulation of Human Movement:** Introduction to Movement Biomechanics, Inverse Kinematics Analysis, Inverse Dynamics Analysis, Forward Dynamics Simulations, Patient-Specific modeling, Muscle Model Evaluation, Musculoskeletal Geometry, Systems-Level modeling.

#### Unit-II

**Mathematical Modeling and Biomedical Computer Simulation Methods:** MATLAB Overview, measuring cardiac output, receptor kinetics, medical imaging. Mathematical modelling - physical simulation - advantages and limitations - process control - Transport phenomena - concept of physical domain and computational domain - assumptions and limitations in numerical solutions – Finite element method and Finite difference method.

#### Unit-III

**Simulation:** Basic concepts of simulation - data manipulation, data exchange of the human structure, Manual Simulation of Systems: Simulation of Queuing Systems such as single channel and multi channel queue, lead time demand, inventory system, reliability problem, time-shared computer model, job-shop model, Statistical Models in Simulation: Overview of probability and statistics, useful statistical model, discrete distribution, continuous distribution, empirical distribution and Poisson process. Queuing Models: Characteristics of queuing systems, queuing notations, long run measures of performance of queuing systems, Steady state behavior of Markovian models (M/G/1, M/M/1, M/M/c) overview of finite capacity and finite calling population models, Network of Queues.

#### Unit-IV

**Modeling analysis in Living systems:** Common Features of Complex Living Systems, Reducing Complexity and Representations, The Kinetic Theory of Active Particles with Linear Interactions, Nonlinear Interactions and Learning, cardiovascular systems simulation, physiologically based pharmacokinetic model.

#### **TEXTBOOKS**

1. Discrete Event System Simulation by Jerry Banks, John.S.Carson, Barry. C.Nelson and David.M.Nicol (Prentice Hall, 2009)
2. Simulation Modeling and Analysis by Averill.M.Law (McGraw Hill, 2007)
3. Advanced Engineering Mathematics by Erwin Kreyzig (John Wiley & Sons, 2007)

#### **REFERENCE BOOKS**

1. Applied Numerical Methods for Engineers using MATLAB and C by R.J. Schilling and S.L. Harris (Thomson pub., 2004)
2. Handbook of Laboratory Animal Science, 2nd Edition, CRC Press, 2003. ISBN 0-8493-10865
3. Biosimulation: simulation of living systems by Daniel. A. Beard Cambridge texts in Biomedical Engineering, 2012 (Cambridge University Press)

#### **Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

## BME306B FIBER OPTICS AND LASERS IN MEDICINE

### B. Tech. Semester – VIII (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Theory</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit-I

**Introduction to fiber optics:** Basic fiber link, applications, principles of light: Introduction, EM spectrum, internal & external reflections, Snell's law, optical fiber numerical aperture, Fresnel reflection.

**Optic fiber & its properties:** Introduction, Basic fiber construction, propagation of light, modes of operation, refractive index profile, types of fibres, dispersion, data rate and bandwidth, attenuation, losses.

#### Unit-II

**Connectors, Splices & Couplers:** Introduction, splices: mechanical, fusion, protection of splice, connectors: SMA, STC, bionic etc, coupling: passive, Stan, TEE types. Optical sources & Photo Detectors: Introduction: creation of photons, LED, laser diode, photo detectors: introduction, PIN photodiode, avalanche photodiode, photodiode parameters, detector noise, speed of response, SNR.

**Modulation scheme for fiber optics transmission:** Introduction, digital modulation, analog modulation schemes, multiplexing.

#### Unit-III

**Laser Systems:** Introduction, types of lasers: Solid state lasers, Gas lasers, Dye lasers, Lasers used in medical practice: Ruby laser, CO<sub>2</sub> laser, Nd-Y AG laser and related solid state laser.

**Laser -Tissue Interaction:** Terminology, spectral band designations, energy & power, irradiant & radiant exposure, fluence, thermal diffusion fibers & contact tips, Types of laser-tissue interactions

#### Unit-IV

**Laser Application in Medical Therapy:** Introduction, application in general surgery, dermatology, ophthalmology, cardiovascular & chest surgery, dentistry, neuro surgery, otolaryngology & head and neck surgery, tumor surgery, gynecologic laser, endoscopy, laproscopy, neuroendoscopy

#### TEXTBOOKS

1. Therapeutic Lasers -Theory and practice by G. David Baxter (Churchill livingstone publications)
2. Medical Lasers and their safe use by David H Shiney, Stephen and L. Trokel (Springer-Verlag publications)

#### REFERENCE BOOKS

1. Laser and optical fibers in medicine by Katzer and Abraham (Academic press publications)
2. An Introduction to optical fibers by A. M. Cherin (McGraw Hill publications)
3. Elements of fiber optics by S. L. Wymer (Regents-Prentice Hall publications)
4. Biomedical Electronics & Instrumentation by S. K. Venkata Ram (Galgotia publications)

#### Note:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.



## ECE310B MICROCONTROLLER BASED SYSTEM DESIGN

### B. Tech. Semester – VI (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>

<b>Class Work</b>	<b>: 25 Marks</b>
<b>Examination</b>	<b>: 75 Marks</b>
<b>Total</b>	<b>: 100 Marks</b>
<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit-I

**INTRODUCTION OF EMBEDDED SYSTEMS:** Definition, ingredients of embedded system, requirements & challenges of embedded system design, different types of microcontrollers: Embedded microcontrollers, external memory microcontrollers etc., processor architectures: Harvard V/S Princeton, CISC V/S RISC, microcontrollers memory types, microcontrollers features: clocking, i/o pins, interrupts, timers, and peripherals.

**SOFTWARE FOR EMBEDDED SYSTEM DESIGN:** Development tools/ environments, Assembly language programming style, Interpreters, High level languages, Intel hex format object files, Debugging.

#### Unit-II

**8051 MICROCONTROLLER:** Pin diagram explanation, internal diagram 8051, Instruction Set, Addressing mode, data transfer instruction, logical, arithmetic instruction, bit instruction, branching instruction.

**TIMERS, SERIAL INTERFACE & INTERRUPTS OF 8051 MICROCONTROLLER:** Timer: Control Word, mode of timers, simple programming, generation of square wave, Serial interface: Introduction, Control Word, mode of serial interface, simple programming, Interrupts: Introduction, Control word Simple Programming, generation of waveforms using interrupt, serial interface using interrupt.

#### Unit-III

**PIC MICROCONTROLLER:** Introduction to PIC microcontrollers, features of PIC family microcontrollers, architecture and pipelining, program memory considerations, addressing modes, CPU registers, Instruction set, and simple operations.

**FEATURES OF PIC MICROCONTROLLER:** Timer: Control Word, mode of timers, simple programming, generation of square wave, Watch-dog timer, Serial interface: Introduction, Control Word, mode of serial interface, simple programming, Interrupts: Introduction, Control word Simple Programming, generation of waveforms using interrupt, serial interface using interrupt.

#### Unit-IV

**APPLICATIONS BASED ON 8051 MICROCONTROLLER:** Interfacing of memory, intelligent LCD, 8255, ADC, DAC, LED display, Memory Card, Bio-metric system.

**APPLICATION BASED ON PIC MICROCONTROLLERS:** Interfacing of Graphical Display, Memory Card, Bio-metric system Music box, Applications like Mouse wheel turning, PWM motor control, ultra sonic distance measuring, Temperature Sensor, Pressure Sensor, Magnetic Field Sensor.

#### **Reference Books:**

1. 8051, Scott Mackenzie, PHI, Englewood Cliffs, New Jersey.
2. Programming & Customizing the 8051 Microcontroller, Myke Predko, Tata McGraw-Hill Pub. Co. Ltd., New Delhi.
3. 8051 Architecture Programming & Applications, K. J. Ayala, Penram International Publishers, India.
4. Programming & Customizing the PIC Microcontroller, Myke Predko, Tata McGraw-Hill Pub. Co. Ltd., New Delhi.

#### **NOTE:**

In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.

**HUM302B      REPORT WRITING SKILLS**  
**B. Tech. Semester – VI (Common for all branches)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>1</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>Examination</b>	<b>: 50 Marks</b>
				<b>Total</b>	<b>: 75 Marks</b>
				<b>Duration of Examination</b>	<b>: 2 Hours</b>

**OBJECTIVE**

The course aims at developing competence for report writing with a focus on its complex writing techniques and procedures.

**COURSE CONTENT**

**UNIT I**

**Report Writing**

Reports: meaning, their importance and types, Structure of reports, Formats of reports, Use of illustrations

**UNIT II**

**Writing of Business and Technical Reports:**

Preliminary steps and procedure of writing report, writing various types of reports on technical, business related topics

**RECOMMENDED READING**

- a. Borowick, Jerome. N. *Technical Communication and its Applications*. New Delhi: PHI, 2000
- b. Guffey, Mary Ellen. *Business Communication: Process & Product*. USA: South western College Publishing, 2000.
- c. Kumar, Sanjay and Pushp Lata. *Communication Skills*. Delhi: OUP, 2011

**SCHEME OF END SEMESTER EXAMINATION (MAJOR TEST) AND INSTRUCTIONS FOR THE EXAMINER**

1. The duration of the exam will be 2 hours.
2. The Question Paper for this theory course shall have three questions in all covering both the units. All will be compulsory with internal choice.
3. Question no. 1 will be of 10 marks. The question may have two/three parts with enough internal choice, covering various components of both the Units.
4. Question no 2 with internal choice will be of 10 marks covering contents of the Unit I. It will be theoretical in nature.
5. Question no 3 will have two parts of 15 marks each. The student will be asked to write reports on business and technical subject/ issue covering contents of Unit II. The emphasis would be on testing the actual report writing on a given business and technical situation/ subject in letter format.

**BME322B      BIOMATERIAL LAB**  
**B. Tech. Semester – VI (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**LIST OF EXPERIMENTS**

1. To study biomaterials like Hip implant or Knee implant.
2. Characterization studies of polymeric material using Fourier Transform Infrared Spectroscopy (FTIR-ATR Spectroscopy).
3. Characterization studies of polymeric material using Differential Scanning Calorimetry (DSC).
4. Characterization studies of polymeric material using Thermo Gravimetric analysis studies (TGA).
5. To study the swelling properties of polymeric material like Hydroxy Ethyl Meth Acrylate (HEMA).
6. To study and synthesize Bone Cement.
7. To study Biomechanical properties of given sample using INSTRON machine.
8. To study Corrosion & its type.
9. To study Dental implants.
10. To setup an experimental facility for testing of biomaterials.

**Note:** Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the department as per the scope of the syllabus.

## BME324B HEALTHCARE TECHNOLOGY AND ENTREPRENEURSHIP WORKSHOP

### B. Tech. Semester – VI (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

#### Unit-I

**Healthcare Technology Market:** Indian Healthcare Industrial Environment – competence; opportunities and challenges, entrepreneurship and economic growth, status of healthcare industry in India and resource availability, Conception, in-sighting and evaluation of ideas, ecosystem development, sources and decision making, technoeconomics, local and global scenario.

#### Unit-II

**Introduction to Entrepreneurship:** Identification and characteristics of entrepreneurs, types of entrepreneurship, emergence of first generation entrepreneurs, environmental influence and growth of women entrepreneurs. Choice of technology – Collaborative interaction for Technology development. Behavioral aspects of entrepreneurs: Personality – determinants, attributes and models, leadership concepts and models. Values and attitudes, motivation aspects, changing behavior.

#### Unit-III

**Time and Project Management:** Time Management: Various approaches of time management, their strengths and weaknesses. Sources of Capital, Informal Risk Capital, Venture (seed) Capital and Going Public, Managing Growth, Harvesting and Exit Strategy. Project formulation, Project Management, project planning and control using CPM-PERT techniques, human aspects in project management, writing of proposals for funding and grants. Myths of Innovation, Creativity and the Business Idea, Creative thinking methods, Creative problem solving, analysis of market demand, demand supply gap, financial and profitability analysis and technical analysis. Project financing sector in India.

#### Unit-IV

**Case studies on Health Care Entrepreneurship:** On the ground solutions for ending poverty, making the Investments needed to end poverty, the Global Impact to end Poverty, case studies on community services for e.g. water borne diseases, disaster management, case study on interface between biomedical sciences and technology.

#### **TEXTBOOKS**

1. Vasant Desai, Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House, 1997.
2. Prasanna Chandra, Project – Planning, Analysis, Selection, Implementation and Review, Tata Mc Graw Hill Publishing Company Ltd., 1995.
3. B.Badhai, Entrepreneurship for Engineers, Dhanpath Rai & Co., Delhi, 2001

#### **REFERENCE BOOKS**

1. Stephen R. Covey and A.Roger Merrill, First Things First, Simon and Schuster, 2002.
2. Robert D. Hisrich and Michael P.Peters, Entrepreneurship, Tata Mc Graw Hill ed., 2002.Strategic tools for Entrepreneurship.
3. Entrepreneurship, Eighth edition by Robert D. Hisrich, Micheal P. Peters and Dean A. Shepherd McGraw-Hill,2010

#### **Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

**ECE330B      MICROCONTROLLER LAB**  
**B. Tech. Semester – VI (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**LIST OF EXPERIMENTS**

1. Study Architecture of 8051 Microcontroller & Power on reset circuit.
2. (a) Write an assembly language program to add eight 8-bit numbers.  
(b) Write an assembly language program to find average of eight 8-bit numbers.
3. (a) Write an assembly language program to find a maximum number from a given 8-bit ten numbers.  
(b) Write an assembly language program to find a minimum number from a given 8-bit ten numbers.
4. Arrange the given ten 8-bit numbers in ascending order.
5. Generate a square wave of 10kHz at P1.0 Crystal frequency is XXXX.
6. Write a program to transfer data from given memory block B1 to block B2.
7. Interface LED and switch with microcontroller 8051 or PIC.
8. Interface seven segment display with microcontroller 8051 or PIC.
9. Interface LCD with microcontroller 8051 or PIC.
10. Write an assembly language program for External program and test on hardware.
11. Interface stepper motor with microcontroller 8051 or PIC.
12. Interface DC motor with microcontroller 8051 or PIC and control speed using PWM.
13. Write an assembly language program to transfer message serially.
14. Write an assembly language program using interrupts to simultaneously create 7kHz and 500kHz square wave on P1.0 and P1.1 respectively.
15. Design a mini project based on microcontroller.

**Note:-**

- 1 Total ten experiments are to be performed in the semester.
- 2 At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed and set by the concerned institution as per the scope of the syllabus.



## HUM304B ORAL PRESENTATION SKILLS

B. Tech. Semester – VI (Common for all branches)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 2 Hours</b>

### OBJECTIVE

To enable students to develop their speaking skills with professional proficiency

### COURSE CONTENT

#### Oral Presentations:

Group Discussion; Mock interviews

#### Note for the Teacher:

The teacher concerned, by devising her/his method, must preview and review the student's spoken proficiency at the beginning and end of the semester respectively to find the efficacy of the course and degree of improvement in the student.

### RECOMMENDED READING

- Konar, Nira. *English Language Laboratories: A Comprehensive Manual*. Delhi: PHI, 2011
- Kumar, Sanjay and Pushp Lata. *Communication Skills*. Delhi: OUP, 2011

### SCHEME OF END SEMESTER EXAMINATION (Practical)

An external Practical exam of 30 marks of 2 hour duration for the course will be conducted by an external examiner appointed by the university's Controller of Exams.

**NOTE:** Students will be tested for their oral communication competence making them participate in Group discussion, mock situations for interview. Students may also be evaluated through a viva conducted by an external examiner.

## GPBME302B GENERAL PROFICIENCY & ETHICS

### B. Tech. Semester – VI (Biomedical Engineering)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Examination</b>	<b>:</b>	<b>75 Marks</b>
<b>1</b>	<b>--</b>	<b>--</b>	<b>2</b>	<b>Total</b>	<b>:</b>	<b>75 Marks</b>

The purpose of this course is to inculcate a sense of professionalism in a student along with personality development in terms of quality such as receiving, responding, temperament, attitude and outlook. The student efforts will be evaluated on the basis of his/ her performance / achievements in different walks of life.

A Faculty Counselor will be attached to a group of students which will remain associated with him /her during the entire period of the degree program in the University. Each faculty member will serve as a faculty counselor. They will act like a local guardian for the students associated with him / her and will help them in terms of career guidance, personal difficulties.

#### **B. The student will present a written report before the committee with following in view:**

The student will present before the committee his/her achievements during the current academic session in the form of a written report highlighting followings:

I.	Academic Performance	-----
II.	Extra Curricular Activities / Community Service, Hostel Activities	<b>(8 Marks)</b>
III	Technical Activities / Industrial, Educational tour	<b>(8 Marks)</b>
IV	Sports/games	<b>(14 Marks)</b>
V	Moral values & Ethics	<b>(15 Marks)</b>

**NOTE:** Report submitted by the students should be typed on both sides of the paper.

#### **C. A student will support his/her achievement and verbal & communicative skill through presentation before the committee. (30 Marks)**

#### **C. Moral values & Ethics**

Syllabus - A few topics from the below mentioned books

1. R.R.Gaur, R. Sangal and G.P. Bagaria, “ Bagaria, “ A foundation course in Human Values and Professional Ethics”, Pub: Excel Books, New Delhi-110028.
2. M. Govindrajana, S Natrajan & V.S. Senthil Kumar, “ Engineering Ethics (including Human Values )” Eastern Economy Edition, Prentics Hall of India Ltd.

A minor test/Quiz will be conducted during the semester and It will be the duty of the concerned teacher assigned to teach Moral values & Ethics to submit the awards to respective chairman of the department / Director/Principal.

The evaluation of this course will be made by the following Committee.

#### **University Departments:**

1	Chairperson of the Department	Chairman
2	Senior Most Faculty Counselor	Member
3	Vice- Chancellor’s Nominee	Member

#### **Affiliated Colleges:**

1	Director/Principal	Chairman
2	Head of the Department/Sr. Faculty	Member
3	External Examiner to be appointed by the University	Member

**Note:** Remuneration will be paid to the external examiner only (at par with the other practical examinations).

## BME401B BIOMEDICAL IMAGE PROCESSING

### B. Tech. Semester – VII (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit-I

**Introduction and Digital Image Processing Fundamentals:** Digital Image Formation, Fundamentals Steps in Image Processing, Elements of Image Processing systems, Sampling and Quantization, Image Neighbors and Distance.

**Transforms used in Image Processing:** Introduction to Fourier Transform, Discrete Fourier Transform and Some Properties of Fast Fourier Transform, Wavelet transform.

#### Unit-II

**Image Enhancement:** Background, Minimum Mean-square Error Restoration, Least square Error Restoration, Constrained Least square Error restoration, Restoration by singular Value decomposition, Homomorphic filtering.

#### Unit-III

**Image Compression:** Fundamentals, Image Compression Models, Error Free compression Techniques, Lossy compression Techniques

**Image segmentation:** Detection of Discontinuities, Pixel Board approach of segmentation, Multilevel Thresholding, Local Thresholding, Region based approach of segmentation.

#### Unit-IV

**Colour Image Processing:** Colour Fundamentals, Colour Models, Examples of colour Image Processing, Pseudo colouring and colour Displays.

**Biomedical Application:** Computer Tomography (Radon Transform, Back Projection Operator), MRI Images, Processing of Radiograph, Angiogram, Sonography including Doppler Technique, EEG image processing

#### **TEXTBOOKS**

1. Digital Image Processing – Rafael C. Gonzalez and Richard E. Woods (Pearson Education)
2. Fundamentals of Digital Image Processing – A.K. Jain (Pearson Education).

#### **REFERENCE BOOKS**

1. Digital Image Processing and Analysis – B. Chanda and D. Dutta Najumdar (Eastern economy Edition). D
2. Digital Image Processing for Medical Application- Geoff Dougherty.

#### **Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronic gadgets including Cellular phones are not allowed in the examination.

## BME403B NUCLEAR MEDICINE RADIATION AND SAFETY

### B. Tech. Semester – VII (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Theory</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hrs.</b>

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#### Unit-I

**Introduction:** Properties and effects of radioactive emissions: Isomeric transition, Gamma-ray emission, Internal Conversion, Alpha-Decay, Beta Decay, Positron Decay, Electron Capture and their applications in nuclear medicine.

**Radiation detectors:** Types: Gas-filled, Solid state & Semiconductor Detectors and applications in nuclear medicine.

#### Unit-II

**Radio Isotope Imaging:** Radiopharmaceuticals-selection & localization, uptake monitoring system, Rectilinear scanner, The gamma camera, Construction and working, Performance Characteristics.

#### Unit-III

**Emission Tomography Techniques:** Introduction, Principles & applications of SPECT, Principle & application of PET, System performance parameters and quality control function.

**In vitro techniques:** Introduction, Single & double isotope method, Radioimmunoassay, RIA Counting System, Liquid scintillation counting system, RIA application.

#### Unit-IV

**The computer in NM:** Applications, Image Construction, Frame Modes, Resolution, Pixel Size.

**Radiation protection and safety:** Units of exposure and dose, Safety of non - ionizing and Ionizing radiation. Stochastic and non-Stochastic effects, Risk Factors, Safety limits., Principles of radiation dosimetry; Internal and External dosimetry.

#### **TEXTBOOKS**

1. The physics of Radiology By H. E. Johns and J. R. Gunningham.
2. Physics and Radiobiology in Nuclear Medicine By Saha G (Springer Verlag N. Y. )

#### **REFERENCE BOOKS**

1. Quality control of Nuclear Medicine instrumentation By R. F. Mould (IPSM. York)

#### **Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

**BME405B MEDICAL IMAGING- II**  
**B. Tech. Semester – VII (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**Unit-I**

**Ultrasound:** Principles of Ultrasound imaging, Wave propagation and characteristic acoustic impedance, Interaction with tissue, Ultrasound Instrumentation, Diagnostic scanning modes, artifacts in ultrasonic imaging, ultrasonic image characteristics, Color Doppler, Clinical applications of ultrasound, biological effects of ultrasound.

**Unit-II**

**Magnetic Resonance Imaging:** Nuclear Magnetic Resonance: Angular momentum, magnetic dipole moment, magnetization, Larmor frequency, rotating frame of reference and the RF magnetic field. Generation and Detection of NMR Signal: The magnet (superconducting magnets, permanent magnets), magnetic field gradients, the NMR coil/probe, data acquisition. Clinical applications of MRI, biological effects of MRI.

**Unit-III**

**Emission Tomography:** Radioactivity, production of radionuclides, types of radioactive decays, type of detectors and basic principles, nuclear imaging instrumentation: the Anger scintillation camera, Image characteristics.

Nuclear Imaging: SPECT instrumentation and clinical applications, PET instrumentation and clinical applications, Fluoroscopy

**Unit-IV**

**Radiation Biology and Protection:** Interaction of radiation with tissue, molecular and cellular response to radiation, radiation induced carcinogenesis. Radiation Protection: sources of exposure to ionizing radiations, personnel dosimeter, methods of exposure control, shielding of imaging facilities, prevention of errors in radiology.

**TEXTBOOKS**

1. Introduction to Biomedical Imaging by Andrew G. Webb (Wiley-IEEE press, 2002)
2. Fundamentals of Medical Imaging by Paul Suetens (Cambridge University Press, 2009)

**REFERENCE BOOKS**

1. The essential physics of medical imaging-. J. T. Bushberg, J.A. Seibert, E.M. Leidholdt Jr., J. Boone(Lippincott Williams & Wilkins), 2002.
2. Essentials of Ultrasound. - Williamson, M.( W.b. Saunders), 1996.
3. Biomedical Engineering Fundamentals- Joseph D. Bronzino(CRC Press), 2006.

**Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronic gadgets including Cellular phones are not allowed in the examination.

## BME407B HOSPITAL MANAGEMENT

### B. Tech. Semester – VII (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit-I

**Challenges of Health and Hospital Administration in New Millennium:** Complexity of Hospitals created by ever increasing sophisticated diagnostic tools resulting into high cost (Need of Analysis and Planning), Declining Professional Ethics among specialist and other hospital staff. Analysis of Referral System, Analysis of Hospital Waste Management, Introduction of the latest Technologies to the Hospital Staff, Methods of reducing cost of health services, Analysis of the Quality of Hospital Services, Need of Streamlining the upkeep of Hospital through planning.

#### Unit-II

**Socio-economic Development and Health Care and Nature of Health Care Administration:** Goals and Aspects of Development and Their Inter-Relationship, Principles, Meaning and Objectives of Health Administration, Nature and Scope of Health Administration, Indicators Measuring Impact of Health Care Administration.

**Manpower Planning:** Nature, Meaning and Ingredients of Manpower Planning, Development of Manpower Plans, National Health Policy, Patient Management

#### Unit-III

**Financial Management and Cost Containment:** Introduction to Management, Financial and Cost Management, Organization, Delegation of Powers/Authority and Fixation of Responsibility, Book Keeping, Charts of Accounts and Departmental Numbering, Material Management, Capital and Revenue Expenditure, Financial Statements and Reports, Budget and Budgetary Control, Cost Ascertainment and Cost Containment, Internal Control, Statistics and Management Information Systems.

#### Unit-IV

**Quality Control and Quality Assurance in Health Care in a Hospital:** Meaning and Need of Quality Control, Contents of Quality, Challenges to Setting Standards, Current Methods in Improving Quality and Healthcare.

**Hospital Waste Management:** Classification, Amount of Hospital Waste, Hazards of Hospital Waste, Collection and Transportation of Hospital Waste, Disposal of Hospital Waste, Case Study.

#### **TEXTBOOKS**

1. Hospital Managerial Services by S.L. Goel & R. Kumar Deep & Deep Publications Pvt. Ltd.
2. Hospital Core Services & Healthcare Programmes by S.L. Goel & R. Kumar Deep & Deep Publications Pvt. Ltd.

#### **Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

**BME409B BIOMEDICAL IMAGE PROCESSING LAB.**

**B. Tech. Semester – VII (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 20 Marks</b>
-	-	2	1	<b>P/VV</b>	<b>: 30 Marks</b>
				<b>Total</b>	<b>: 50 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**LIST OF EXPERIMENTS**

1. Introduction to MATLAB & the Image processing tool box.
2. Digital Image representation in MATLAB.
3. Study image enhancement techniques.
4. Histogram Processing & Function Plotting.
5. Generating Frequency domain filter in MATLAB.
6. Sharpening frequency domain filter.
7. Understanding of the harmonic content of an image using Discrete Fourier transform (DFT).
8. Study image reconstruction from projections.
9. Color Image Representation in MATLAB
10. Digital Image coding and Compression measures, optimal coding compression.

**Note:** Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the department as per the scope of the syllabus.

**BME411B PROFESSIONAL TRAINING II**  
**B. Tech. Semester – VII (Biomedical Engineering)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 50 Marks</b>
--	--	2	2	<b>Total</b>	<b>: 50 Marks</b>

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- At the end of 6<sup>th</sup> semester each student would undergo four weeks Professional Training in an Industry/ Institute/ Professional / Organization/ Research Laboratory etc. with the prior approval of the Training and Placement Officer of the University and submit in the department a typed report along with a certificate from the organization.
- The typed report should be in a prescribed format.
- The report will be evaluated in the VII Semester by a Committee consisting of three teachers from different specialization to be constituted by the Chairperson of the department. The basis of evaluation will primarily be the knowledge and exposure of the student towards different processes and the functioning of the organization.
- The student will interact with the committee through presentation to demonstrate his/her learning.
- Teachers associated with evaluation work will be assigned 2 periods per week load.



## **BME413B PROJECT**

### **B. Tech. Semester – VII (Biomedical Engineering)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 100 Marks</b>
--	--	4	4	<b>Total Marks</b>	<b>: 100 Marks</b>

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The primary objective of this course is to develop in students the professional quality of synthesis employing technical knowledge obtained in the field of Engineering & Technology through a project work involving design, analysis augmented with creativity, innovation and ingenuity.

Project involving design/ fabrication/ testing/ computer simulation/ case studies etc. which commences in the VII Semester will be completed in VIII Semester and will be evaluated through a panel of examiners consisting of the following:

Chairman of Department	: Chairperson
Project coordinator	: Member Secretary
Respective project supervisor	: Member

The student will be required to submit two copies of his/her project report to the department for record (one copy each for the department and participating teacher).

Project coordinator will be assigned the project load of maximum of 2 hrs. per week including his own guiding load of one hr. However, the guiding teacher will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.

The format of the cover page and the organization of the body of the report for all the B.Tech. will be finalized and circulated by the Dean, Faculty of Engineering and Technology.

**GPBME402B      GENERAL FITNESS FOR THE PROFESSION**

**B. Tech. Semester – VIII (Biomedical Engineering)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Examination</b>	<b>:</b>	<b>100 Marks</b>
<b>1</b>	<b>--</b>	<b>--</b>	<b>4</b>	<b>Total</b>	<b>:</b>	<b>100 Marks</b>

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The purpose of this course is to inculcate a sense of professionalism in a student along with personality development in terms of quality such as receiving, responding, temperament, attitude and outlook. The student efforts will be evaluated on the basis of his/ her performance / achievements in different walks of life.

The evaluation will be made by the committee of examiners constituted as under:

1. Dean, Faculty of Engineering & Technology/ Director  
/Principal of affiliated college : Chairperson
2. Chairperson of the department : Member
3. External expert : Appointed by the university

**A. The student will present a written report before the committee with following in view:**

The student will present before the committee his/her achievements during the current academic session in the form of a written report highlighting followings:

- I. Academic Performance -----
- II. Extra Curricular Activities / Community Service, Hostel Activities **(12 Marks)**
- III. Technical Activities / Industrial, Educational tour **(12 Marks)**
- IV. Sports/games **(16Marks)**

**Note:** Report submitted by the students should be typed on both sides of the paper.

**B. A student will support his/her achievement and verbal & communicative skill through presentation before the examiners. **(40 Marks)****

**C. Faculty Counselor Assignment **(20 Marks)****

It will be the duty of the student to get evaluated by respective faculty counselor and to submit the counselor assessment marks in a sealed envelope to the committee.

A counselor will assess the student which reflects his/her learning graph including followings:

1. Discipline throughout the year
2. Sincerity towards study
3. How quickly the student assimilates professional value system etc.
4. Moral values & Ethics- Syllabus (one lecture/week on the topics of Human values/Ethics is to be delivered)

## BME402B INNOVATIVE BIOMEDICAL ENGINEERING

### B. Tech. Semester – VIII (Biomedical Engg.)

L T P Credits  
3 1 - 4

Class Work : 25 Marks  
Examination : 75 Marks  
Total : 100 Marks  
Duration of Examination : 3 Hours

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#### Unit-I

**Introduction:** Definition of innovation, drivers for innovation, types of innovation, innovation practices in healthcare sector, evolution of innovation industry, risks involved.

#### Unit-II

**Design and Planning of healthcare device:** Creativity, ideation, brainstorming-mindsets, techniques, exploration, team dynamics. Planning and design aspects involved in new product development, study of market conditions, product feasibility studies, design constraints and solutions. Design thinking- user led innovation.

#### Unit-III

**Latest Biomedical Engineering Innovations in last decade:** Understand the need for development of particular device, idea generation, implementation plan, process planning and device development: AbioCor Artificial Heart, Bio-Artificial Liver, Camera Pill, Bionic Contact Lens, iLIMB Bionic Hand, Mind-Reading Device, eLEGS Exoskeleton and EyeWriter

#### Unit-IV

**Role of Government and funding agencies in helping healthcare innovation:** Innovation and intellectual capital- value, protect, exploit. Scientific techniques for writing of proposals for funding and grants. Role of Government funding agencies in promotion of innovative ideas, different schemes available and details regarding applying to these schemes. Different non-government agencies providing funding to innovators, role of healthcare industry, difficulties and challenges faced by innovators.

#### TEXTBOOKS

1. Vasant Desai, Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House, 1997.
2. Prasanna Chandra, Project – Planning, Analysis, Selection, Implementation and Review, Tata Mc Graw Hill Publishing Company Ltd., 1995.

#### REFERENCE BOOKS

1. Stephen R. Covey and A.Roger Merrill, First Things First, Simon and Schuster, 2002.
2. Robert D. Hisrich and Michael P.Peters, Entrepreneurship, Tata Mc Graw Hill ed., 2002.Strategic tools for Entrepreneurship.
3. Entrepreneurship, Eighth edition by Robert D. Hisrich, Micheal P. Peters and Dean A. Shepherd McGraw-Hill,2010
4. B.Badhai, Entrepreneurship for Engineers, Dhanpath Rai & Co., Delhi, 2001.

#### Note:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

## BME404B BIOLOGICAL CONTROL SYSTEMS

### B. Tech. Semester – VIII (Biomedical Engg.)

L	T	P	Credits
3	1	-	4

Class Work	: 25 Marks
Theory	: 75 Marks
Total	: 100 Marks
Duration of Examination	: 3 Hours

#### Unit-I

**Introduction to state variable analysis of control systems:** Introduction to state variable concept, definition of state variables, matrix representation of state equation, state transition equation, properties of transition matrix, relationship between state equations and higher order differential equations, state equation and transfer function, characteristics equation, Eigen values & Eigen vectors.

#### Unit-II

**Modern control techniques & Introduction to biological control system:** Transformation to phase variables canonical forms of state variables, controllability canonical form, observability canonical form Jordan canonical form, controllability of linear system, observability of linear system relationship among controllability, observability and transfer function. Introduction, Dynamic systems and their control, modeling and block diagrams, the pupil control systems, general structure of control systems, the dynamic response characteristics of the pupil control system, open & close loop systems instability, automatic aperture control.

#### Unit-III

**Mathematical modeling of the system:** Thermoregulation, Thermoregulation of cold bloodedness & warm bloodedness, the anatomy of thermo regulation, lumping & partial differential equations, heat transfer examples, mathematical model of the controlled process of the body. Modeling the body as compartments, behavior in simple compartmental system, pharmacy kinetic model, urea distribution model, multi compartmental system. Dissolution of drugs in solid form, distribution and accessibility of body water & tissue compartments, basis for zero order & first order chemical kinetic behavior in the biological system.

#### Unit-IV

**Biological receptors & other Physiological Control Systems:** -Introduction, receptor characteristics, transfer function models of receptors, receptor and perceived intensity.

Respiratory model & systems, cardiovascular control system, skeletal muscle servomechanism.

#### TEXTBOOKS

1. Automatic control systems: By Benjamin C Kuo.
2. Biological control systems: John H Milsum Mc Graw Hill 1966.

#### REFERENCE BOOKS

1. Modern Control Engineering: By K. Ogata
2. Physiological Control Systems: Analysis, Simulation and Estimation by Michael C. K. Khoo
3. Control system Engineering: By I. J. Nagarath. & M. Gopal.
4. Bio- Medical Engineering Principles By: David. O. Cooney , Michel Deckker INC
5. The Application Of Control Theory to Physiological Systems by Howard T Milhorn Sounders Publication
6. Biosimulation: simulation of living systems by Daniel. A. Beard Cambridge texts in Biomedical Engineering, 2012 (Cambridge University Press)

#### Note:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

**BME442B MEDICAL PHYSICS**  
**B. Tech. Semester – VIII (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**Unit-I**

**Heat and Cold in Medicine:** Physical basis of heat and temperature, Thermography and temperature scales, mapping of body's temperatures. Heat therapy, use of cold in medicine, Cryosurgery and safety aspects.

**Energy, Work, Power and Pressure:** Conservation of energy in the body. Energy changes in the body. Work, power heat losses of body. Measurement of pressure in the body, pressure inside Skull, Eye, Digestive system, Skeleton, Urinary bladder etc. Hyperbaric oxygen therapy.

**Unit-II**

**Physics of the Lung & Breathing:** The airways, blood & lung interaction, measurement of lung volumes Pressure flow-volume relationship of the lungs. Physics of the alveoli. Breathing mechanism, airway resistance. Work of breathing. Physics of some common lung diseases.

**Physics of the Cardiovascular system:** Major components of the Cardiovascular system. Oxygen and Carbon dioxide exchange in the capillary system. Work done - by the heart. B. P. and its measurements Transmural pressure. Bernoulli's principle applied to Cardiovascular system. Laminar and turbulent blood flow. Heart sounds. The physics of some cardiovascular diseases.

**Unit-III**

**Electricity within the body:** The nervous system and neurons. Electrical potentials of nerves, Electroretinogram and Electrooculogram, Electrical impedance tomography, Magneto cardiogram and Magneto encephalogram. Electric shock. High frequency & low frequency electricity in medicine and magnetism in medicine, Functional MRI.

**Unit-IV**

**Sound in Medicine:** General properties of sound. The body as a drum. The stethoscope, Ultrasound picture of the body. Ultrasound to measure motion, Physiological effects of Ultrasound in Therapy. The production of speech, Artificial speech processing.

**Light in Medicine:** Measurement of light & its units, Applications of Visual light in medicine, Applications of UV & IR in medicine, LASERS in medicine, Applications of microscopes in medicine.

**TEXT BOOK**

1. Medical Physics by J R Cameron & J G Skofronick, 1978 (Wiley-Interscience publication)

**REFERENCE BOOK**

1. Intermediate Physics for Medicine and Biology by Russell K. Hobbie & Bradley J. Roth, fourth edition, (Springer, 2007)

**Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

**BME444B INTELLIGENT BIOINSTRUMENTATION**  
**B. Tech. Semester – VIII (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>4</b>	<b>--</b>	<b>--</b>	<b>4</b>

<b>Class Work</b>	<b>: 25 Marks</b>
<b>Examination</b>	<b>: 75 Marks</b>
<b>Total</b>	<b>: 100 Marks</b>
<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**Unit-I**

**Introduction:** Intelligence, features characterizing intelligence, intelligent instrumentation system; features of intelligent instrumentation; components of intelligent instrumentation system; Block diagram of an intelligent instrumentation system.

**Unit-II**

**Signal Processing:** Signal amplification & attenuation (OP-AMP based); Instrumentation Amplifier (circuit diagram, high CMRR & other features); Signal Linearization (different types such as Diode-resistor combination, OP-AMP based, etc.); Bias Removal, Signal filtering (outputs from ideal filters, outputs from constant-k filters, matching of filter sections, active analog filters); Signal integration, Voltage follower (pre-amplifier), voltage comparator, Phase-locked loop, Signal addition, Signal multiplication, Signal Transmission Signal amplification, Shielding, Current loop transmission, Voltage-to-frequency conversion.

**Unit-III**

**Smart Sensors, Interfacing:** Primary sensors; Excitation; Compensation (Nonlinearity: look up table method, polygon interpolation, polynomial interpolation, cubic spline interpolation, Approximation & regression; Noise & interference; Response time; Drift; Cross-sensitivity); Information Coding/ Processing; Data Communication; Standards for smart sensor interface, Basic issues of interfacing; Address decoding; Data transfer control;; Sample & hold circuit; Other interface considerations.

**Unit-IV**

**BIOMEMS:** Introduction; Film sensors (Thick film sensors, Thin film sensors); Semiconductor IC technology – standard methods; Microelectro-mechanical systems (Micro-machining, some application examples), Biomems, Nano-sensors, Biosensors- Common Applications.

**TEXTBOOKS**

1. Intelligent Instruments by Barney, G.C., Hemel Hempstead (Prentice Hall, 1985)
2. Principles of Measurement & Instrumentation by Alan S. Morris. (PHI Pvt. Ltd., 1999)

**REFERENCE BOOKS**

1. Sensors & Transducers by D. Patranabis (PHI, 2003)
2. Roman Kuc, Introduction to Digital Signal Processing. N. York: (McGraw-Hill Pub.)

**Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

## BME446B PRINCIPLES OF BIOENGINEERING

### B. Tech. Semester – VIII (Biomedical Engg.)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit-I

**Introduction to Bioengineering:** Overview of bioengineering focused on engineering analysis and design of biological systems. Topics include chemical properties of biological components, rates and equilibrium properties of biological reactions, cellular structure and communication

#### Unit-II

**Physiological studies:** Human Physiological Fluid Mechanics, blood flow in the microcirculation, and other body fluid systems, pulse and wave propagation in blood vessels, mechanical forces on blood vessels: pressure, stretch, and shear force, visco-elasticity and mechanical properties of the vessel, vascular re-modeling and tissue-engineered vascular graft: mechanical factors, biological molecular structure and function, computational modeling of protein structure and function, molecular structure/ function of Neuro-degeneration

#### Unit-III

**Engineering Design of Physiological Models:** Membrane Potentials & Cable Model, Hodgkin Huxley Model, Dielectric Properties of Cells & Biopolymers, Quantitative Physiology of Brain Blood Flow, Visual System Psychophysical Bioengineering: Matching warning signals to the properties of the eye and the visual nervous system. Operating parameters, Operating and non-operating environmental stimuli, Test requirements, external dimensions, maintenance and testability provisions, materials requirements, reliability requirements, external surface treatment, design life.

#### Unit-IV

**Genetic Engineering:** Genetic programming of biological systems, and engineering balances and systems analysis. Application of these concepts to engineering biological systems for diverse areas, including health and medicine, biomanufacturing, and sustainability, is emphasized. Includes an introduction to MATLAB as a problem-solving tool.

#### **TEXT BOOKS**

1. S. Berger, Introduction to Bioengineering
2. Applied Biofluid Mechanics by Lee Waite, Jerry Fine, Mac Grawhill publications, 2007.

#### **REFERENCE BOOKS**

1. B.Badhai, Entrepreneurship for Engineers, Dhanpath Rai & Co., Delhi, 2001.
2. Strategic Tools for social Entrepreneurs: Enhancing the performance of your enterprising nonprofit. Dees, J., J. Emerson and P. Economy. Wiley, 2002

#### **Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

**BME448B TISSUE ENGINEERING**  
**B. Tech. Semester – VIII (Biomedical Engg.)**

**L T P Credits**  
**3 1 - 4**

**Class Work : 25 Marks**  
**Examination : 75 Marks**  
**Total : 100 Marks**  
**Duration of Examination : 3 Hours**

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**Unit-I**

**Introduction:** Basic definition of tissue engineering, Structural organization of tissues: Epithelial, connective; vascularity and angiogenesis, basic wound healing, cell migration, current scope of development and use in therapeutic and in-vitro testing.

**Unit-II**

**Cell culture:** Different types of cell, progenitor cells and cell differentiations, different kind of matrix, cell-cell interaction. Aspect of cell culture: cell expansion, cell transfer, cell storage and cell characterization, Immunomodulation and Immunoisolation, Bioreactors.

**Unit-III**

**Molecular biology aspects:** Cell signaling molecules, growth factors, hormone and growth factor signaling, growth factor delivery in tissue engineering, cell attachment: differential cell adhesion, cell migration, cell-cell communication, receptor-ligand binding, and Cell surface markers.

**Scaffold and transplant:** Engineering biomaterials for tissue engineering, Degradable materials (collagen, silk and polylactic acid), porosity, mechanical strength, 3-D architecture and cell incorporation. Engineering tissues for replacing bone, cartilage, tendons, ligaments, skin and liver. Basic transplant immunology stems cells: introduction, hepatopoiesis.

**Unit-IV**

**Case study and regulatory issues:** Mechanical properties of Biological tissues, Transport properties of biological tissues, Cell transplantation for liver, musculoskeletal, cardiovascular, neural, visceral tissue engineering. Ethical, FDA and regulatory issues of tissue engineering.

**TEXTBOOKS**

1. Principles of Tissue Engineering by Robert. P.Lanza, Robert Langer & William L. Chick( Academic press).
2. Tissue Engineering, B. Palsson, J.A. Hubbell, R.Plonsey& J.D. Bronzino, CRC- Taylor & Francis

**REFERENCE BOOKS**

1. The Biomedical Engineering –Handbook, Joseph D. Bronzino, CRC press.
2. Introduction to Biomedical Engg. , Endarle, Blanchard &Bronzino, Academic press.
3. Frontiers of Tissue Engineering – Patrick. Mikos, MacIntire, Pergamon Press

**Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.



**BME452B NEURAL ENGINEERING**  
**B. Tech. Semester – VIII (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**Unit-I**

**Introduction and Brain machine interface:** Neurophysiology; neural plasticity; neurological dysfunctions; history and growth of neuro-engineering. Machine interface: human voluntary motor control system; biomaterials, configurations, and characteristics of implantable multi-array electrodes, action potentials, resting potentials and local field potentials; cortical signal recording and decoding; clinical applications, ECoG-based brain-machine interface; brain-machine interface based on surface EEG/MEG recording; clinical applications.

**Unit-II**

**Peripheral-nerve-machine interface and Muscle-machine interface:** Nerves, Nerve structure, Volume Conductor Effects, Recorded nerve signals. Nerve stimulation due to current flow, response to stimulation (strength-duration curve, twitch response, tetanic contractions, force-pulse frequency effect, force-modulation frequency), design of stimulators, uses of muscle stimulation, simulation of neuron activation, efferent neural signal recording and decoding, biomaterial, configuration, and characteristics of implantable electrodes, intramuscular EMG recording and decoding, targeted muscle re-innervation, clinical applications

**Unit-III**

**Technologies in prosthetics and orthotics & Deep Brain Stimulation (DBS):** Human-robot interaction and integration; clinical needs for advancing the bionic legs and arms; ethical issues in neural-machine interface, Implantable electrodes; brain pacemaker; surgery; applications for interfering the epileptic seizure; applications to Parkinson Disease, gamma knife.

**Unit-IV**

**Functional electrical stimulation and other technologies in neuro-motor rehabilitation:** Peripheral nerve stimulation; type of stimulation electrodes, clinical applications, mechanisms for neuro-motor rehabilitation, robotics and virtual reality in physical therapy; transcranial magnetic stimulation (TMS). Human visual system; type of electrodes; surgery for electrode placement, clinical applications, human auditory system; stimulation system and electrodes; surgery; clinical applications: cochlear stimulators

**TEXT BOOKS**

1. R. H. S. Carpenter, *Neurophysiology (3rd Edition)*, Arnold, 1996.
2. B. H. Brown, R. H. Smallwood, D. C. Barber, P. V. Lawford and D. R. Hose, *Medical Physics and Biomedical Engineering*, Institute of Physics Publishing, 1999.
3. "Neuroprosthetics: Theory and Practice", edited by Kenneth W. Horch, Gurpreet S. Dhillon

**REFERENCE BOOKS**

1. "Principles of Neural Science, 4th ed." by Kandel ER, Schwartz JH, Jessell TM 2000. McGraw-Hill, New York. ISBN 0-8385-7701-6
2. "Neural Engineering: Computation, Representation, and Dynamics in Neurobiological Systems" by Chris Eliasmith, C. H. Anderson, MIT Press, ISBN-10: 0262050714
3. "Neural Engineering (Bioelectric Engineering)" by Bin He, Springer, 2005, ISBN-10: 0306486091
4. Gurpreet S. Dhillon, World Scientific Publishing Company, Incorporated, 2004, ISBN: 9812380221
5. "Neuroengineering" edited by D. J. Dilorenzo and J. D. Bronzino, Published by CRC Press, 2007; ISBN 0849381746.

**Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.



**BME456B BIONANOTECHNOLOGY**  
**B. Tech. Semester – VIII (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Theory</b>	<b>: 75Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Durationof Examination</b>	<b>: 3 Hrs.</b>

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**Unit-I**

**Introduction to MEMS:** Introduction to BioMEMS; Historical background – Smart Materials and structures, Microsystems and their advantages. Materials used – Technology involved in MEMS. General Application in Healthcare

**Micromachining Technology:** Soft Lithography, Etching, Ion implantation, wafer bonding, integrated processing, Wet & Dry Bulk micro machining, surface micromachining, coating Technology and CVD –LIGA process

**Unit-II**

**Principles of Microsystems:** General principles – Microsystems – Pressure system; Actuators, Electrostatic forces; Piezoelectric Crystals.

**Unit-III**

**BIOMEMS:** Special features, Requirements for medical applications, MEMS for Health care, Drug delivery systems, Application in Blood pressure sensors, Biochip, Micro needles, Microelectrodes, Prosthesis and catheter end sensors

**Unit-IV**

**Biomedical NanoTechnology:** Trends in Biomedical NanoTechnology; Drug Delivery Systems and Drug Synthesis; NanoTechnology in diagnostics; nano-enabled components for biodefense; implants and prosthetics, Toxicity in nanomaterials

**TEXTBOOKS**

1. Biomedical NanoTechnology ;Neelina H Malsch ; CRC (2005)
2. Fundamentals of BioMEMS and Medical Microdevices (SPIE Press Monograph Vol. PM153) ; Steven S. Saliterman; SPIE-- the International Society for Optical Engineering (2006).

**REFERENCE BOOKS**

1. The MEMS Handbook, Second Edition - 3 Volume Set (Mechanical Engineering); Mohamed Gad-el-Hak; CRC; 2 edition (2005)
2. Fundamentals of Micro fabrication: The Science of Miniaturization, Second Edition; Marc J. Madou; CRC; 2 edition (2002)
3. MEMS and Microsystems: Design and Manufacture; Tai-Ran Hsu; McGraw-Hill; 1 edition (2001).

**Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

**BME458B      BIO-MEDICAL ETHICS AND DEVICE REGULATIONS**  
**B. Tech. Semester – VIII (Biomedical Engg.)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**Unit-I**

**Sources of Medical Law and Ethics:** Nature and sources of medical ethics, Sources of medical law. Consent, Confidentiality and Clinical Negligence: Consent to Treatment, Confidentiality and Clinical Negligence.

**Unit-II**

**Mental Health:** Types of mental health, Adults with Incapacity. Issues :The law in relation to abortion, The ethics of abortion , Reproductive Technology and surrogacy ,The law in relation to end of life issues ,The ethics of end of life issues and Research.

**Unit-III**

**Maintaining professional standards:** Maintaining standards and regulation, Presenting evidence and reports, The Coroner's court, The General Medical Council, Doctors' rights: Employment and other rights of doctors

**Unit-IV**

**Device regulation:** Classifications and requirements of Medical devices, Harmonized standards ,CE approval , Quality Assurance and Quality – Definition of quality, quality management, principles of TQM, measures for Quality Control. Safety & Testing of Medical devices -patenting .

**TEXT BOOKS**

1. Ronald Munson's *Intervention and Reflection: Basic Issues in Medical Ethics 5th Ed.*
2. Ethics of Health Care: An Introductory Textbook by Benedict M. Ashley, Kevin D. O'Rourke, Georgetown University Press; 3rd edition, 2002.

**REFERENCE BOOK**

1. Introduction to Bio-Medical Engineering by John D. Enderle, Susan M. Blanchard & Elsevier (Academic) press, 2nd edition, 2005

**Note:**

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

## BME424B BIOLOGICAL CONTROL SYSTEMS LAB

### B. Tech. Semester – VIII (Biomedical Engg.)

L	T	P	Credits	Class Work	: 20 Marks
--	--	2	1	Examination	: 30Marks
				Total	: 50 Marks
				Duration of Examination	: 3 Hours

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#### LIST OF EXPERIMENTS

1. To Simulate the Linear lung mechanics model using MATLAB.
2. To realize simple simulink model of muscle stretch reflex using MATLAB. .
3. To develop a simulink program to determine the steady-state-operating point of the ventilatory control system using MATLAB.
4. To realize simulink implementation of neuromuscular reflex model using MATLAB.
5. To realize simulink implementation of cardio vascular variability model using MATLAB.
6. To develop simulink model of blood glucose – insulin regulation using MATLAB.
7. To develop simulink model of circulatory control that accounts for the effect of respiration on heart rate and arterial blood pressure using MATLAB.
8. To simulate patient ventilator system using MATLAB.
9. To simulate steady state neuromuscular reflex using MATLAB.
10. To simulate respiratory sinus arrhythmia using MATLAB.

**Note:** Ten experiments are to be performed selecting any seven experiments from the above list. Remaining three experiments may either be performed from the above list, or designed and set by the department as per the scope of the syllabus.

**BME408B SEMINAR**  
**C. Tech. Semester – VIII (Biomedical Engineering)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 50 Marks</b>
--	--	2	2	<b>Total Marks</b>	<b>: 50 Marks</b>

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The objectives of the course remains

- To learn how to carry out literature search
- To learn the art of technical report writing
- To learn the art of verbal communication with the help of modern presentation techniques

A student will select a topic in emerging areas of Engineering & Technology and will carry out the task under the observation of a teacher assigned by the department.

He/ She will give a seminar talk on the same before a committee constituted by the chairperson of the department. The committee should comprise of three faculty members from different specializations. The teacher associated in the committee will be assigned 2 hours teaching load per week.

However, guiding students' seminar will not be considered towards teaching load.

The format of the cover page and the organization of the body of the seminar report for all the undergraduate programs will be finalized and circulated by the Dean, Faculty of Engineering and Technology.

**BME412B      PROJECT**  
**B. Tech. Semester – VIII (Biomedical Engineering)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 75 Marks</b>
--	--	8	8	<b>Examination</b>	<b>: 125 Marks</b>
				<b>Total</b>	<b>: 200 Marks</b>
				<b>Duration</b>	<b>of : 3 Hours</b>
				<b>Examination</b>	

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The project started in VII Semester will be completed in VIII Semester and will be evaluated through a panel of examiners consisting of the following:

Chairperson of Department	: Chairperson
Project coordinator	: Member
External expert	: To be appointed by the University

The student will be required to submit two copies of his/her project report to the department for record (one copy each for the department and participating teacher).

Project coordinator will be assigned the project load of, maximum of 2 hrs. per week including his own guiding load of one hr. However, the guiding teacher will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.

The format of the cover page and the organization of the body of the report for all the B. Tech. will be finalized and circulated by the Dean, Faculty of Engineering and Technology.

# OPEN ELECTIVES

## SEMESTER-VII

### List of Open Electives

1	MEI 623B	ENTREPRENEURSHIP	6	BT401B	BIOINFORMATICS
2	BME451B	MEDICAL INSTRUMENTATION	7	AE417B	MODERN VEHICLE TECHNOLOGY
3	ECE305B	CONSUMER ELECTRONICS	8	CE451B	POLLUTION & CONTROL
4	EE451B	ENERGY AUDIT	9	CSE411B	MANAGEMENT INFORMATION SYSTEM
5	EEE457B	ENERGY RESOURCES & TECHNOLOGY	10	IT 413B	CYBER SECURITY

### Note:

- 1 Every student has to participate in the sports activities. Minimum one hour is fixed for sports activities either in the morning or evening. Weightage of Sports is given in General Proficiency Syllabus.
- 2 *Students will be permitted to opt for any one elective run by the other department. However, the department shall offer those elective for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. The minimum strength of the students should be 20 to run an elective.*
- 3 Assessment of Professional Training-II, undergone at the end of VI semester, will be based on seminar, viva-voce, report and certificate of Professional Training obtained by the student from the industry, , institute, research lab, training center etc
- 4 The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
- 5 Electronics gadgets including Cellular phones are not allowed in the examination



## MEI623B ENTREPRENEURSHIP

### B. Tech. Semester – VII (Open Elective)

L	T	P	Credits
4	-	--	4

Class Work	:	25 Marks
Examination	:	75 Marks
Total	:	100 Marks
Duration of Examination	:	3 Hours

#### Unit-I

**ENTREPRENEURIAL DEVELOPMENT PERSPECTIVE:** Concepts of Entrepreneurship Development, Evolution of the concept of Entrepreneur, Entrepreneur Vs. Intrapreneur, Entrepreneur Vs. Entrepreneurship, Entrepreneur Vs. Manager, Attributes and Characteristics of a successful Entrepreneur, Role of Entrepreneur in Indian economy and developing economies with reference to Self-Employment Development, Entrepreneurial Culture

#### Unit-II

**CREATING ENTREPRENEURIAL VENTURE:** Business Planning Process, Environmental Analysis - Search and Scanning, Identifying problems and opportunities, Defining Business Idea, Basic Government Procedures to be complied with.

#### Unit-III

**ENTREPRENEURSHIP DEVELOPMENT AND GOVERNMENT:** Role of Central Government and State Government in promoting Entrepreneurship - Introduction to various incentives, subsidies and grants - Export Oriented Units - Fiscal and Tax concessions available; Role of Central/State agencies in the Entrepreneurship Development - District Industries Centers (DIC), Small Industries Service Institute (SISI), Entrepreneurship Development Institute of India (EDII), National Institute of Entrepreneurship & Small Business Development (NIESBUD), National Entrepreneurship Development Board (NEDB).

#### Unit-IV

#### **PROJECT MANAGEMENT AND CASE STUDIES**

Technical, Financial, Marketing, Personnel and Management Feasibility, Estimating and Financing funds requirement - Schemes offered by various commercial banks and financial institutions like IDBI, ICICI, SIDBI, SFCs, Venture Capital Funding, Why do Entrepreneurs fail - The Four Entrepreneurial Pitfalls (Peter Drucker), Case studies of Successful Entrepreneurial Ventures, Failed Entrepreneurial Ventures and Turnaround Ventures.

#### **Texts and References:**

1. Entrepreneurship: New Venture Creation - David H. Holt.
2. Entrepreneurship - Hisrich Peters.
3. The Culture of Entrepreneurship - Brigitte Berger.
4. Project Management - K. Nagarajan.
5. Dynamics of Entrepreneurship Development - Vasant Desai.
6. Entrepreneurship Development - Dr. P.C.Shejwalkar.
7. Thought Leaders - Shrinivas Pandit.
8. Entrepreneurship, 3rd Ed. - Steven Brandt.
9. Business Gurus Speak - S.N.Char.
10. The Entrepreneurial Connection - Gurmit Narula.

#### **Note:**

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

## BME451B MEDICAL INSTRUMENTATION

### B. Tech. Semester – VII (Open Elective)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>:</b>	<b>25 Marks</b>
<b>4</b>	<b>-</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>:</b>	<b>75 Marks</b>
				<b>Total</b>	<b>:</b>	<b>100 Marks</b>
				<b>Duration of Examination</b>	<b>:</b>	<b>3 Hours</b>

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#### Unit-I

**Physiology and Transducers:** Cell and its structure – Action and resting – Potential propagation of action potential – Sodium pump – Nervous system – CNS – PNS – Nerve cell – Synapse – Cardio pulmonary system – Physiology of heart and lungs – Circulation and respiration – Transducers – Different types – Piezo-electric, ultrasonic, resistive, capacitive, inductive transducers – Selection criteria.

#### Unit-II

**Electro – physiological and Non-electrical Parameter Measurements:** Basic components of a biomedical system – Electrodes – Micro, needle and surface electrodes – Amplifiers – Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier. ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms. Measurement of blood pressure – Cardiac output – Cardiac rate – Heart sound – Respiratory rate – Gas volume – Flow rate of CO<sub>2</sub>, O<sub>2</sub> in exhaust air - PH of blood, ESR, GSR measurements – Plethysmography.

#### Unit-III

**Medical Imaging and Patient Monitoring Systems:** X-ray machine - Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Electrical safety. Biological effects of X-rays and precautions.

#### Unit-IV

**Assisting and Therapeutic Equipments:** Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialyzers. Respiratory Instrumentation - Mechanism of respiration, Spirometry, Pneumotachograph Ventilators.

#### TEXT BOOKS

1. Biomedical Instrumentation and Measurements – Leslie Cromwell and F.J. Weibell, E.A. Pfeiffer, PHI, 2nd Ed, 1980.
2. Medical Instrumentation, Application and Design – John G. Webster, John Wiley, 3rd Ed., 1998.

#### REFERENCE BOOKS

1. Principles of Applied Biomedical Instrumentation – L.A. Geoddes and L.E. Baker, John Wiley, 1975.
2. Hand-book of Biomedical Instrumentation – R.S. Khandpur, TMH, 2nd Ed., 2003.
3. Biomedical Telemetry – Mackay, Stuart R., John Wiley, 1

#### Note:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions carry equal marks.
2. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/ exchange of calculator are prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

## ECE305B CONSUMER ELECTRONICS

### B. Tech. Semester – VII (Open Elective)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>:</b>	<b>25 Marks</b>
<b>4</b>	<b>-</b>	<b>--</b>	<b>4</b>	<b>Examination</b>	<b>:</b>	<b>75 Marks</b>
				<b>Total</b>	<b>:</b>	<b>100 Marks</b>
				<b>Duration of Examination</b>	<b>:</b>	<b>3 Hours</b>

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#### Unit-I

**MONOCHROME TV (INTRODUCTION):** Elements of a TV System, Picture transmission, Sound transmission, Picture reception, Sound reception, Synchronization, Receiver control, Image continuity, Scanning Process, Aspect Ratio, Flicker, Composite Video Signal, Picture Elements, Kell factor, Vertical Resolution, Horizontal Resolution, Video bandwidth, Interlacing, 625 Line System, Bandwidths for TV Transmission, Vertical and horizontal synch detail, Vestigial Side Band transmission (Advantages and Disadvantages)

**MONOCHROME TV (PICTURE AND CAMERA TUBES):** Monochrome picture tube, beam reflection, Beam focussing, Screen Phosphor, Face plate, Picture tube characteristics, picture tube circuit controls, Monochrome Camera Tubes: Basic principle, Image Orthicon, Vidicon, Plumbicon

#### Unit-II

**COLOUR TV ESSENTIALS:** Compatibility, Colour perception, Three Colour theory, Luminance, Hue and Saturation, Dispersion and Recombination of light, Primary and secondary colours, luminance signal, Chrominance Signal, Colour picture tube, colour TV Camera, Colour TV display Tubes, colour Signal Transmission, Bandwidth for colour signal transmission, Colour TV controls. Cable TV, Block Diagram and principle of working of cable TV.

**PLASMA AND LCD:** Introduction, liquid crystals, types of LCD's, TN, STN, TFT, Power requirements, LCD working, Principle of operation of TN display, Construction of TN display, Behaviour of TN liquid crystals, Viewing angle, colour balance, colour TN display, limitations, advantages, disadvantages, applications.

#### Unit-III

**LED AND DMD :** Introduction to LED Television, comparison with LCD and Plasma TV's, schematic of DMD, introduction to Digital MicroMirror device, Diagram of DMD, principle of working, emerging applications of DMD.

**MICROWAVE OVENS AND AIR CONDITIONERS:** Microwaves, Transit Time, Magnetron, Waveguides, Microwave Oven, Microwave Cooking. Air conditioning, Components of air conditioning systems, all water Air conditioning systems, all air air conditioning Systems, Split air conditioner.

#### Unit-IV

**MICROPHONES:** Introduction, characteristics of microphones, types of microphone: carbon, moving coil, wireless, crystal, introduction to tape recorder.

**LOUDSPEAKER:** Introduction to ideal and basic loudspeaker, loudspeaker construction types of loudspeaker: Dynamic and permanent magnet, woofers, tweeters, brief introduction to baffles, equalisers.

#### **TEXTBOOKS :**

1. Consumer Electronics by S. P. Bali (Pearson Education)
2. Complete Satellite and Cable T.V by R.R Gulati (New Age International Publishers)

#### **REFERENCE BOOKS:**

1. Monochrome and Colour Television by R. R. Gulati

#### **Note:**

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

## EE451B ENERGY AUDIT

### B. Tech. Semester – VII (Open Elective)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>:</b>	<b>25 Marks</b>
<b>4</b>	<b>-</b>	<b>--</b>	<b>4</b>	<b>Examination</b>	<b>:</b>	<b>75 Marks</b>
				<b>Total</b>	<b>:</b>	<b>100 Marks</b>
				<b>Duration of Examination</b>	<b>:</b>	<b>3 Hours</b>

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#### Unit-I

**INTRODUCTION TO THE POWER DISTRIBUTION SYSTEM:** Description of the power distribution system- voltage levels, Components of the distribution system- Substation, Transformer, feeders, distribution system planning, operation & maintenance objectives, activities involved in O&M, grid management, load scheduling & dispatch, load balancing, 66-33/11 KV substation equipment, 11/0.4 KV substation equipment, Distribution transformers- reasons for DT failures.

#### Unit-II

**ENERGY ACCOUNTING & ENERGY AUDIT:** Need for energy accounting, objectives & functions of energy accounting, Energy flow diagram in power distribution system, energy accounting procedure- Energy measurement, and problems in energy accounting & overcoming these problems in energy accounting, Definition, need and types of energy audit, energy audit instruments, procedure for conducting an energy audit.

#### Unit-III

**AT&C LOSS REDUCTION & EFFICIENCY IMPROVEMENT:** Concepts and principles of distribution losses- transmission & distribution losses, AT&C losses in power distribution network, factors contributing to high technical & commercial losses. Technical loss reduction- Short term measures for technical loss reduction, long term plans for technical loss reduction, Commercial loss reduction- reasons for commercial losses, measures for commercial loss reduction.

#### Unit-IV

**DEMAND SIDE MANAGEMENT:** An introduction, Why DSM?, Benefits of DSM, DSM in power systems: load management, DSM techniques and emerging trends, EC Act 2001, DSM on consumer side – the industrial sector, the agricultural sector, the domestic & commercial sectors, ESCO-a route for DSM.

#### **TEXT BOOKS:**

1. Handbook of Energy Engineering, The Fairmont Press, INC.-Albert Thumann& Paul Mehta.
2. Energy Management Supply & Conservation, Butterworth Heinemann, 2002-dr. Clive Beggs.

#### **REFERENCE BOOKS:**

1. Hand book on energy audit & environment management by ISBN 81-1993.0920 TERI

#### **Note:**

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

## EEE457B ENERGY RESOURCES & TECHNOLOGY

### B. Tech. Semester – VII (Open Elective)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>4</b>	<b>-</b>	<b>--</b>	<b>4</b>

<b>Class Work</b>	<b>: 25 Marks</b>
<b>Examination</b>	<b>: 75 Marks</b>
<b>Total</b>	<b>: 100 Marks</b>
<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### Unit-I

**ENERGY SOURCES & AVAILABILITY:** World energy situation. Indian energy scenario. Comparative study of thermal, hydro, nuclear and gas power plants. Impact of thermal, gas, hydro and nuclear power stations on environment, air and water pollution, green house effect (global warming), Plasma confinement - magnetic confinement and inertial confinement, geothermal, hydrogen energy, fuel cells, Alkaline fuel cells (AFC), Solid oxide fuel cell (SOFC), Molten carbonate fuel cells (MCFC), thermo-electric power, MHD power generation OTEC & tidal waves.

#### Unit-II

**SOLAR ENERGY:** Solar constant, solar radiation geometry, local solar time, day length, solar radiation measurement, radiation on inclined surface, solar radiation data & solar charts. Flat plate collectors, liquid and air type. Theory of flat plate collectors, advanced collectors, optical design of concentrators, selective coatings, solar water heating, solar dryers, solar stills, solar cooling and refrigeration. Thermal storage. Conversion of heat into mechanical energy. Active and passive heating of buildings. Solar cells.

#### Unit-III

**WIND ENERGY:** Wind as a Source of Energy, Characteristics of wind, wind data. Horizontal & Vertical axis wind Mills, Wind Energy: Wind energy potential measurement, general theories of wind machines, basic laws and concepts of aerodynamics, wind mill and wind electric generator. Basic electric generation schemes- constant speed constant frequency, variable speed constant frequency and variable speed variable frequency schemes. Applications of wind energy.

#### Unit-IV

**BIOMASS ENERGY:** Introduction to biomass, biofuels & their heat content, biomass conversion technologies. Aerobic & anaerobic digester, Factors affecting biogas production, biogas plants - types & description. Utilisation of biogas - Gasifiers, direct thermal application of Gasifiers. Advantages & problems in development of Gasifiers, use in I.C. engines, Energy plantation. Pyrolysis scheme. Alternative liquid fuels –ethanol and methanol. Ethanol production.

#### **TEXT BOOKS:**

1. Electric Power Generation, B.R.Gupta
2. Power Generation, Operation and Control, Wood and Wollenberg, John Wiley & Sons,1984.
3. Power Plant Engg: G.D. Rai

#### **REFERENCE BOOKS:**

1. Renewable Energy Resources: John Twidell and Tony Weir
2. Renewable Energy Resources Conventional & Non- Conventional: M.V.R Koteswara Rao
3. Science & Technology of Photovoltaics: Jayarama Reddy P.

#### **Note:**

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

**BT401B BIOINFORMATICS**  
**B. Tech. Semester – VII ( Open Elective)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>4</b>	<b>-</b>	<b>--</b>	<b>4</b>

<b>Class Work</b>	<b>:</b>	<b>25 Marks</b>
<b>Examination</b>	<b>:</b>	<b>75 Marks</b>
<b>Total</b>	<b>:</b>	<b>100 Marks</b>
<b>Duration of Examination</b>	<b>:</b>	<b>3 Hours</b>

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**Unit-I**

**Introduction:** Internet, intranet and extranet, networking, protocols, genomic data, organization, representation, data base management systems.

**Sequencing Data Bank:** Introduction, collecting and storing sequence in laboratory, nucleic acid data bank – Gen Bank, EMBL, AIDS and RNA, protein data bank (PDB), cambridge structural database CSD, genome data bank, hybridoma data bank structure and others.

**Unit-II**

**Sequence Analysis:** Analysis tools for sequence data banks, pair wise alignment: NEEDLEMAN and WUNSCH algorithms, Smith Waterman, multiple alignment – CLUSTAL-W, BLAST, FASTA, sequence patterns and motifs and profiles.

**Predictions:** Secondary and tertiary structure: algorithms Chao-Fasman algorithm, hidden Markov model, neural networking, protein classification, fold libraries, fold recognition (threading), homology detection, SRS-access to biological data banks.

**Unit-III**

**Phylogenetic Analysis**– Basic concepts in systematics, taxonomy and phylogeny, phylogenetic trees- various types and their construction, tree building methods, distance methods, multiple alignment character based method, phylogenetic software.

**Managing Scientific Data:** Introduction, challenges faced in integration of biological information, SRS, Kleisli Query System TAMBIS, P/FDM mediator for a bioinformatics database, federation, discovery link and data management.

**Unit-IV**

**Genomics & Proteomics:** Genome mapping, assembly and comparison, functional genomics: sequence based approaches & microarray based approaches, proteomics: technology of protein expression analysis & posttranslational modifications, protein sorting, protein-protein interaction.

**TEXT / REFERENCE BOOKS:**

- Developing Bioinformatics Computer Skill, ed. Gibes & Jombeck, Shroff Publication
- Bioinformatics, ed. David W. Mount

**Note:**

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

## AE417B MODERN VEHICLE TECHNOLOGY

### B. Tech. Semester – VII (Open Elective)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>:</b>	<b>25 Marks</b>
<b>4</b>	<b>-</b>	<b>--</b>	<b>4</b>	<b>Examination</b>	<b>:</b>	<b>75 Marks</b>
				<b>Total</b>	<b>:</b>	<b>100 Marks</b>
				<b>Duration of Examination</b>	<b>:</b>	<b>3 Hours</b>

#### Unit-I

**TRENDS IN POWER PLANTS:** Hybrid vehicles – stratified charged / lean burn engines – Hydrogen engines – battery vehicles – Electric propulsion with cables – magnetic track vehicles.

#### Unit-II

**SUSPENSION BRAKES AND SAFETY:** Air suspension – Closed loop suspension – antiskid braking system, Retarders, Regenerative braking safety cage – air bags – crash resistance – passenger comfort

#### Unit-III

**NOISE & POLLUTION:** Reduction of noise – Internal & external pollution control through alternate fuels / power plants – Catalytic converters and filters for particulate emission.

#### Unit-IV

**VEHICLE OPERATION AND CONTROL:** Computer control for pollution and noise control and for fuel economy – Transducers and actuators – Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

**VEHICLE AUTOMATED TRACKS:** Preparation and maintenance of proper road network – National highway network with automated roads and vehicles – Satellite control of vehicle operation for safe and fast travel.

#### **TEXT BOOKS**

1. Heinz Heisler, “Advanced Vehicle Technology” - Arnold Publication.

#### **REFERENCES**

1. Beranek.L.L., Noise reduction, McGraw Hill Book Co., Inc., Newyork, 1993.
2. Bosch Hand Book, 3rd Edition, SAE, 1993.

#### **Note:**

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

## CE451B POLLUTION & CONTROL

### B. Tech. Semester – VII (Open Elective)

-	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>:</b>	<b>25 Marks</b>
	<b>4</b>	<b>-</b>	<b>--</b>	<b>4</b>	<b>Examination</b>	<b>:</b>	<b>75 Marks</b>
					<b>Total</b>	<b>:</b>	<b>100 Marks</b>
					<b>Duration of Examination</b>	<b>:</b>	<b>3 Hours</b>

#### Unit-I

**WATER POLLUTION** – Classification of water pollutants, water characteristics, effluent standards, primary treatment, secondary treatment – aerobic (activated sludge, aerated lagoons, trickling filter, roughing filter, rotating biological contactor) anaerobic (contact process, UASB).

#### Unit- II

**AIR POLLUTION:** Classification of air pollutants: Particulates: Physical characteristics, mode of formation, setting properties, Control measures.

**HYDROCARBONS:** Nature; sources, control, Carbon Monoxide: Source, harmful effects on human health, control measures. Oxides of Sulphur and Nitrogen Sources, effects on human health and plants. Control measure.

#### Unit-III

**SOLID WASTE:** Types, sources and properties of solid waste, methods of solid waste treatment and disposal

**SOLID WASTE MANAGEMENT** – Generation, Collection and techniques for ultimate disposal, Elementary discussion on resource and energy recovery.

#### Unit- IV

Elementary treatment of nuclear pollution, metal pollution, noise pollution their effects & control.

Trace element: Mechanism of distribution, essential and non essential elements, trace of element in marine environment, its ecological effects and biological effects.

#### **Suggested Books:**

1. Environmental Engg.: by Howard s. Peavy & Others, MGH International.
2. Metacaf – EDDY – Waste-water engineering revised by George Teholonobus (TMH)
3. Environmental Chemistry by B.K. Sharma, Goel Publishing, Meerut.
4. Environmental Chemistry, A.K.DE, Wiley Eastern.
5. Air Pollution: H.C. Perking – Mc Graw Hill.

#### **Note:**

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.



## CSE411B MANAGEMENT INFORMATION SYSTEM

### B. Tech. Semester – VII (Open Elective)

-	L	T	P	Credits	Class Work	:	25 Marks
	4	-	--	4	Examination	:	75 Marks
					Total	:	100 Marks
					Duration of Examination	:	3 Hours

#### Unit-I

##### **FOUNDATIONS:-**

**INFORMATION SYSTEM:** Introduction to Information System and MIS, Decision support and decision making systems, systems approach, the systems view of business, Managing the digital firm, Electronic Commerce and Electronic business, DBMS, RDBMS, introduction to Telecommunication and Networks

**I.T.INFRASTRUCTURE:-** Managing Hardware Assets, Managing Software Assets, Managing Data Resources. Internet And New It Infrastructure .

#### Unit-II

**CONCEPTUAL SYSTEM DESIGN:** Define the problems, set systems objective, establish system constraints, determine information needs determine information sources, develop alternative conceptual design and select one document the system concept, and prepare the conceptual design report. Information Systems Security and Control, Ethical and Social Impact of Information Systems.

#### Unit-III

**DETAILED SYSTEM DESIGN:** Inform and involve the organization, aim of detailed design, project management of MIS detailed design, identify dominant and trade of criteria, define the sub systems, sketch the detailed operating sub systems and information flow, determine the degree of automation of each operation, inform and involve the organization again, inputs outputs and processing, early system testing, software, hardware and tools propose an organization to operate the system, documentation of detailed design

#### Unit-IV

**IMPLEMENTATION, EVALUATION AND MAINTENANCE OF THE MIS:** Plan the implementation, acquire floor space and plan space layouts, organize for implementation, develop procedures for implementation, train the operating personnel, computer related acquisitions, develop forms for data collection and information dissemination, develop the files test the system, cut-over, document the system, evaluate the MIS control and maintain the system. Pitfalls in MIS development, Redesigning the organization with Information systems, Managing Knowledge Work.

##### **TEXT BOOKS:**

1.Management Information System by W. S. Jawadekar, 2002, Tata McGraw Hill.

2.Management Information System by K.C. Laudon & J.P. Laudon 7<sup>th</sup> Edition 2003 Pearson Education Publishers Indian Reprint.

3.Information System for Modern Management (3<sup>rd</sup> edition)- Robert G. Murdick, Loel E. Ross & James R. Claggett. PHI

##### **REFERENCE BOOKS:**

1.Management Information System; O Brian; TMH

2.Management Information System by Davis Olson Mac Graw Hill

3.Management Information System by Stallings,(Maxwell Mc Millman Publishers)

##### **Note:**

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.

**IT413B      CYBER SECURITY**  
**B. Tech. Semester – VII (Open Elective)**

-	L	T	P	Credits
	4	-	--	4

Class Work	:	25 Marks
Examination	:	75 Marks
Total	:	100 Marks
Duration of Examination	:	3 Hours

**Unit-I**

**INTRODUCTION TO CYBERCRIME:** Cybercrime and Information Security, Classifications of Cybercrimes, The need for Cyberlaws, The Indian IT Act Challenges to Indian Law and Cybercrime Scenario in India, Weakness in Information Technology Act and its consequences, Digital Signatures and the Indian IT Act, Cybercrime and Punishment; Technology, Students and Cyberlaw; Survival tactics for the Netizens, Cyber-offenses: Cyberstalking, Cybercafe and Cybercrimes, Botnets, Attack Vector, Cloud Computing;

**Unit-II**

**TOOLS AND METHODS USED IN CYBERCRIME:** Proxy Servers and Anonymizers, Phishing and identity theft, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow; Cybercrime: Mobile and Wireless Devices: Trends in Mobility, Attacks on Wireless Networks, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones.

**Unit-III**

**UNDERSTANDING COMPUTER FORENSICS:** The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Challenges in Computer Forensics, Forensics Auditing, Antiforensics.

**Unit-IV**

**CYBERSECURITY: ORGANIZATIONAL IMPLICATIONS:** Cost of Cybercrimes and IPR Issues, Web Threats for Organizations, Security and Privacy Implications from Cloud Computing, Social Media Marketing, Social Computing and the Associated Challenges for Organizations, Protecting People's Privacy in the Organization, Organizational Guidelines for Internet Usage, Safe Computing Guidelines and Computer Usage Policy, Incident Handling, Forensics Best Practices, Media and Asset Protection, Importance of Endpoint Security in Organizations.

**TEXT BOOKS:**

- “Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Nina Godbole, Sunit Belapur, Wiley India Publications, April, 2011

**Note:**

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