St. PETER'S INSTITUTE OF HIGHER EDUCATION AND RESEARCH

(Deemed to be University U/S 3 of the UGC Act,1956)

Avadi, Chennai – 600 054.

B.E. (BIOMEDICAL ENGINEERING) PROGRAMME

(Approved by AICTE)

(I to VIII SEMESTERS)

REGULATIONS AND SYLLABI UNDER CHOICE BASED CREDIT SYSTEM

(REGULATION – 2020)

Effective from the Academic Year 2020-2021

St. Peter's Institute of Higher Education and Research

B.E. (BIOMEDICAL ENGINEERING)

REGULATION 2020

CHOICE BASED CREDIT SYSTEM

VISION & MISSION OF THE INSTITUTION

Vision

To achieve, Academic Excellence in Engineering, Technology and Science through Teaching, Research and Extension to Society

Mission

By generating, preserving and disseminating knowledge through rigorous academic study, inquisitiveness to understand and explore nature, entrepreneurship with creativity and innovation

VISION & MISSION OF THE DEPARTMENT

Vision

To develop Health oriented Engineering technologies and to enhance and improve the health status of the Nation.

Mission

To produce academically qualified research oriented and professionally eminent Biomedical Engineers to serve the field of medicine with their Engineering skills.

Program Educational Objectives (PEOs)

Upon Completion of the course, our graduates will:

PEO1: Demonstrate their skills in solving challenges in their chosen field through the core foundation and knowledge acquired in biology, medicine and engineering.

PEO2: Display leadership, make decisions with societal and ethical responsibilities, function and communicate effectively in multidisciplinary settings.

PEO3: Recognize the need for sustaining and expanding their technical competence and engage in learning opportunities throughout their career and life.

PROGRAM OUTCOMES (POs):

Engineering Graduates will be able to:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern

engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

Graduates will have ability:

PSO1: To apply advanced technology for measurement and interpretation of biological data addressing the issues associated with the interface between living and non-living systems.

PSO2: To utilize mathematics, software tools, science and engineering for accurate diagnosis and therapy.

PSO3: To develop and improve information system in healthcare for automated and remote access.

Contribution 1: Reasonable **2: Significant** **3: Strong**

St. PETER'S INSTITUTE OF HIGHER EDUCATION AND RESEARCH

B.E. (BIOMEDICAL ENGINEERING) PROGRAMME

REGULATIONS AND SYLLABI UNDER CHOICE BASED CREDIT SYSTEM

(Effective from the Academic Year 2020-2021)

B.E / B. Tech. REGULATIONS (2020)

Regulations – 2020 is applicable to the students admitted to the Degree of Bachelor of Engineering (B.E.), Bachelor of Technology (B.Tech.) (Eight Semesters) programme effective from the academic year 2020-2021

1. NOMENCLATURE

Programme : Refers to the Bachelor of Engineering / Technology Stream that a student has chosen for study.

Course : Refers to the course (Subject) that a student would have to undergo during the study in the Institution

Batch : Refers to the Starting and Completion year of a Programme of study. Eg. Batch of 2020–2024 refers to students belonging to a 4 year Degree programme admitted in 2020 and completing in 2024.

Department : Each Programme of the Institution is grouped under a Department. Eg. B.E Biomedical Engineering is grouped under Departments of Biomedical Engineering. This Department offers various Undergraduate and Postgraduate Programmes in Engineering like B.E (Biomedical Engineering), M.E (Biomedical Engineering).

Dean : Refers to the Head of Engineering Programmes.

HoD : Refers to the Head of a Department (HoD) offering various UG and PG programmes.
He/She will be the Head of all staff members and Students belonging to the Department

2. QUALIFICATION FOR ADMISSION

Qualification for admission will be as per the criterion specified by the appropriate agencies of the Government of India.

- Candidates who passed the Higher Secondary Examination with Mathematics, Physics and Chemistry conducted by the Government of Tamil Nadu or its equivalent in the relevant subjects as recognized by the Institute or any other equivalent Examination thereto and who appeared for the entrance test conducted by the University or approved institutions wherever prescribed are eligible for admission to Four Year B.E. Programme.
- Candidates who passed Three Year Diploma in Technical Education in the concerned subject conducted by the Government of Tamil Nadu are eligible for admission to the Second Year of Four Year B.E. Programme in the relevant discipline.

3. STRUCTURE OF PROGRAMME

Every Programme will have a curriculum with syllabi consisting of theory and practical.

Credit Distribution

S.No	Category	No. of Courses	Credits
1.	Institute Core Courses	21	52
2.	Institute Elective Courses	02	06
3.	Program Core Courses	32	94
4.	Program Elective Courses	06	18
Total		**62**	**170**

SEMESTER 1

Sl. No.	Course Code	Course Title	L	T	P	C	MARKS		
							CA	EA	TOTAL
1.	AELT1101	English	3	0	0	3	40	60	100
2.	AMAT1101	Mathematics –I	3	1	0	4	40	60	100
3.	ACYT1101	Chemistry	3	0	0	3	40	60	100
4.	AEET1101	Basic Electrical & Electronics Engineering	3	0	0	3	40	60	100

5.	AMET1101	Engineering Graphics Design	1	2	0	3	40	60	100
6.	ACYL1101	Chemistry Laboratory	0	0	4	2	40	60	100
7.	AMEL1101	Engineering Practices Laboratory	0	0	4	2	40	60	100
	Total		**13**	**4**	**8**	**20**	**280**	**420**	**700**

SEMESTER 2

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**MARKS**		
							CA	**EA**	**TOTAL**
1.	APHT1101	Physics	3	0	0	3	40	60	100
2.	AMAT1102	Mathematics –II	3	1	0	4	40	60	100
3.	ACST1100	Fundamentals of Computing & Communication	3	0	0	3	40	60	100
4.	ACST1101	Computer Programming	3	0	0	3	40	60	100
5.	ACHT1101	Environmental Science	3	0	0	3	40	60	100
6.	APHL1101	Physics Laboratory	0	0	4	2	40	60	100
7.	ACSL1101	Computer Programming Laboratory	0	0	4	2	40	60	100
8	ASSL1101	Soft Skills I	0	0	2	1	100	0	100
		TOTAL	**15**	**1**	**10**	**21**	**380**	**420**	**800**

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS,

SEMESTER 3

Sl. No.	**Course Code**	**Course Title**	L	T	P	C	MARKS		
							CA	EA	TOTAL
1.	AMAT2103	Transforms and Partial differential equations	3	1	0	4	40	60	100
2.	ABMT2102	Bio Chemistry	3	0	0	3	40	60	100
3.	AECT2103	Signals and Systems	3	0	0	3	40	60	100
4.	AECT2101	Electron Devices and Circuits	3	0	0	3	40	60	100

5.	ABMT2103	Anatomy and Human Physiology	3	0	0	3	40	60	100
6.	AECT3113	Analog and Digital Communication	3	0	0	3	40	60	100
7.	AECL2101	Electron Devices and Circuits Laboratory	0	0	4	2	40	60	100
8.	ABML2101	Anatomy and Human Physiology Laboratory	0	0	4	2	40	60	100
9	ASSL2102	Soft Skills - II	0	0	2	1	100	0	100
	TOTAL		**18**	**1**	**10**	**24**	**420**	**480**	**900**

SEMESTER 4

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**MARKS**		
							CA	**EA**	**TOTAL**
1.	ABMT2104	Biocontrol Systems	3	1	0	4	40	60	100
2.	ABMT2105	Biomaterials and artificial organs	3	1	0	3	40	60	100
3.	AECT2164	Analog and Digital ICs	3	1	0	3	40	60	100
4.	ABMT2106	Pathology and Microbiology	3	0	0	3	40	60	100
5.	ABMT2107	Biosensors and Measurements	3	0	0	3	40	60	100
6.	AECL2174	Analog and Digital ICs Laboratory	0	0	4	2	40	60	100
7.	ABML2102	Pathology and Microbiology Laboratory	0	0	4	2	40	60	100
8.	ABMI2101	Internship I	0	0	0	2	100	0	100
9.	ASSL2103	Soft Skills - III	0	0	2	1	100	0	100
	TOTAL		**15**	**1**	**10**	**23**	**420**	**480**	**900**

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS,

SEMESTER 5

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**MARKS**		
							CA	EA	TOTAL
1.	ABMT3108	Biomedical Instrumentation	3	0	0	3	40	60	100
2.	AECT3111	Digital Signal Processing	3	1	0	4	40	60	100
3.	ABMT3109	Diagnostic and Therapeutic Equipment I	3	0	0	3	40	60	100
4.		PE I	3	0	0	3	40	60	100

5.		PE II	3	0	0	3	40	60	100
6.		UE I	3	0	0	3	40	60	100
7.	ABML3103	Biomedical Instrumentation Laboratory	0	0	4	2	40	60	100
8.	AECL3175	Digital Signal Processing Laboratory	0	0	4	2	40	60	100
9.	ASSL3104	Soft Skills IV	0	0	2	1	100	0	100
	TOTAL		18	1	10	24	420	480	900

SEMESTER 6

Sl. No.	Course Code	Course Title	L	T	P	C	MARKS		
							CA	EA	TOTAL
1.	AMBT1101	Principles of Management and Professional Ethics	3	0	0	3	40	60	100
2.	ABMT3110	Diagnostic and Therapeutic Equipment II	3	0	0	3	40	60	100
3.	AECT2107	Micro Processor and Microcontroller	3	0	0	3	40	60	100
4.		PE III	3	0	0	3	40	60	100
5.		PE IV	3	0	0	3	40	60	100
6.	ABML3104	Diagnostic and Therapeutic Equipments Laboratory	0	0	4	2	40	60	100
7.	AECL2170	Micro Processor and Microcontroller Laboratory	0	0	4	2	40	60	100
8.	ABMI3102	Internship II	0	0	0	2	100	0	100
9.	ASSL3105	Soft Skills V	0	0	2	1	100	0	100
	TOTAL		**15**	**0**	**10**	**22**	**480**	**420**	**900**

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS,

SEMESTER 7

Sl. No.	Course Code	Course Title	L	T	P	C	MRKS		
							CA	EA	TOTAL
1.	ABMT4132	Radiological Equipments	3	0	0	3	40	60	100
2.	ABMT4133	Neural Networks and Fuzzy systems	3	0	0	3	40	60	100
3.	AECT3128	Digital Image Processing	3	0	0	3	40	60	100
4.		PE V	3	0	0	3	40	60	100
5.		PE VI	3	0	0	3	40	60	100

6.		UE II	3	0	0	3	40	60	100
7.	AECL3180	Digital Image Processing Laboratory	0	0	2	2	40	60	100
8.	ABMP4101	Project Phase I	0	0	6	3	40	60	100
	TOTAL		**18**	**0**	**8**	**23**	**320**	**480**	**800**

SEMESTER 8

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	MRKS		
							CA	EA	TOTAL
1.	ABMT4131	Quality Assurance and Safety in Hospital	3	0	0	3	40	60	100
2.	ABMT4130	Human Values and Medical Ethics	3	0	0	3	40	60	100
3.	ABMP4102	Project Phase II	0	0	14	7	40	60	100
	TOTAL		**6**	**0**	**14**	**13**	120	180	300

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS,

Overall total credits for B.E Biomedical Engineering	170

(i) **Institute Core Courses (IC)** which includes General Foundation courses comprising English, Mathematics, Basic Sciences and Engineering Sciences along with Laboratories.

Institute Core Applicable to B.E. BIOMEDICAL ENGINEERING				
Sl. No.	**Course Code**	**Course Title**	**No. of Courses**	**No. of Credits**
1	AMAT1101	Mathematics I	1	4
2	AMAT1102	Mathematics II	1	4
3	AMAT2103	Mathematics III	1	4
4	APHT1101	Physics	1	3
5	APHL1101	Physics Lab	1	2
6	ACYT1101	Chemistry	1	3
7	ACYL1101	Chemistry Lab	1	2
8	AELT1101	English	1	3
9	ACHT1101	Environmental Science	1	3
10	AMBT1101	Principles of management and Professional Ethics	1	3
11	AMET1101	Engineering Graphics	1	3

12	AMEL1101	Engineering Practices	1	2
13	AEET1101	Basic Electrical and Electronics Engineering	1	3
14	ACST1101	Computer Programming	1	3
15	ACSL1101	Computer Programming Lab	1	2
16	ACST1100	Fundamentals of Computing and Communication	1	3
17		Soft Skills Lab 1	1	1
18		Soft Skills Lab 2	1	1
19		Soft Skills Lab 3	1	1
20		Soft Skills Lab 4	1	1
21		Soft Skills Lab 5	1	1
TOTAL				**52**

(ii)**Programme Core courses (PC)** belonging to the Major Programme of study.

S.No.	Course Code	Course Name	Pre Requisite	Credits
1	ABMT2102	Bio Chemistry	Chemistry	3
2	AECT2103	Signals and Systems	Mathematics I & II	3
3	AECT2101	Electron Devices and Circuits	Physics	3
4	ABMT2103	Anatomy and Human Physiology	None	3
5	AECT3113	Analog and Digital Communication	Signals and Systems	3
6	ABMT2104	Biocontrol Systems	Mathematics I & II	4
7	ABMT2105	Biomaterials and Artificial organs	Anatomy and Human Physiology	3
8	ABMT2107	Biosensors and Measurements	None	3
9	AECT2164	Analog and Digital ICs	Electron Devices and Circuits	3
10	ABMT2106	Pathology and Microbiology	Anatomy and Human Physiology, Biochemistry	3
11	ABMT3108	Biomedical Instrumentation	Anatomy and Human Physiology, Electron Devices and Circuits	3
12	AECT3111	Digital Signal Processing	Signals and Systems	4
13	ABMT3109	Diagnostic and Therapeutic Equipment I	Biomedical Instrumentation	3

14	ABMT3110	Diagnostic and Therapeutic Equipment II	Diagnostic and Therapeutic Equipment I	3
15	AECT2107	Micro Processor and Microcontroller	Electron Devices and Circuits	3
16	ABMT4114	Neural Networks and Fuzzy systems	Digital Image Processing	3
17	AECT3128	Digital Image Processing	Digital Signal Processing	3
18	ABMT4111	Radiology Equipments	Physics	3
19	ABMT4112	Quality Assurance and Safety in Hospital	Diagnostic and Therapeutic Equipment II	3
20	ABMT4113	Human Values and Medical Ethics	None	3
21	AECL2101	Electron Devices and Circuits Laboratory	Electron Devices and Circuits	2
22	ABML2101	Anatomy and Human Physiology Laboratory	Anatomy and Human Physiology	2
23	AECL2174	Analog and Digital ICs Laboratory	Analog and Digital ICs, Electron Devices and Circuits	2
24	ABML2102	Pathology and Microbiology Laboratory	Pathology and Microbiology	2
25	ABML3103	Biomedical Instrumentation Laboratory	Biomedical Instrumentation	2
26	AECL3175	Digital Signal Processing Laboratory	Digital Signal Processing	2
27	ABML3104	Diagnostic and Therapeutic Equipments Laboratory	Diagnostic and Therapeutic Equipment II	2
28	AECL2170	Micro Processor and Microcontroller Laboratory	Microprocessor and Microcontroller	2
29	AECL3180	Digital Image Processing Laboratory	Digital Image Processing, Digital signal Processing Laboratory	2
30	ABMP4101	Project Phase I		3
31	ABMP4102	Project Phase II		7
32	ABMI2101	Internship I		2
33	ABMI3102	Internship II		2
TOTAL				94

(iii)**Programme Electives (PE)** offered by the Department related to the Major programme of study. A student should choose atleast 6 courses during the programme.

PROGRAM ELECTIVES

Group – I: Biomedical Instrumentation

Sl.No	Course Code	Electives	L	T	P	C
1.	ABMT3111	Biomechanics and Biofluidics	3	0	0	3
2.	ABMT3113	Rehabilitation Engineering	3	0	0	3
3.	ABMT3114	Physiological Modeling	3	0	0	3
4.	ACST3110	Computer Networks	3	0	0	3
5.	ABMT3115	Bio Signal Processing	3	0	0	3
6.	ABMT4127	Hospital Training and Equipment Management	3	0	0	3
7.	ABMT3116	Virtual Instrumentation	3	0	0	3
8.	ABMT4128	Trouble Shooting of Medical Instruments	3	0	0	3
9.	ABMT4129	Medical Imaging Techniques	3	0	0	3

Group – II: Nano Biosystems

Sl.No	Course Code	Electives	L	T	P	C
1.	ABMT3117	Biomedical Nanotechnology	3	0	0	3
2.	ABMT3118	Neural Engineering	3	0	0	3
3.	ABMT3119	Wearable systems	3	0	0	3
4.	ABMT3120	Body area networks	3	0	0	3
5.	ABMT3121	BioMEMS	3	0	0	3
6.	ABMT3122	Medical physics	3	0	0	3
7.	ABMT3123	Medical Optics	3	0	0	3
8.	ACST3136	Soft Computing techniques	3	0	0	3
9.	ABMT4131	Artificial Organs And Implants	3	0	0	3
10.	ABMT4132	Brain Control interface and its applications	3	0	0	3
11.	ABMT4133	Nanotechnology and applications	3	0	0	3

Group – III: Bioinformatics

Sl.No	Course Code	Electives	L	T	P	C
1.	ABMT3124	Telehealth Technology	3	0	0	3
2.	ABMT3125	Biostatistics	3	0	0	3

3.	ABMT3126	Biometric Systems	3	0	0	3
4.	AECT3114	Embedded and real time systems	3	0	0	3
5.	ACST2104	Programming and Data structures	3	0	0	3
6.	AECT2165	Internet of Things in healthcare	3	0	0	3
7.	ACST3115	Big Data Analytics	3	0	0	3
8.	ACST3144	Grid and Cloud Computing(TCS ion)	3	0	0	3
9.	ACST3136	Machine learning Techniques	3	0	0	3
10.	ABMT4134	Robotics and Automation in Medicine	3	0	0	3
11.	ABMT4135	Virtual Reality in medical applications	3	0	0	3
12.	ABMT4136	Bioinformatics	3	0	0	3

(iv)**Institute Electives (IE)** comprising of Professional elective courses from respective Departments and provides the opportunity to a students to choose any course of any stream. A student should choose atleast 2 courses during the programme.

INSTTUTE ELECTIVES				
Sl. No.	**Branch**	**Course Code**	**Course Name**	**Credits**
1	**CSE**	ACST3112	Soft Computing and its applications	3
2	**CSE**	ACST3120	Artificial Intelligence For Real World Applications	3
3	**CSE**	ACST4124	Machine Learning For Real World Applications	3
4	**CSE**	ACST4139	Applied Cloud Computing	3
5	**IT**	AITT3111	Cyber Security Fundamentals	3
6	**IT**	AITT3119	PRACTICAL APPROACH TO DATA MINING AND ANALYTICS	3
7	**IT**	AITT4129	Big Data Analytics Tools and Applications	3
8	**IT**	AITT4130	Foundations of Block Chain Technologies	3
9	**ECE**	AECT3117	Electromagnetic Interference and	3

			Compatibility	
10	**ECE**	AECT3120	PCB Design	3
11	**ECE**	AECT3121	Digital Design using EDA tools	3
12	**CSE, IT**	AITT3120	Internet of Things – Overview & its Application	3
13	**EEE**	AEET3112	Industrial Automation	3
14	**EEE**	AEET3119	Electric Vehicle Drive System	3
15	**EEE**	AEET4140	Robotic Systems	3
16	**Mech**	AMET4163	Waste Management	3
17	**Mech**	AMET4164	Computer Workstation Ergonomics	3
18	**Mech**	AMET4165	Structure and Properties of Materials	3
19	**Mech**	AMET4166	Total Quality Management	3
20	**Mech**	AMET4167	Supply chain Management	3
21	**Mech**	AMET4168	Industrial Automation	3
22	**Civil**	ACIT4130	Disaster Management	3
23	**Civil**	ACIT4131	Safety Engineering	3
24	**Civil**	ACIT4132	Climate Change	3
25	**Civil**	ACIT4125	Environmental Impact Assessment	3
26	**BME**	ABMT4128	Trouble shooting of Medical Instruments	3
27	**BME**	ABMT3117	Biomedical Nanotechnology	3
28	**BME**	ABMT1101	Biology for Engineers	3
29	**BME**	ABMT4136	Bioinformatics	3
30	**HUM**	AHMT4101	Gender, Culture and Development studies	3
31	**HUM**	AHMT4102	State, Nation Building and Politics	3
32	**HUM**	AHMT4103	Work Ethics, Corporate Social responsibility and Governance	3

33	**HUM**	AHMT4104	Indian Constitution, Essence of Indian Knowledge Tradition	3
34	**HUM**	AMBT3102	Cognitive Science	3
35	**MBA**	AMBT3103	Stock Trading Fundamentals	3
36	**MBA**	AMBT3104	Industrial Economics	3
37	**MBA**	AMBT3105	Finance for Non Finance Professionals	3
38	**Maths**	AMAT2105	Numerical Methods	3
39	**Maths**	AMAT2106	Statistics and Numerical Methods	3
40	**Maths**	AMAT2108	Probability and Statistics	3
41	**Maths**	AMAT2109	Probability and Queuing Theory	3
42	**Maths**	AMAT2110	Resource Management Techniques	3

(vi)**ONLINE Courses:** The department Board of Studies (BoS) shall approve the list of online courses offered by approved external agencies. While listing the courses, the BoS shall consider the following points:

a. The course evaluation is carried out by the same external agency

b. Equivalent grading mechanism to be arrived at by the department

A student can register up to a maximum of 24 credits (total) as online courses during the entire programme of study. These shall be treated as Elective courses (program elective or open elective). Students may be allowed to register for one course per semester starting from 5th session onwards.

(vii)**Internship Training** during the course of study.

(viii)**Project Work**

Each semester curriculum shall normally have a blend of lecture courses and practical courses.

3.1 MEDIUM OF INSTRUCTION:

The medium of instruction, examinations and project report will be in English Language throughout the Programme.

3.2 CREDIT ALLOTMENT TO COURSES

Each course is normally assigned certain number of credits as follows:

Lecture Hours (Theory) : 1 credit per lecture hour per week.

Laboratory Hours	**:**	1 credit for 2 Practical hours, 2 credits for 3 or 4 hours of practical per week.
Project Work phase I	**:**	3 credits for 6 hours of project work (Phase - I) per week.
Project Work phase II	**:**	7 credits for 14 hours of project work (Phase - II) per week.
Internship Training	**:**	2 credits for 2 weeks of Training

*** All the engineering course having 3 credits may have 4 lecture hours of which one hour will be dedicated for tutorial which will not be accounted as a credit.**

(v) **DURATION OF THE PROGRAMME**

A student is normally expected to complete the B.E./B.Tech. Programme in 8 semesters but in any case not more than 12 consecutive semesters from the time of commencement of the course (not more than 10 semesters for those who join 3rd semester under Lateral entry system).

(vi) **REQUIREMENTS FOR COMPLETION OF A SEMESTER**

A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirement for completion of a semester.

- He/She secures not less than 75% of overall attendance in that semester.
- Candidates who do not have the requisite attendance for the semester will not be permitted to write the semester Examinations.

(vii) **VARIOUS POSITIONS IN A DEPARTMENT**

6.1 **DEAN** : All Engineering Departments are headed by a Dean. The dean is responsible for all activities taking place in coordination with all department heads and all staff members belonging to them. The Dean shall act as a linkage between the HoD's, faculty members and the students. The Dean makes a review of all the academic activities of staff, students and research on a regular time interval and takes steps to improve the morale of all staff and students.

6.2 HEAD OF THE DEPARTMENT

Each department offering various UG and PG programmes is headed by a Head (HoD). The head of the department (HoD) is responsible for allotting courses to each staff member uniformly in consultation with other HoD's and School Deans. The HoD is responsible for streamlined teaching of courses to students, improvement and assessment of teaching quality within the department on a continuous basis, assessment of staff members, transparent conduct of continuous assessment examinations, interacting with parents, ensuring that all academic and non-academic activities of staff and students are monitored and steps taken for their improvement.

6.3FACULTY ADVISOR

To help the students in planning their courses of study and to render general advice regarding either the academic programme or any other activity, the Head of the Department concerned, will assign every year, a certain number of students from the first year to a faculty member who will be called as Faculty Advisor. The set of students thus assigned will continue to be under the guidance of this Faculty Advisor till they complete the programme or replaced by the HOD. The Faculty Advisor gets information about the syllabus coverage by the staff members, requirements of the students academically and otherwise, attendance and progress of the students from the respective class counselors. The Faculty Advisor also informs the students about the academic schedule including the dates of assessments and syllabus coverage for each assessment, weightage for each assessment, their continuous assessment marks and attendance % details before the commencement of end semester examinations.

6.4CLASS COUNSELOR

There shall be a class counselor for each class/section. The class counselor will be one among the teachers of the department. He/She will be appointed by the Head of the respective department. The responsibilities for the class counselor shall be:

- To act as the channel of communication between the HoD, dean, year coordinator, course coordinator, staff and students of the respective class.
- To collect and maintain various statistical details of students.
- To help the year coordinator in planning and conduct of the classes.
- To monitor the academic performance of the students including attendance and to inform the year coordinator.
- To take care of the students' welfare activities like industrial visits, seminars, awards etc.

6.5COURSE COORDINATOR FOR EACH COURSE

Each theory course offered to more than one class or branch or group of branches, shall have a "course coordinator". The course coordinator will be nominated by the school dean in consultation with respective head of the department. The course coordinator will be normally a senior staff who is one among the teachers teaching the course.

The "Course Coordinator" shall meet the teachers handling the course, as often as possible and ensure

- A common teaching methodology is followed for the course.
- The study materials are prepared by the staff members and communicated to the students periodically.
- The involvement of students in course based projects and assignments.
- To prepare common question paper for continuous assessment exams.
- For uniform evaluation of continuous assessments answer sheets by arriving at a common scheme of evaluation.

The course coordinator is responsible for evaluating the performance of the students in the continuous assessments and end semester examinations and analyse them to find suitable methodologies for improvement in the performance. The analysis should be submitted to the HoD and school dean for suitable action.

6.6 CLASS COMMITTEE

a) Constitution of the Class Committee

For every class, a class committee shall be constituted by the Heads of Department, as given below:

Chairman	A faculty member not teaching that particular class
Members	• Faculty of all the courses of study • Four student members from the class to be nominated by the Head of the Department

b) Functions of the Class Committee

(i) The class committee shall meet thrice during the session. The first meeting will be held within two weeks from the date of commencement of the session in which the nature of the broad assessment procedure for the different courses will be discussed. The second and third meetings will be held six weeks and ten weeks respectively from the commencement of a session to meaningfully interact and express opinions and suggestions to improve the effectiveness of teaching - learning process and analyze the performance of the students in the assessments. The chairperson of the class committee should send the minutes of the class committee meetings to the Dean through the Head of the Department, immediately after the class committee meetings.

(ii) During the first meeting of the class committee, all the faculty members shall give their course plan to the class committee chairperson for approval and uploading into the course plan website

(iii) Any innovation in any course plan not agreed by the class committee or the HoD will be referred to the Chairman for approval.

7 COURSE PLAN AND DELIVERY

a) The course plan (**IC, PC, PE, OE, and PLC**) will have details of the overview of the course, course objectives, course outcome, course teaching and learning activities and course assessment methods and policy on compensation assessment.

b) Each course will have tailor-made assessment models viz. group tasks, assignments, report on field visit, quizzes, open book tests, laboratory exercises, mini-project and end of session summative assessment etc. The course plan will also have details of information on study materials.

c) The number of assessments for a course shall range from 4 to 6.

d) Every course should have a final assessment (End Semester) on the entire syllabus with 60% weightage.

e) The course plan shall be approved by the Class Committee (CC) chairperson and the HoD of the Department offering the course.

f) The Course plans for all courses offered by the Institute will be available in the website for reference by the faculty and students.

8 ATTENDANCE

All courses should have a common attendance policy:

a) At least 75% attendance in each course is mandatory.

b) A maximum of 10% shall be allowed under On Duty (OD) category.

c) Students with less than 65% of attendance shall be prevented from writing the End Semester

Examination..

9 ASSESSMENT PROCEDURE

Each **COURSE** shall have assessments done according to the Course Plan drawn by the faculty who handles the course . The assessments of a course will depend on the needed course learning outcomes.

There will be a continuous assessment examination and end semester examination for both theory and practical courses of all programmes.

(i) Theory courses

Continuous Assessment (CAE) : 40 Marks
End Semester Exams (ESE) : 60 Marks

(ii) Practical courses

Continuous Assessment (CAE) : 40 Marks
End Semester Exams (ESE) : 60 Marks

9.1 CONTINUOUS ASSESSMENT EXAMS (CAE)

(a) Theory Courses

- There will be a minimum of Three continuous assessment exams (Assessment Test 1,2 and a Model Exam) , for each theory course.

DISTRIBUTION OF CONTINUOUS ASSESSMENT EXAM (CAE) MARKS FOR A THEORY COURSE			
Evaluation Component	Syllabus coverage	Duration of the Exam	Max. Weightage
CAE-1	First 1.5 Units of the syllabus	2 Hours	25 Marks (20% weightage for CAE 1 & CAE 2 and 60% for Model Exam)
CAE-2	Next 1.5 Units of the syllabus	2 Hours	
Model Exam	Full syllabus	3 Hours	
Assignment	• 2 written assignments for each course / • Written quiz (or) Presentation of a written Report (or) Case study / • Multiple choice Objective Type Test		10 Marks
Mini Project (or) Group Presentation	• Technical Project involving not more than 3 students (or) any other Group Presentation related to the course.		5 Marks

The total marks secured in the assessment exams out of 100, will be converted to 40 Marks.

- The continuous assessment marks obtained by the candidate in the first appearance shall be retained, considered and valid for all subsequent attempts, till the candidate secures a pass.

(b) Practical Courses

- For practical courses, the student will be evaluated on a continuous basis for 20 Marks (which will include performing all experiments, submitting observation and record note book in scheduled format and time), 15 marks for model exam at the end of the semester and 5 marks for attendance in the course.

- For practical courses, if a student has been absent for some practical classes or has performed poorly, then the student will have to get permission from the lab incharge and year coordinator to do the experiments, so that he/she meets all the requirements for the course and thereby allowed to appear for model and end semester exams.

- If a student has not done all the experiments assigned for that lab, before the scheduled date or has attendance percentage less than 90%, the student will not be allowed to appear for the model and end semester practical exam. Such students will have to redo the course again by doing all the experiments in the next semester when the course is offered.

9.2 END SEMESTER EXAMINATIONS (ESE)

- The end semester examinations shall normally be conducted between October and December during the odd semesters and between March and May during the even semesters for both theory and practical courses of all programmes.

- End semester examinations will be conducted for a maximum of 100 marks. The marks secured in end semester exams will be converted to 60 marks.

- End semester practical exams will be conducted for a maximum of 50 marks.

9.3 Internship / Industrial Training

- Every student is required to undergo Industrial Visits during every semester of the Programme. HoDs shall take efforts to send the students to industrial visits in every semester.
- Every student will have to undergo Internship / Industrial training for a Minimum period of 2-3 weeks during the semester Holidays at the end of second year and Third Year.

- This could be internship in an industry approved by the Dean or Professional Enrichment courses (like attending Summer Schools, Winter Schools, Workshops) offered on Campus or in Registered Off Campus recognised Training Centres approved by the Dean for a minimum period of 3 weeks.

- A report on Training undergone by the student, duly attested by the Coordinator concerned from the industry / Organisation, in which the student has undergone training and the Head of the Department concerned, shall be submitted after the completion of training. The evaluation of report and viva voce examination can be computed as per norms for the End Semester examination.

- The evaluation of training will be made by a three member committee constituted by Head of

the Department in consultation with Faculty Advisor and respective Training Coordinator. A presentation should be made by the student before the Committee, based on the Industrial Training or Professional Enrichment undergone.

9.4 PURSUING COURSES IN OTHER INDIAN INSTITUTIONS AND ABROAD

- A student can be selected, to get Professional Exposure in his/her area of Expertise in any Reputed Research Organization or Educational Institution of repute or any Universities in India and abroad.
- This is possible only with the List of Research Organizations, Educational Institutions in India and abroad approved by the Academic Council.
- The student can have the option of spending not more than three to Six months in the Final year or Pre- final year of his/her Degree. During this period, the student can do his/her Project work or register for courses which will be approved by the Class Committee and Dean, under the Guidance of a Project Supervisor who is employed in the Organization and Co-guided by a staff member from our Institution.
- Credit Transfer can be done by the CoE on submission of certificate through the HoD and Dean within 15 days of completion of the training.
- The students who undergo training outside the Institution (either in India or Abroad) is expected to abide by all Rules and Regulations to be followed as per Indian and the respective Country Laws, and also should take care of Financial, Travel and Accommodation expenses.

9.5 NSS/ NCC/ YRC/SPORTS Training

NSS/ NCC/ YRC training is compulsory for all the Undergraduate students:

- The activities will include Practical / Field activities / Extension lectures. The activities shall be beyond class hours.
- The student participation shall be for a minimum period of 45 hours per session during the first / Second year.
- The activities will be monitored by the respective faculty in charge and the Year Coordinator.
- Grades will be awarded on the basis of participation, attendance, performance and behavior. Grades shall be entered in the mark statement as given below:

  Very Good, Good, Satisfactory and **Unsatisfactory**

- If a student gets an unsatisfactory Grade, he/she has to repeat the above activity in the subsequent years, along with the first year students.
- The Grades awarded by the Faculty in-charge shall be entered in the Third Year (Sixth Semester) Mark Statement.
- A student who has not completed the **NSS / NCC / YRC** requirements in first six semesters will not be permitted to continue the B.Tech. Programme.

9.6 PROJECT WORK

- Project work has to be done by each student in the final year. The project work has been divided in to two phases (Phase - I and II). Project work Phase - I has to be done in the pre-final semester and

Phase - II during the final semester.

- Permission for project work in the second year of the programme in general will be given to innovative and industry related work. Such projects will be evaluated in every session until the VIII semester. If the evaluation committee is satisfied with the progress of the project work, continuation for the project work will be given until the final assessment is made in the VIII semester. In case, there is no tangible progress in a session, such project work will be terminated and the students will have to do their project in the final year in their respective departments.

- Project work may be allotted to a single or two students as a group. In special cases, the number of students in a project group cannot exceed three, if it can be justified by the project supervisor and HoD, that the project work content is large enough.

- For project work, assessment is done on a continuous basis by 3 reviews for 50 marks and final viva voce carries 50 Marks.

- There shall be three project reviews (conducted during the pre-final semester and final semester) to be conducted by a review committee. The student shall make presentation on the progress made, before the committee. The head of the department shall constitute the review committee for each branch in consultation with school dean. The members of the review committee will evaluate the progress of the project and award marks.

	PROJECT REVIEWS			FINAL PROJECT VIVA VOCE
	1	2	3	
Max. Marks	5	15	30	50

- The total marks obtained in the three reviews, rounded to the nearest integer is the continuous assessment marks out of 50. There shall be a final viva-voce examination at the end of final semester conducted by one internal examiner, one external examiner and the supervisor concerned.

- A student is expected to attend all the project reviews conducted by the institution on the scheduled dates. It is mandatory for every student to attend the reviews, even if they are working on a project in an industry based outside Chennai city. It is their duty to inform the organization about the project reviews and its importance, and get permission to attend the same. If a student does not attend any of the project reviews, he / she shall not be allowed for the successive reviews and thereby not allowed to appear for the final viva voce.

- The final project viva-voce examination shall carry 50 marks. Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination. The external examiner shall be appointed by the controller of examinations. The internal and external examiner will evaluate the project for 20 Marks each. The project report shall carry a maximum of 10 marks.

- The candidate is expected to submit the project report as per the guidelines of the institution on or before the last day of submission. If a candidate fails to submit the project report on or before the specified deadline, he/she can be granted an extension of time up to a maximum limit of 5 days for the submission of project work, by the head of the department.

- If he/she fails to submit the project report, even beyond the extended time, then he/she is deemed

to have failed in the project work and shall register for the same in the subsequent semester and re-do the project after obtaining permission from the HoD and Dean.

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9.7 **REVALUATION OF ANSWER PAPERS**;

A candidate can apply for revaluation of his/her End semester examination answer paper in a theory course, immediately after the declaration of results, on payment of a prescribed fee along with application to the Controller of Examinations through the Head of the Department. The Controller of Examination will arrange for the revaluation and the result will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

10 PASSING REQUIREMENTS

- A candidate should secure not less than 50% of total marks **(Minimum 50%** of the grand total of CAE Marks and ESE marks put together) prescribed for the courses, subject to securing a minimum of 30% marks out of maximum mark in End Semester Exams (ESE). Then he/she shall be declared to have passed in the examination.
- If a candidate fails to secure a pass in a particular course, it is mandatory that he/she shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that he/she should continue to register and reappear for the examination till he/she secures a pass.

11 WITHDRAWAL FROM EXAMINATIONS

- A candidate may, for valid reasons, (medically unfit / unexpected family situations) be granted permission to withdraw from appearing for the examination in any course or courses in any one of the semester examination during the entire duration of the degree programme.
- Withdrawal application shall be valid only if the candidate is otherwise normally eligible (if he/she satisfies Attendance requirements and should not be involved in Disciplinary issues or Malpractice in Exams) to write the examination and if it is made within FIVE days before the commencement of the examination in that course or courses and also recommended by the Dean through HoD.
- Notwithstanding the requirement of mandatory FIVE days notice, applications for withdrawal for special cases under extraordinary conditions will be considered based on the merit of the case.
- Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class – ……, First Class with Distinction and First Class.
- Withdrawal is NOT permitted for arrears examinations of the previous semesters.

12 AUTHORIZED BREAK OF STUDY

- This shall be granted by the Institution, only once during the full duration of study, for valid reasons for a maximum of one year during the entire period of study of the degree programme.
- A candidate is normally not permitted to temporarily break the period of study. However, if a candidate would like to discontinue the programme temporarily in the middle of duration of study for

valid reasons (such as accident or hospitalization due to prolonged ill health), he / she shall apply through the School Dean in advance (Not later than the Reopening day of that semester) through the Head of the Department stating the reasons. He /She should also mention clearly, the Joining date and Semester for Continuation of Studies after completion of break of Study. In such cases, he/she will attend classes along with the Junior Batches. A student who availed break of study has to rejoin only in the same semester from where he/she left.

- The authorized break of study will not be counted towards the duration specified for passing all the courses for the purpose of classification only for First Class.
- The total period for completion of the programme shall not exceed more than 12 consecutive semesters from the time of commencement of the course (not more than 10 semesters for those who join 3rd semester under Lateral entry system) irrespective of the period of break of study in order that he / she may be eligible for the award of the degree.
- If any student is not allowed to appear for End Semester Examinations for not satisfying Academic requirements and Disciplinary reasons, (Except due to Lack of Attendance), the period spent in that semester shall NOT be considered as permitted 'Break of Study' and is NOT applicable for Authorized Break of Study.
- In extraordinary situations, a candidate may apply for additional break of study not exceeding another one Semester by paying prescribed fee for break of study. Such extended break of study shall be counted for the purpose of classification of First Class Degree.
- If the candidate has not reported back to the department, even after the extended Break of Study, the name of the candidate shall be deleted permanently from the institution enrolment. Such candidates are not entitled to seek readmission under any circumstances.

13 AWARD OF DEGREE

All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each course as detailed below:

RANGE OF MARKS FOR GRADES

Range of Marks	Letter Grade	Grade Points (GP)
90 -100	O	10
80 – 89	A	9
70 – 79	B	8
60 – 69	C	7
50 – 59	D	6
00-49 (Reappear)	RA	0
ABSENT	AAA	0
Withdrawal	W	0
Authorised Break of Study	ABS	0

13.1 CUMULATIVE GRADE POINT AVERAGE CALCULATION

The CGPA calculation on a 10 Point scale is used to describe the overall performance of a student in all courses from first semester to the last semester. RA, AAA and W grades will be excluded for calculating GPA and CGPA.

$$GPA = \frac{\sum_{i=1}^{N} Ci\ GPi}{\sum Ci} \qquad CGPA = \frac{\sum_{i=1}^{n} Ci\ GPi}{\sum Ci}$$

Where

Ci – Credits for the course

GPi – Grade Point for the course

i – Sum of all courses successfully cleared during all the semesters

n – Number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA

14 GRADE SHEET

After revaluation results are declared in each semester, Grade Sheets will be issued to each student. At the end of programme a consolidated grade sheet also will be issued to each student. The grade sheet and consolidated grade sheet will contain the following details:

- Name of the candidate with date of birth and photograph.
- The programme and degree in which the candidate has studied
- The list of courses enrolled during the semester and the grade secured
- The Grade Point Average (GPA) for the semester.

15 CLASSIFICATION OF DEGREE AWARDED

Final Degree is awarded based on the following:

Range of CGPA	Classification of Degree
≥ 7.50	**First Class with Distinction**
≥ 6.00 <7.50	**First Class**
≥ 5.00 < 6.0	**Second Class**

Minimum requirements for award of Degree: A student should have obtained a minimum of 5.0 CGPA.

1. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 8 semesters in his/her first appearance within a maximum of 8 consecutive semesters (maximum of 6 semesters for Lateral entry students who join the course in the third semester) securing a overall CGPA of not less than 7.5 (Calculated from 1st semester) shall be declared to have passed the examination in **First Class with Distinction**. Authorized Break of Study vide Clause 12, will be considered as an Appearance for Examinations, for award of First Class with Distinction. Withdrawal shall not be considered as an appearance for deciding the eligibility of a

candidate for First Class with Distinction.

2. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 8 semesters within a maximum period of 8 consecutive semesters (maximum of 6 semesters for Lateral entry students who join the course in the third semester) after his/her commencement of study securing a overall CGPA of not less than 6.0 (Calculated from 1st semester), shall be declared to have passed the examination in **First Class.** Authorized break of study vide Clause 12 (if availed of) or prevention from writing End semester examination due to lack of attendance will not be considered as Appearance in Examinations. For award of First class, the extra number of semesters than can be provided (in addition to four years for Normal B.E / B.Tech and 3 years for Lateral Entry) will be equal to the Number of semesters availed for Authorized Break of Study or Lack of Attendance. Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class.

3. All other candidates who qualify for the award of the Degree having passed the examination in all the courses of all the 8 semesters within a maximum period of 12 consecutive semesters (10 consecutive semesters for Lateral Entry students, who join the course in the third semester) after his/her commencement of study securing a overall CGPA of not less than 5.0, (Calculated from 1st semester) shall be declared to have passed the examination in **Second Class**.

4. A candidate who is absent in semester examination in a course/project work after having registered for the same, shall be considered to have appeared in that examination for the purpose of classification.

16 ELIGIBILITY FOR THE AWARD OF DEGREE

A student shall be declared to be eligible for the award of the B.E/B.Tech. degree, provided the student has successfully completed all the requirements of the programme, and has passed all the prescribed examinations in all the 8 semesters within the maximum period specified in clause 3.

i) Successfully gained the required number of total credits as specified in the curriculum corresponding to his/her programme within the stipulated time.

ii) Successfully completed the programme requirements and has passed all the courses prescribed in all the semesters within a maximum period of 6 years (5 Years for Lateral Entry Candidates) reckoned from the commencement of the first semester to which the candidate was admitted.

iii) Successfully completed any additional courses prescribed by the Institution.

iv) has earned a CGPA of not less than 5

v) has no dues to the Institution, Library, Hostels, etc.,

vi) has no disciplinary action pending against him / her.

vii) No disciplinary action pending against the student.

The award of Degree must have been approved by the Board of Management of the Institution.

17 DISCIPLINE

Every student is required to observe disciplined and decorous behaviour both inside and outside the Institution and not to indulge in any activity which will tend to bring down the prestige of the Institution. If a student indulges in malpractice in any of the end semester theory / practical examination, continuous assessment examinations he/she shall will be liable for disciplinary action as prescribed by the Institution from time to time.

18 POWER TO MODIFY

From time to time, the Institution may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary.

SYLLABUS

I Semester

		L	T	P	C	Total Marks
AELT1101	**ENGLISH**	**3**	**0**	**0**	**3**	**100**

PREREQUISITES: None

COURSE OBJECTIVES

- To enhance communication skills especially in listening, speaking with confidence, read variety of materials and to improve their writing skills effectively.
- To learn better pronunciation by using proper phonetic sounds with accurate word accent.
- To provide PowerPoint presentations, participation in Group Discussion and facing Interviews with confidence.

1. **Vocabulary Building**
   - **1.1** The concept of Word Formation
   - **1.2** Root words from foreign languages and their use in English
   - **1.3** Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
   - **1.4** Synonyms, antonyms, and standard abbreviations.
2. ***Basic Writing Skills***

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

4. Nature and Style of sensible Writing

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

5. Writing Practices

5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing
5.4 Report Writing
5.5 Instructions
5.6 Check list
5.7 Recommendations
5.8 Paragraph Writing

6. Oral Communication

(This unit involves interactive practice sessions in Language Lab)
Listening Comprehension

- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations
- Group Discussion

Course Outcomes:

CO 1: Knowledge to communicate effectively using Phonetic sounds.
CO 2: Knowledge in using Stress Rules of English While Communicating.
CO 3: Get Self Confidence in one's life by performing presentation skills and Role Plays.
CO 4: Make good presentations through writing one's Resume.
CO5: Get knowledge to participate in Team discussion to get Individual confidence.

Text Books

(i) *Practical English Usage.* Michael Swan. OUP.1995.
(ii)*Remedial English Grammar.* F.T. Wood. Macmillan.2007
(iii) *On Writing Well.* William Zinsser. Harper Resource Book.2001
(iv) *Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press.2006.
(v) *Communication Skills*. Sanjay Kumar and PushpLata. Oxford University Press.2011.

(vi) *ExercisesinSpokenEnglish.*Parts.I-III.CIEFL,Hyderabad.OxfordUniversity Press.

AMAT1101	MATHEMATICS - I	L	T	P	C	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES:

- Application of Matrices in problems of Science and Engineering.
- Application of Sequences and Series.
- To apply the concepts of radius of curvature, evolute, envelope and asymptotes.
- To apply the concept of Taylor series, Maxima minima, composite function and Jacobians.
- To gain knowledge in evaluation of Double and triple Integrals and its applications.

UNIT 1 MATRICES 12 Hrs.

Introduction – Rank of Matrix – Solution of a system of Linear Equations - Non Homogenous and Homogenous equations -Symmetric-Skew Symmetric Matrices-Hermitian and Skew Hermitian Matrices- Characteristic equation-Eigen values of a real matrix-Eigen vectors of a real matrix-Properties of Eigen values-Cayley – Hamilton theorem- finding A inverse using cayley Hamilton theorem- Finding higher powers of A using Cayley – Hamilton theorem- orthogonal reduction of a symmetric matrix to diagonal form-Reduction of Quadratic form to canonical by orthogonal transformations-Orthogonal matrices-Applications of Matrices in Engineering.

UNIT 2 SEQUENCE AND SERIES 12 Hrs

Sequences – Definition and Examples- Types of Convergence- Series of Five terms – Test of Convergence- Comparison test – Integral test- D'Alemberts Ratio test- Raabe's root test- Covergent of Exponential Series- Cauchy's Root test- Log test- Alternating Series: Leibnitz test- Series of positive and Negative terms- Absolute Convergence- Conditional Convergence- Simple Applications Convergence of series in engineering.

UNIT 3 APPLICATIONS OF DIFFERENTIAL CALCULUS 12 Hrs

Rolls and Mean Value Theorem-Maxima and Minima of one variable-Radius of Curvature – Cartesian and polar coordinates - Circle of curvature- Applications of Radius of curvature in engineering- Evolute – Involute -Asymptotes - Envelope of standard curves- Evolute as the envelop of normals - Beta Gamma Functions and their Properties.

UNIT 4 DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 12 Hrs

Function of two variables – Partial derivatives-Eulers Theorems- Total differentials- Taylor's expansion with two variables up to third order terms- Maxima and Minima- Constrained Maxima and Minima by Lagrangian Multiplier method- Jacobians - Properties of Jacobians.

UNIT 5 INTEGRAL CALCULus 12 Hrs

Evaluation of double integration in Cartesian and polar coordinates-Evaluation of double integral by changing of order of integration-Area as a double integral using Cartesian and polar- -Conversion from Cartesian to polar in double integrals- Triple integration in Cartesian coordinates and its applications.

Max. 60 Hrs.

COURSE OUTCOMES

At the end of this course, students will be able to:

CO1: Know how the Matrices, Eigen values and Eigen Vectors Reduce to Quadratics form.
CO2: Attain the skills of convergence and divergence of series using different test and apply sequences and Series in the problems.
CO3: Understand the concepts of envelope and Circle of curvature and apply them in the problems.
CO4: Obtain the knowledge of Maxima and Minima, Jacobian, and Taylor series.
CO5: Understand the evaluation of multiple integrals using change of variables and its applications.
CO6: Develop the canonical form of a quadratic form. Construct evolutes and envelope of family of curves

REFERENCES

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
5. Dr.M.K.Venkatraman, Engineering Mathematics volume-1,The National Publishing company,4th Edition.

ACYT1101	CHEMISTRY	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITES: None

COURSE OBJECTIVES

- To make the students conversant with Atomic and Molecular structure, Spectroscopic techniques and applications.
- To develop an understanding of the concepts of Intermolecular forces and potential energy surfaces
- To understand the use of free energy in chemical equilibria.
- To have thorough knowledge on periodic properties.
- To understand the basic concepts of Stereochemistry, Organic reactions and synthesis of a drug molecule

***Module* I ATOMIC AND MOLECULAR STRUCTURE**

Schrodinger equation. Particle in a box. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

***Module* II SPECTROSCOPIC TECHNIQUES AND APPLICATIONS**

Principles of spectroscopy and selection rules.Electronic spectroscopy and their applications for conjugated molecules and nanoparticles.Fluorescence and its applications in medicine.Vibrational and rotational spectroscopy of diatomic molecules.Applications.Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques.Diffraction and scattering.

***Module* III INTERMOLECULAR FORCES AND POTENTIAL ENERGY SURFACES**

Ionic, dipolar and Van der Waals interactions.Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

***Module* IV USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA**

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies.Free energy and emf.Cell potentials, the Nernst equation and applications.Acid base, oxidation reduction and solubility equilibria.Water chemistry.Corrosion.Use of free energy considerations in metallurgy through Ellingham diagrams.

***Module* V PERIODIC PROPERTIES**

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

***Module* VI STEREOCHEMISTRY**

Representations of 3 dimensional structures, structural isomers and

stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

***Module* VII ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE**

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings.Synthesis of a commonly used drug molecule.

COURSE OUTCOMES:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

CO 1: Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecularforces.

CO 2: Rationalise bulk properties and processes using thermodynamic considerations.

CO 3: Distinguish the ranges of the electromagnetic

spectrum used for exciting different molecular energy levels in various spectroscopictechniques

CO 4: Rationalise periodic properties such as ioniza

CO 5: List major chemical reactions that are used in the synthesis of molecules.

Text Books

1. University chemistry, by B. H.Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N.Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M.S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

REFERENCES:

1. Steven W. Smith, "The Scientist and Engineer"s Guide to Digital Signal Processing", California Technical Publishing, 1997.

2. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education, 2004.

3. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.

Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing, Processing and Perception of Speech and Music", Wiley- India Edition, 2006.

ACYL1101	CHEMISTRY LABORATORY	L	T	P	C	Total Marks
		0	0	4	2	100

PREREQUISITES: None

COURSE OBJECTIVES

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and Instrumental analysis.
- To Estimate rate constants of reactions from concentration of reactants/products as a function of time.

Any 10-12 experiments from the following:

- Determination of surface tension andviscosity
- Thin layer chromatography
- Ion exchange column for removal of hardness of water
- Determination of chloride content of water
- Colligative properties using freezing point depression
- Determination of the rate constant of a reaction
- Determination of cell constant and conductance of solutions
- Potentiometry - determination of redox potentials andemfs
- Synthesis of apolymer/Determination of molecular weight of polymer
- Saponification/acid value of anoil
- Chemical analysis of asalt
- Lattice structures and packing ofspheres
- Models of potential energysurfaces
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between twoimmiscible liquids
- Adsorption of acetic acid by charcoal
- Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part ofegg.
- Conductometric titration of strong acid and strong base
- Determination of strength of acids in a mixture using conductivity meter.
- Determination of Total, Permanent and Temporary hardness of water by EDTA method

COURSE OUTCOMES:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learnto:

CO 1: Estimate rate constants of reactions from concentration of reactants/products as a function of time.

CO 2: Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water,etc.

CO 3: Synthesize a small drug molecule and analyse a salt sample.

Text Books

- Vogel's text book of quantitative and qualitative chemical analysis

AEET1101	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITES: None

Course Objectives

- To provide comprehensive idea about AC and D C circuit analysis, working principles and applications of basic machines in electrical engineering.
- To highlight the importance of transformers in transmission and distribution of electric power.
- To Develop selection skill to identify the type of generators or motors required for particular application.
- To Impart a basic knowledge of Power Converters.
- To give knowledge about components of Low Voltage Electrical Installations.

Module 1 : DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronousgenerators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Course Outcomes:

CO 1: To understand and analyze basic electric and magnetic circuits.
CO 2: To study the working principles of electrical machines and power converters.
CO 3: To introduce the components of low voltage electrical installations.

Text Books

(i) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
(ii) D. C. Kulshreshtha, "BasicElectrical Engineering", McGraw Hill, 2009.
(iii) L. S. Bobrow, " Fundamentals of Electrical Engineering", Oxford University Press, 2011.
(iv) E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
(v) D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India,1989.

AMET1101	ENGINEERING GRAPHICS DESIGN	L	T	P	C	Total Marks
		1	2	0	3	100

PREREQUISITES: None

Traditional Engineering Graphics:
Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)
(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

Module 1: Introduction to Engineering Drawing covering,
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections covering,
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module 3: Projections of Regular Solidscovering,
those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4:Sections and Sectional Views of Right Angular Solids
covering,Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections covering,
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa,Conventions;

Module 6: Overview of Computer Graphics covering,
listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in

CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Module 7: Customization & CAD Drawing
consisting of set up of the drawing page and the printer, including scale settings, Settingup of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawingcircles;

***Module 8: Annotations, layering & other functions*covering**
Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models.Part editing and two-dimensional documentation of models.Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views ofdwelling;

Module 9: Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing
foundation to ceiling; Introduction to Building Information Modelling (BIM).

Course Outcomes:

CO 1: To design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
CO 2: Introduction to engineering design and its place in society.
CO 3: Exposure to the visual aspects of engineering design.
CO 4: Exposure to engineering graphics standards.
CO 5: Exposure to computer-aided geometric design

Text Books

(i) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
(ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
(iii) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMHPublication
(iv) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
(v) (Corresponding set of) CAD Software Theory and UserManuals

AMEL1101	ENGINEERING PRACTICES LABORATORY	L	T	P	C	Total Marks
		0	0	4	2	100

PREREQUISITES: None

Course Objectives

- To gain practical experience on fundamental RL and RC circuits.
- To gain practical experience on different two port networks.
- To evaluate the performance characteristics of DC shunt generator.
- To evaluate the efficiency of DC shunt machine.
- To evaluate the performance characteristics and speed control of DC shunt motor.

1. Study of AC and DC measuring Instruments and their ranges
2. (a)Wattmeter and their connections and application in power measurement. (b)Standard Values of Resistors and Capacitors.
3. The steady state and Transient Response of R-L, R-C, and R-L- C circuits for step input Voltage – response curves to be traced from oscilloscope.
4. (a) The sinusoidal input the steady state response opf R- L and R-C Circuits using oscilloscope.

(b) Measure the phase difference between voltage and current using oscilloscope.

5. To study the no load current waveform of a transformer using oscilloscope.
6. To carry out No load & Load Test on a transformer , Measurements of Voltages, Currents and Power on No Load and under load conditions.
7. 3 Phase Transformer connections using 3 single phase transformers.
8. Load test on 3 Phase connected transformers and measurement of phase and line voltages, Measurement of Input and Output power and Efficiency Calculations.
9. To determine the Torque- Speed Characteristics of Separately Excited DC motor.
10. (a) To Conduct a load test of 3 Phase Induction motor and to draw the Torque- Slip characteristics.

(b) Reversal of motor terminals to change the direction of rotation.

11. (a) No load test and to draw I f vs E g characteristics of an alternator.
    (b) Load test on a 3 Phase alternator.
12. To control the phase angle of DC- DC converter and draw its firing angle vs DC output voltage Characteristics.
13. To study the operation of
    (a) DC –DC Converter.
    (b) DC – AC Inverter with PWM output.
14. Speed Control of Squirrel cage Induction motor using PWM Inverter.

Course Outcomes:

CO 1: Get an exposure to common electrical components and their ratings.
CO 2: Make electrical connections by wires of appropriate ratings.
CO 3: Understand the usage of common electrical measuring instruments.
CO 4: Understand the basic characteristics of transformers and electrical machines.
CO 5: Get an exposure to the working of power electronic converters.

II SEMESTER

APHT1101	**PHYSICS**	**L**	**T**	**P**	**C**	**Total Marks**
		3	**0**	**0**	**3**	**100**

PREREQUISITES: None

Course Objectives

- To develop ideas & mathematical solutions to Quantum mechanics.
- To impart knowledge on the concepts of magneto statics, magnetic flux density,

scalar and vector potential and its applications.

- To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
- To aware the students about various phenomenon of waves and optics.

To understand the principles and applications Lasers in Various Streams of Engineering.

Module 1: Wave nature of particles and the Schrodinger equation: Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time- independent Schrodinger equation for wave function, Born interpretation, probability current, Expectation values, Free-particle wave function and wave-packets, Uncertainty principle.

Module 2: Introduction to solids: Free electron theory of metals, Fermi level, density of states, Application to white dwarfs and neutron stars, Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands Numerical solution for energy in one-dimensional periodic lattice by mixing plane waves.

Module 3: Magnetostatics: Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.

Module 4: Electrostatics in a linear dielectric medium: Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.

Module 5: Wave optics: Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach-Zehnder interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Module 6: Lasers : Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers(ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicines.

Course Outcomes:

Upon completion of the course, students will be able to:

- CO1: Explain the structure and working operation of basic electronic devices.
- CO2: Able to identify and differentiate both active and passive elements

CO3: Analyze the characteristics of different types of Laser

Suggested Text Boo*ks*

(i) David Griffiths, Introduction to Electrodynamics
(ii) D. J. Griffiths, Quantummechanics
(iii) Eisberg and Resnick, Introduction to QuantumPhysics

Suggested Reference Books

(i) Ian G. Main, Oscillations and waves inphysics
(ii) H.J. Pain, The physics of vibrations and waves (iii)E. Hecht,Optics (iii)A. Ghatak, Optics
(iv) O. Svelto, Principles of Lasers
(v) Halliday and Resnick,Physics
(vi) W. Saslow, Electricity, magnetism andlight
D. J. Griffiths, Quantummechanics

		L	T	P	C	Total Marks
AMAT1102	**MATHEMATICS - II**	**3**	**1**	**0**	**4**	**100**

COURSE OBJECTIVES:

- To Apply the concept of Differential Equations in problems of Engineering
- To gain knowledge in evaluation of Line, Surface and Volume Integrals
- To know the techniques of Laplace Transforms and inverse transform and apply them in the problems of Science and Engineering.
- To know the properties of Analytic functions and its applications
- To gain knowledge of evaluation of improper integrals involving complex functions using Residue theorem and apply them in Engineering fields.

UNIT 1 ORDINARY DIFFERENTIAL EQUATIONS 12 Hrs

Introduction-Linear equations of second order with constant coefficients-Linear equations of second order variable coefficients- Homogeneous equation of Euler type- Homogeneous equation of Legendre's Type- Homogenous equation of Cauchy's type- Equations reducible to homogeneous form- Variation of parameters- Simultaneous first order with constant co-efficient.- Applications of Differential Equation in engineering

UNIT 2 VECTOR CALCULUS 12 Hrs

Introduction to vectors - Derivative of a vector function with respect to a scalar -General rules for differentiation (without proof)-Derivative of a constant vector-Derivative of a vector functions in terms of its components- Gradient-divergence- curl – Solenoidal- Irrotational fields- Vector identities (without proof) –Directional derivatives- Line integrals- Surface integrals- Volume Integrals- Green's theorem (without proof)- Gauss divergence theorem (without proof),verification- Stoke's theorems (without proof) –Verification.

UNIT 3 LAPLACE TRANSFORMS 12 Hrs

Laplace Transforms of standard functions- Transforms properties- Transforms of Derivatives and Integrals- Initial value and Final value theorems and verification of simple problems- periodic functions - Inverse Laplace transforms using partial fractions- shifting theorem- Convolution theorem- Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficient - Solution of Integral equation and integral equation involving convolution type- Application of Laplace Transform in engineering.

UNIT 4 **ANALYTIC FUNCTIONS**
12 Hrs

Definition of Analytic Function –Cauchy Riemann equations- Cauchy Riemann equations- Properties of analytic function- Determination of analytic function using – Milne-Thomson's method- Conformal mappings :magnification ,rotation, inversion, reflection- bilinear transformation- Cauchy's integral theorem (without proof)- Cauchy's integral theorem applications

UNIT 5 **COMPLEX INTEGRATION**
12 Hrs

Cauchy's integral formulae- Taylor's expansions with simple problems- Laurent's expansions with simple problems- Singularities- Types of Poles and Residues- Cauchy's residue theorem - Contour integration :Unit circle.- Contour integration :semicircular..

Max. 60 Hrs.

COURSE OUTCOMES

At the end of this course, students will be able to:

CO1: Solve the Differential Equations and Its applications in engineering problems.
CO2: Apply the techniques of vector calculus.
CO3: Solving ODE Many Engineering problems can be transformed in to problems involving ODE and integrals. Laplace transforms method and complex analytic methods can be used for solving theorem.
CO4: Know the fundamentals of complex analytic functions and its properties.
CO5: Gain knowledge in evaluating improper integrals using Residue theorem.
CO6: Understand Cauchy's integral formulae and Taylor's expansions with simple problems explain etc.

REFERENCES

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
5. Dr.M.K.Venkatraman, Engineering Mathematics volume-2,The National Publishing company,4th Edition

		L	T	P	C	Total Marks
ACST1100	**FUNDAMENTALS OF COMPUTING AND COMMUNICATION**	**3**	**0**	**0**	**3**	**100**

PREREQUISITES: None
COURSE OBJECTIVES

- Introduce the fundamentals of computing devices, peripheral devices and trouble shooting
- Understand the basics of Operating Systems and network communications
- Provide hands-on use of Microsoft Office applications Word, Excel, Access and PowerPoint and Data Publishing tools

Gain familiarity to recent computing trends and technologies

UNIT I- Basics of Computer **NO. OF HOURS: 9**

Five Component Model of a Computer, System and Application software (introduction) storage devices , primary (RAM, ROM, PROM, EPROM, cache) Memory and secondary (magnetic tape, hard disk, Compact disks) memory , peripheral devices, printers, Hardware Trouble Shooting.

UNIT II- Operating Systems Fundamentals **NO. OF HOURS: 9**

Definition, Types of Operating Systems: **Batch Operating System, Time Sharing OS, Distributed OS, Network OS, Real Time OS: Hard and Soft RTOS. Case Studies: Windows and Linux OS**

UNIT III- Networking Basics **NO. OF HOURS: 9**

Networking Basics - Uses of a network and Common types of networks , Network topologies and protocols, TCP/IP protocol stack, Network media and hardware.

UNIT IV- Word Processing and Desktop Publishing **NO. OF HOURS: 9**

Overview of Database Management System, Word Processing: Editing and Reviewing, Drawing, Tables, Graphs, Templates, Worksheet Management: Formulas, Functions, Charts, designing powerful power-point presentation. Adobe Photoshop: Using standard toolbox, creation and manipulation of images.

UNIT V- Current Computing Trends and Technologies **NO. OF HOURS: 9**

Principles of Service Oriented Architecture, Basics of: Grid Computing, Cloud Computing, Internet of Things, Mobile Computing, Artificial Intelligence, Data Science and Quantum Computing

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1**:** Bridge the fundamental concepts of computers with the present level of knowledge of the

Students.

CO2: Familiarize the basic concepts of operating systems and network communications

CO3: Understand the fundamentals of word processing and desktop publishing tools

CO4: Gain exposure to the recent computing trends and technologies

TEXT / REFERENCE BOOKS

1. Peter Norton, Introduction to computers, Sixth Edition Tata McGraw Hill (2007)
2. Andrews Jean, A Guide to Managing & Maintaining Your PC, Cengage Publication 6/e
3. Anita Goel, Computer Fundamentals, Pearson Education

Joiner Associates Staff, Flowcharts: Plain & Simple: Learning & Application Guide , Oriel Inc

ACST1101	COMPUTER PROGRAMMING	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITES: None

Course Objectives

- Introduction of Algorithms and Programming Concept.
- Writing Arithmetic Expressions and operator precedence in C and Python.
- Understand array data structures and strings.
- Sorting and Searching Algorithms and introduction to complexity.
- Understand Functions and Recursion.

Understand Structures and Pointers.

Unit 1 Introduction to Programming

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples.
From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

Unit 2 Arithmetic expressions and precedence

Conditional Branching and Loops (using C and Python)
Writing and evaluation of conditionals and consequent branching Iteration and loops

Unit 3 Arrays and strings

Arrays (1-D, 2-D), Character arrays and Strings (using C) List, Tuple, Dictionary, Strings(using Python)

Unit 4 Basic Algorithms

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots o equations, notion of order of complexity through example programs

Unit 5 Function (using C and Python) and Recursion

Functions (including using built in libraries), Parameter passing in functions, call by value Passing arrays to functions: idea of call by reference- Recursion, as a different way o solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 6 Structure and Pointers

Structures, Defining structures and Array of Structures, Idea of pointers, Defining pointers
Use of Pointers in self-referential structures, notion of linked list

Course Outcomes:

CO1: To formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C and Python language).
To test and execute the programs and correct syntax and logical errors.
CO2: To implement conditional branching, iteration and recursion.
To decompose a problem into functions and synthesize a complete program using divide and conquerapproach.
CO3: To use arrays, pointers and structures to formulate algorithms and programs.
CO4: To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
CO5: To apply programming to solve simple numerical method problems, namely root Finding

of function, differentiation of function and simple integration.

Suggested Text Books

(i) Byron Gottfried, Schaum's Outline of Programming with C,McGraw-Hill
(ii) E. Balaguruswamy, Programming in ANSI C, TataMcGraw-Hill
(iii) Guido van Rossum and Fred L. Drake Jr," An Introduction to Python"- Revised and updated for Python 3.2, Network Theory Ltd., 2011.
(iv) Mark Lutz ,"Programming Python", O Reily, 4th Edition, 2010, ISBN 9780596158118
(v) Magnus Lie Hetland , "Beginning Python: From Novice to Professional", 2nd Edition 2009,ISBN:9781590599822

Suggested Reference Books

(i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall ofIndia
(ii) John V Guttag, "Introduction to Computation and Programming Using Python"Revised and expanded Edition, MIT Press , 2013
(iii) Robert Sedgewick, Kevin Wayne, Robert Dondero,"Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
(iv) Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015

		L	T	P	C	Total Marks
ACHT1101	**ENVIRONMENTAL SCIENCE**	**3**	**0**	**0**	**3**	**100**

PREREQUISITES: None

COURSE OBJECTIVES

- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth"s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management

UNIT1: ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY NO. OF HOURS: 9 Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical 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 – conservation of biodiversity: In-situ

and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc

UNIT 2: ENVIRONMENTAL POLLUTION NO. OF HOURS: 9

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO2, NOX, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water

quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural

UNIT 3: NATURAL RESOURCES NO. OF HOURS: 9

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – 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. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants. Field study of local area to document environmental assets – river/forest/grassland/hill/mountain

UNIT 4: SOCIAL ISSUES AND THE ENVIRONMENT NO. OF HOURS: 9

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT 5: HUMAN POPULATION AND THE ENVIRONMENT NO. OF HOURS: 9

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies

COURSE OUTCOMES

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course:

CO1: Public awareness of environment at infant stage

CO2: Ignorance and incomplete knowledge has lead to misconceptions

CO3: Development and improvement in standard of living has lead to serious environmental disasters

TEXT / REFERENCE BOOKS

1. J Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education, 2004.
2. Benny Joseph, „Environmental Science and Engineering", Tata Mc Graw-Hill, New Delhi, 2006..
3. R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standard",
4. Vol. I and II, Enviro Media.
5. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
6. Dharmendra S. Sengar, "Environmental law", Prentice Hall of India PVT LTD, New Delhi, 2007.
7. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press 2005

		L	T	P	C	Total Marks
APHL1101	**PHYSICS LABORATORY**	**0**	**0**	**4**	**2**	**100**

Course Objectives

To introduce different experiments to test basic understanding of physics concepts applied in optics, waves and electromagnetic

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any five)

1. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
2. Determination of angle of the prism and angle of minimum deviation
3. Photoelectric effect Experiment
4. Determination of band gap of a semiconductor
5. LC circuit and LCRcircuit
6. Measurement of speed of light on a table top using modulation

Experiments on electromagnetic induction and electromagnetic breaking

Course Outcomes:

Upon completion of the course, the students will be able to

CO 1: apply principles of optics, waves and quantum mechanics for engineering applications

		L	T	P	C	Total Marks
ACST1101	**COMPUTER PROGRAMMING LABORATORY**	**0**	**0**	**4**	**2**	**100**

III Semester

AMAT2103	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES:

- To apply the concept of Fourier series in the field of Engineering.
- To gain knowledge in evaluation of partial differential equations and its applications**.**
- To know the techniques of Fourier transforms and it's inverse.
- To apply the concepts of probability in distributions.
- To gain knowledge in evaluation of two dimensional random variables.

UNIT 1 FOURIER SERIES 12 Hrs

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT 2 PARTIAL DIFFERENTIAL EQUATIONS 12 Hrsa

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT 3 APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12 Hrs

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction - Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT 4 FOURIER TRANSFORMS 12 Hrs

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity-Discrete Fourier Transforms

UNIT 5 Z - TRANSFORMS AND DIFFERENCE EQUATIONS 12 Hrs

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

Max. 60 Hrs.

COURSE OUTCOMES

At the end of this course, students will be able to:

CO1: Have good knowledge in Fourier series and apply in the field of Engineering.
CO2: Know to formulate and solve partial differential equations.
CO3: Gain good knowledge with applications of partial differential equations.
CO4: Know the fundamentals of Fourier transforms and its properties.
CO5: Gain good knowledge with Z transforms and its properties.
CO6: The understanding of the mathematical principles on transforms and partial

differential equations would provide them the ability to formulate and solve l problems in engineering.

REFERENCES:

1. Kreyszig.E, "Advanced Engineering Mathematics", 10th edition, John Wiley & Sons. Singapore, 2012.
2. Grewal B.S, "Higher Engg Maths", Khanna Publications, 42nd Edition, 2012.
3. Sankara Rao, "Introduction to Partial Differential Equations", 2nd Edition, PHI Learning Pvt. Ltd., 2006.
4. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007.
5. Venkataraman, M,K., Engineering Mathematics - Vol.III - A & B (13th edition), National Publishing Co., Chennai,1998

AECT2103	SIGNALS AND SYSTEMS	L	T	P	C	Total Marks
		3	1	0	4	100

PREREQUISITES: AMAT1102 Mathematics II

OBJECTIVES:

The student should be:

- To analyze the continuous time discrete time signals & systems and its biosignal applications.

Unit 1 Basics of Discrete and Continuous Time Signals and Systems

Generation, representation of discrete time signals and continuous time signals, standard discrete time signals, standard continuous time signals-Classification of signals: Continuous time(CT) ,Discrete time (DT) signals -Mathematical operations on CTS and DTS-scaling, folding,time shifting, addition and multiplication. Classification of systems: static and dynamic systems, time invariant and time variant, linear and nonlinear systems, causal and non-causal systems, stable and unstable systems. Basic bio signal measurements

Unit 2 Analysis of Continuous Time Signals and System

Fourier series analysis-trigonometric fourier series, Cosine fourier series, Exponential fourier series, Fourier transform analysis, Laplace transform analysis, Poles and zeros, Analysis of differential equation- impulse response, Transfer function, Frequency response

Unit 3 Convolution and Correlation of Discrete

Convolution-graphical method, properties, methods of performing linear convolution, Circular convolution-circular representation and circular shift of DT signals-procedure for evaluating circular convolution, linear convolution via circular convolution, methods of computing circular convolution, Sectioned convolution-overlap add method, Overlap save method, Inverse system, deconvolution Correlation- autocorrelation and cross correlation

Unit 4 Transforms of Discrete Time Signals and Systems

Z transform-properties-region of convergence- representation of poles and zeros in z transform, Inverse z transform- residue method, Partial fraction method, Discrete time fourier transform-properties, frequency response of LTI DT signals, Frequency response of first order, second order DT signals, Analysis of impulse response using differential equation, Relation between Z transform and DTFT, Introduction to discrete fourier transform, Inverse discrete fourier transform.

Unit 5 Realization and Biosignal Applications

Introduction to discrete time Infinite impulse response (IIR) and finite impulse response (FIR) systems, Structure for realization of IIR systems-direct form-I, direct form-II, Cascade form, parallel form of IIR system, Structure for realization of FIR systems-direct form, cascade and linear phase realization of FIR systems, Neural Firing rate analysis, Linearized model and system equations for immune response

Course Outcomes:

At the end of the course, the students will be able to:

CO1. Classify the continuous time signals and systems and discrete-time signals and systems

CO2. Analyze the continuous time signals using fourier series and fourier transforms

CO3. Compute the convolution and correlation of discrete time systems.

CO4. Understand the concepts of z-transform and discrete Fourier transform

CO5. Analyze the discrete time IIR and FIR systems by using suitable structures and bio signal applications

TEXT BOOK:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, —Signals and Systems‖, Pearson, 2015.(Unit 1-V)

REFERENCES:

1. B. P. Lathi, —Principles of Linear Systems and Signals‖, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, —Signals & Systems - Continuous and Discrete‖, Pearson, 2007.
3. John Alan Stuller, —An Introduction to Signals and Systems‖, Thomson, 2007.

AECT2101	ELECTRON DEVICES AND CIRCUITS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITES: None.

OBJECTIVES:

The student should be made to:

- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

Unit 1 PN JUNCTION DEVICES

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diodecharacteristics- Zener Reverse characteristics – Zener as regulator

Unit 2 TRANSISTORS AND THYRISTORS

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics.

Unit 3 AMPLIFIERS

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

Unit 4 MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

Unit 5 FEEDBACK AMPLIFIERS AND OSCILLATORS

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO1. Explain the structure and working operation of basic electronic devices.
CO2. Able to identify and differentiate both active and passive elements
CO3. Analyze the characteristics of different electronic devices such as diodes and transistors
CO4. Choose and adapt the required components to construct an amplifier circuit.
CO5. Employ the acquired knowledge in design and analysis of oscillators

TEXT BOOKS:

1. David A. Bell ,‖Electronic devices and circuits‖, Oxford University higher education, 5th edition 2008.
2. Sedra and smith, —Microelectronic circuits‖,7th Ed., Oxford University Press

REFERENCES:

1. Balbir Kumar, Shail.B.Jain, —Electronic devices and circuits‖ PHI learning private limited, 2nd edition 2014.
2. Thomas L.Floyd, —Electronic devices‖ Conventional current version, Pearson prentice hall, 10th Edition, 2017.
3. Donald A Neamen, —Electronic Circuit Analysis and Design‖ Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, —Electronic Devices and Circuit Theory‖, 2002.
5. Robert B. Northrop, —Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation‖, CRC Press, 2004.

		L	T	P	C	Total Marks
ABMT2103	**ANATOMY AND HUMAN PHYSIOLOGY**	**3**	**0**	**0**	**3**	**100**

PREREQUISITES: N o n e

OBJECTIVES:

The student should be made to:

- Know basic structural and functional elements of human body.
- Learn organs and structures involving in system formation and functions.
- Understand all systems in the human body.

Unit 1 BASIC ELEMENTS OF HUMAN BODY

Cell: Structure and organelles - Functions of each component in the cell. Cell membrane –transport across membrane – origin of cell membrane potential – Action potential. Tissue: Types – Specialized tissues – functions.

Unit 2 SKELETAL AND RESPIRATORY SYSTEM

Skeletal system: Bone types and functions – Joint - Types of Joint - Cartilage and functions. Respiratory System: Components of respiratory system – Respiratory Mechanism. Types of respiration - Oxygen and carbon dioxide transport and acid base regulation

Unit 3 CIRCULATORY SYSTEM

Blood composition - functions of blood – functions of RBC. WBC types and their functions. Blood groups – importance of blood groups – identification of blood groups. Blood vessels- Structure of heart – Properties of Cardiac muscle – Conducting system of heart – Cardiac cycle – ECG - Heart sound - Volume and pressure changes and regulation of heart rate –Coronary Circulation. Factors regulating Blood flow.

Unit 4 URINARY AND SPECIAL SENSORY SYSTEM

Urinary system: Structure of Kidney and Nephron. Mechanism of Urine formation and acid base regulation – Urinary reflex – Homeostasis and blood pressure regulation by urinary system. Special senses: Eye and Ear.

Unit 5 NERVOUS SYSTEM

Structure of a Neuron – Types of Neuron. Synapses and types. Conduction of action potential in neuron. Brain – Divisions of brain lobes - Cortical localizations and functions - EEG. Spinal cord – Tracts of spinal cord - Reflex mechanism – Types of reflex. Autonomic nervous system and its functions.

COURSE OUTCOMES:

At the end of the course, the students should be made to:

CO1. Describe basic structural and functional elements of human body.
CO2. Explain organs and structures involving in system formation and functions.
CO3. Identify all systems in the human body.
CO4. Demonstrate the function of urinary and special sensory system
CO5. Acquire knowledge on nervous system

TEXT BOOK:

1. Elaine.N. Marieb , "Essential of Human Anatomy and Physiology", Eight Edition, Pearson Education, New Delhi ,2007.

REFERENCES:

1. Gillian Pocock, Christopher D. Richards, The human Body – An introduction for Biomedical and Health Sciences, Oxford University Press, USA, 2009
2. William F.Ganong, "Review of Medical Physiology", 22nd Edition, Mc Graw Hill, New Delhi, 2005
3. Eldra Pearl Solomon, "Introduction to Human Anatomy and Physiology", W.B. Saunders Company, Harcourt Brace Jovanovich, 2003.
4. Guyton & Hall, "Medical Physiology", 12th Edition, Elsevier Saunders, 2010

AECT3113	ANALOG AND DIGITAL COMMUNICATION	L	T	P	C	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

The students should be made to,

- Understand analog and digital communication techniques
- Learn data and pulse communication techniques
- Be familiarized with source and Error control coding
- Gain knowledge on multi-user radio communication

UNIT 1 ANALOG COMMUNICATION

Noise: Source of Noise - External Noise- Internal Noise - Noise Calculation. Introduction to Communication Systems: Modulation – Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of SSB Techniques - Theory of Frequency and Phase Modulation – Comparison of various Analog Communication System (AM – FM – PM).

UNIT 2 DIGITAL COMMUNICATION

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Minimum Shift Keying (MSK) –Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK – 16 PSK - Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK– FSK – PSK – QAM).

UNIT 3 DATA AND PULSE COMMUNICATION

Data Communication: History of Data Communication - Standards Organizations for Data Communication- Data Communication Circuits - Data Communication Codes - Error Detection and Correction Techniques - Data communication Hardware - serial and parallel interfaces. Pulse Communication**:** Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM – PCM)

UNIT 4 SOURCE AND ERROR CONTROL CODING

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes, convolution codes, viterbi decoding algorithm

UNIT 5 MULTI-USER RADIO COMMUNICATION

Advanced Mobile Phone System (AMPS) - Global System for Mobile Communications (GSM) - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Hand off - Overview of Multiple Access Schemes - Satellite Communication - Bluetooth.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Apply analog and digital communication techniques
CO2. Understand data and pulse communication techniques
CO3. Analyze Source and Error control coding
CO4. Design multi-user radio communication
CO5. Differentiate Various types of communication

TEXT BOOKS/ REFERENCES:

1. Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Edition, PearsonEducation, 2009.
2. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons, 2004
3. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2007
4. H.Taub, D L Schilling and G Saha, "Principles of Communication", 3rd Edition, Pearson Education, 2007.
5. B. P.Lathi, "Modern Analog and Digital Communication Systems", 3rd Edition, Oxford University Press, 2007.
6. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2002.
7. Martin S.Roden, "Analog and Digital Communication System", 3rd Edition, Prentice Hall of India, 2002.
8. B.Sklar, "Digital Communication Fundamentals and Applications" 2nd Edition Pearson Education, 2007.

AECL2101	ELECTRON DEVICES AND CIRCUITS LABORATORY	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITES: AECT2101 Electron Devices and Circuits

COURSE OBJECTIVES:

The student should be made

- To learn the characteristics of basic electronic devices such as Diode, BJT,FET, SCR
- To understand the working of RL,RC and RLC circuits
- To gain hand on experience in Thevinin & Norton theorem, KVL & KCL, and Super Position Theorems

LIST OF EXPERIMENTS

1. Characteristics of PN Junction Diode
2. Zener diode Characteristics & Regulator using Zener diode
3. Common Emitter input-output Characteristics
4. Common Base input-output Characteristics

5. FET Characteristics
6. SCR Characteristics
7. Clipper and Clamper & FWR
8. Verifications of Thevinin & Norton theorem
9. Verifications of KVL & KCL
10. Verifications Of Super Position Theorem
11. Verifications of maximum power transfer & reciprocity theorem
12. Determination Of Resonance Frequency of Series & Parallel RLC Circuits
13. Transient analysis of RL and RC circuits

LABORATORY REQUIREMENTS

BC 107, BC 148,2N2646,BFW10 - 25 each 1N4007, Zener diodes - 25 each Resistors, Capacitors, Inductors - sufficient quantities Bread Boards - 15 Nos CRO (30MHz) – 10 Nos. Function Generators (3MHz) – 10 Nos. Dual Regulated Power Supplies (0 – 30V) – 10 Nos

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1. Analyze the characteristics of basic electronic devices
CO2. Design RL and RC circuits
CO3. Verify Thevinin & Norton theorem KVL & KCL, and Super Position Theorems

ABML2101	ANATOMY AND HUMAN PHYSIOLOGY Laboratory	L	T	P	C	Total Marks
		0	0	4	2	100

PREREQUISITE: ABMT2103 Anatomy and Human Physiology

COOURSE OBJECTIVES:

The Students will be made to

- Estimation and quantification of biomolecules.
- Separation of macromolecules.

LIST OF EXPERIMENTS:

1. General tests for carbohydrates, proteins and lipids.
2. Preparation of serum and plasma from blood.
3. Electrophoresis
4. Thin layer chromatography
5. ESR , PCV.
6. MCH , MCV ,MCHC.
7. Estimation of hemoglobin.
8. Enumeration of RBC
9. Differential Leucocyte count.
10. Identification of blood groups.

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

CO1. Do estimation and interpret the changes in biomolecules.
CO2. Separate and analyze the importance of macromolecules.

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:

Requirement for a batch of 30 students
Spectrophotometer 1 No
Colorimeter 2 Nos.
pH meter 1 No
Weighing balance 1 No
Refrigerator 1 No
Vortex Shaker 2 Nos.
SDS gel electrophoresis 1 No

TLC, ready TLC plates 1 No
Wintrobe's tube 2 Nos.
Centrifuge Normal 1 No
Centrifuge Cooling 1 No
Microslides 2 packets
Lancet 5 boxes
Microscope 1 No
Neubaur's Chamber 2 Nos.
Heparinized Syringe 1box
Haemoglobinometer 1 No
Capillary tubes 1 box
Ophthalmoscope (direct & Indirect) 1 No
Blood grouping kit 1

IV Semester

ABMT2104	BIOCONTROL SYSTEMS	L	T	P	C	Total Marks
		3	1	0	4	100

PREREQUISITE: AMAT1101 Mathematics- I, AMAT1102 Mathematics – II

COURSE OBJECTIVES:

The student should be made

- To understand the concept behind feedback and continuum in various systems and subsystems.
- To analyse the systems in time and frequency domain and to understand the concept of stability
- To apply mathematical modelling principles in understanding the various fundamental biological systems
- To analyse biological system models using MATLAB

UNIT 1 INTRODUCTION

Open and Closed loop Systems, Modeling and Block Diagrams, Block diagram and signal flow graph representation of systems, reduction of block diagram and signal flow graph, Introduction to Physiological control systems- Illustration, Linear models of physiological systems, Difference between engineering and physiological control system.

UNIT 2 TIME RESPONSE ANALYSIS

Step and impulse responses of first order and second order systems, time domain specifications of first and second order systems, steady state error constants, Definition of stability, Routh- Hurwitz criteria of stability, root locus technique, construction of root locus and study of stability.

UNIT 3 FREQUENCY RESPONSE ANALYSIS

Frequency domain specifications - Polar plots, Bode plots, Nyquist plot, Nyquist stability criterion, closed loop stability, Constant M and N circles, Nichol's chart.

UNIT 4 BIOLOGICAL SYSTEM MODELS

Distributed parameter versus lumped parameter models, Model development of Cardiovascular system- Heart model-circulatory model, Pulmonary mechanics- Lung tissue visco-elastance-chest wall- airways, Interaction of Pulmonary and Cardiovascular models, Static analysis of physiological systems – Regulation of cardiac output, Regulation of ventilation.

UNIT 5 BIOLOGICAL CONTROL SYSTEM ANALYSIS

Simple models of muscle stretch reflex action, Study of steady state analysis of muscle stretch reflex action, Study of transient response analysis of neuromuscular reflex model action, Study of frequency response of circulatory control model, Stability analysis of Pupillary light reflex.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Understand the need for mathematical modeling of various systems, representation of systems in block diagrams and signal flow graphs and are introduced to biological control systems.
CO2. Analyze the time response of various systems and discuss the concept of system stability
CO3. Analyze the frequency response characteristics of various systems using different charts
CO4. Understand the concept of modeling basic physiological systems
CO5. Comprehend the application aspects of time and frequency response analysis.

TEXT BOOKS:

1. I.J. Nagarath and M. Gopal —Control Systems Engineering", Fifth Edition, Anshan Publishers, 2008.
2. Michael C K Khoo, —Physiological Control Systems‖, IEEE Press, Prentice Hall of India, 2005

REFERENCES:

1. Benjamin C. Kuo, —Automatic Control Systems‖, Prentice Hall of India, 1995.
2. John Enderle Susan Blanchard, Joseph Bronzino —Introduction to Biomedical Engineering‖, second edition, Academic Press, 2005.
3. Richard C. Dorf, Robert H. Bishop, —Modern control systems‖, Pearson, 2004.

ABMT2105	BIOMATERIALS AND ARTIFICIAL ORGANS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: ABMT2103 Anatomy and Human Physiology

COURSE OBJECTIVES:

- To study the characteristics and classification of biomaterials.
- To understand the response of biomaterials in living system.
- To learn about the polymeric materials and composites in tissue replacements.
- To describe the principles of implant design with a case study
- To explain the implant design parameters and solution in use
- To know the compatibility and functioning of artificial organs inside the living system.

UNIT 1 INTRODUCTION TO BIO-MATERIALS

Definition and classification of bio-materials, mechanical properties, visco elasticity, biomaterial performance, body response to implants, wound healing, blood compatibility, Nano scale phenomena. Metallic implants - Stainless steels, co-based alloys, Ti-based alloys, shape memory alloy, nanostructured metallic implants, degradation and corrosion, ceramic implant – bio inert, biodegradable or bioresorbable, bioactive ceramics, nanostructured bio ceramics.

UNIT 2 POLYMERIC IMPLANT MATERIALS

Polymerization, factors influencing the properties of polymers, polymers as biomaterials, biodegradable polymers, Bio polymers: Collagen, Elastin and chitin. Medical Textiles, Materials for ophthalmology: contact lens, intraocular lens. Membranes for plasma separation and Blood oxygenation, electro spinning: a new approach.

UNIT 3 TISSUE REPLACEMENT IMPLANTS

Small intestinal sub mucosa and other decullarized matrix biomaterials for tissue repair: Extra cellular Matrix. Softtissue replacements, sutures, surgical tapes, adhesive, Percutaneous and skin implants, maxillofacial augmentation, Vascular grafts, hard tissue replacement Implants, joint replacements, tissue scaffolding and engineering using Nano biomaterials.

UNIT 4 ARTIFICIAL ORGANS &PRINCIPLES OF IMPLANT DESIGN

Introduction, outlook for organ replacements, design consideration, evaluation process. TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, individual organs – kidney, liver, heart and lung, bone marrow, cornea. Principles of implant design, Clinical problems requiring implants for solution,Tissue engineering, scaffolds, cells and regulators criteria for materials selection.

UNIT 5 BLOOD INTERFACING IMPLANTS&TESTING OF BIOMATERIAL

Neural and neuromuscular implants, heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, artificial kidney- dialysis membrane and artificial blood. Gastrointestinal system, Dentistry, Maxillofacial and craniofacial replacement, Soft tissue repair, replacement and augmentation. Biocompatibility, blood compatibility and tissue compatibility tests, Toxicity tests, sensitization, carcinogenicity, mutagenicity and special tests, Invitro and Invivo testing; Sterilisation of implants and devices: ETO, gamma radiation, autoclaving. Effects of sterilization.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Analyze different types of Biomaterials and its classification and apply the concept of nanotechnology towards biomaterials use.
CO2. Identify significant gap required to overcome challenges and further development in metallic and ceramic materials, polymer materials.
CO3. Gain adequate knowledge about artificial organs & transplants
CO4. Have in-depth knowledge about Artificial organs
CO5. Develop a knowledge on blood interfacing implants and testing of Biomaterials

TEXTBOOKS:

1. Sujata V. Bhatt, —Biomaterials‖, Second Edition, Narosa Publishing House, 2005.
2. Sreeram Ramakrishna, MuruganRamalingam, T. S. Sampath Kumar, and Winston O. Soboyejo, —Biomaterials: A Nano Approach‖, CRC Press, 2010.
3. Kopff W.J, Artificial Organs, John Wiley and sons, New York, 1st edition, 1976.

REFERENCES:

1. Park J.B., —Biomaterials Science and Engineering‖, Plenum Press, 1984.
2. Myer Kutz, —Standard Handbook of Biomedical Engineering & Design‖, McGraw-Hill, 2003.
3. John Enderle, Joseph D. Bronzino, Susan M.Blanchard, —Introduction to BiomedicalEngineering‖ Elsevier, 2005.
4. J D Bronzino, Biomedical Engineering handbook Volume II, (CRC Press / IEEE Press), 2000.
5. Joon B Park, Biomaterials – An Introduction, Plenum press, New York, 1992.
6. Yannas, I. V, —Tissue and Organ Regeneration in Adults‖, New York, NY: Springer, 2001. ISBN:9780387952147.
7. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph.D, Bronzino, —Clinical Engineering‖, CRC Press, 1st edition,2010.

AECT2164	ANALOG AND DIGITAL ICs	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: AECL2101 Electron Devices and Circuits

COURSE OBJECTIVES:

The students should be made,

- To study the application of analog ICs in the designing circuit.
- To study the applications of these Digital ICs.
- To understand the basic of the Digital systems.
- To study the design of the various functional circuits using these ICs.

UNIT 1 NUMBER SYSTEMS AND LOGIC GATES

Decimal, Binary, Octal and Hexadecimal Numbers.-Conversion between these number systems.-Complements r's and (r-1)'s complements.- subtraction using complements –

Encoding numbers and characters using Binary digits. –Binary coded Decimal –Gray code - Binary to Gray code conversion – ASCII Code. Logic gates – Truth tables – NOT, AND, OR, NOR, NAND, XOR, XNOR - Boolean Laws and theorems – Solving Boolean expressions, Truth Tables and Logic circuits – The Karnaugh Map – half adder, full adder, Multiplexers and Demultiplexers - Decoders and encoders. Coding of Combination Circuits in verilog.

UNIT 2 REGISTERS AND COUNTERS

Flip Flops – RS, D, T, JK Flip Flops – Characteristic equations, exciting tables – JK Master – Slave flip-flop – Universal shift register. Design of modulo-N counters – counter design using state diagram. sequential circuit design with verilog.

UNIT 3 OPERATIONAL AMPLIFIERS

The characteristics of Ideal Operation – slew rate, offset voltage, bias current, CMRR, bandwidth - equivalent circuit of an op-Amp – virtual ground concept – Linear applications of op-amp – inverting and noninverting amplifier, summing, subtracting, averaging amplifier - voltage to current converter– current to voltage converter – Differential amplifiers – differentiator and integrator. Nonlinear applications – comparator – Schmitt Triggers – Precision Diode Half wave and full wave rectifiers – Average detectors – peak detector

UNIT 4 ACTIVE FILTERS AND SIGNAL GENERATOR

Active filters (first and second order) – Low pass, high pass, band pass filters, band reject filters (notch filters). Oscillators - RC Phase shift and Weinbridge. Waveform generators - Square, triangular and saw tooth.

UNIT 5 TIMER, PLL, A/D AND D/A CONVERTERS

555 Timer (internal diagram) and its applications – monostable multivibrator, astable multivibrator. Phase locked Loop (565 - block diagram approach) and its applications - Frequency multiplication, Frequency translation, voltage to frequency and frequency to voltage converters. DAC – Binary weighted DAC and R-2R DAC. ADC – single slope and dual slope ADCs, successive approximation ADC

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Explain the application of analog ICs in the designing circuit.
CO2. Do applications of Digital ICs.
CO3. Understand the basic of the Digital systems.
CO4. Design various functional circuits using these ICs such as filters.
CO5. Understand timer, PLL and convertors

TEXT BOOKS:

1. M. Morris Mano , "Digital Logic and Computer design " Prentice Hall 1994.
2. Ramakant A. Gayakwad , "Op-AMP and Linear Ics", Prince Hall, 1994

REFERENCES:

1. Robert B.Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004.
2. Sergio Franco, "Design with Operational Amplifiers and analog Integrated circuits", McGraw- Hills, 2003.
3. Millman J and Halkias .C., "Integrated Electronics", TMH, 2007.
4. John. F. Wakerly, "Digital Design Principles and Practices", Fourth Edition, Pearson Education, 2007
5. Charles H. Roth, Jr, "Fundamentals of Logic Design", Fourth Edition, Jaico Books, 2002

ABMT2106	PATHOLOGY AND MICROBIOLOGY	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITES: ABMT2103 Anatomy and Human Physiology, Biochemistry.

COURSE OBJECTIVES:

The students should be made to,

- Gain knowledge on the structural and functional aspects of living organisms.
- Know the etiology and remedy in treating the pathological diseases.
- Empower the importance of public health.

UNIT 1 CELL DEGENERATION, REPAIR AND NEOPLASIA

Cell injury - Reversible cell injury and Irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification- Dystrophic and Metastatic. cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours Autopsy and biopsy.

UNIT 2 FLUID AND HEMODYNAMIC DERANGEMENTS

Edema, Hyperemia/Ischemia, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock, Chronic venous congestion. Hematological disorders-Bleeding disorders, Leukaemias, Lymphomas Haemorrhage. .

UNIT 3 MICROBIOLOGY

Structure of Bacteria and Virus. Routes of infection and spread; endogenous and exogenous infections, Morphological features and structural organization of bacteria and virus, growth curve, identification of bacteria , culture media and its types , culture techniques and observation of culture. Disease caused by bacteria, fungi, protozoal, virus and helminthes.

UNIT 4 MICROSCOPES

Light microscope – bright field, dark field, phase contrast, fluorescence, Electron microscope (TEM & SEM). Preparation of samples for electron microscope. Staining methods – simple, gram staining and AFB staining.

UNIT 5 IMMUNOPATHOLOGY

Natural and artificial immunity, types of Hypersensitivity, antibody and cell mediated tissue injury: opsonization, phagocytosis, inflammation, Secondary immunodeficiency including HIV infection. Auto-immune disorders: Basic concepts and classification, SLE.Antibodies and its types, antigen and antibody reactions, immunological techniques: immune diffusion, immuno electrophoresis, RIA and ELISA, monoclonal antibodies.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Analyze structural and functional aspects of living organisms.
CO2. Explain the function of microscope
CO3. Discuss the importance of public health.
CO4. Describe methods involved in treating the pathological diseases
CO5. Understand the concepts of immunopathology

ABMT2107	BIOSENSORS AND MEASUREMENTS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: AECT2101 Electron Devices and Circuits.

COURSE OBJECTIVES:

The students should be made to,

- Understand the purpose of measurement, the methods of measurements, errors associated with measurements.
- Know the principle of transduction, classifications and the characteristics of different transducers
- Know the different bridges for measurement.
- Know the different display and recording devices.

UNIT 1 SCIENCE OF MEASUREMENT

Measurement System – Instrumentation - Classification and Characteristics of Transducers - Static and Dynamic - Errors in Measurements and their statistical analysis – Calibration - Primary and secondary standards.

UNIT 2 DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS

Strain Gauge: Gauge factor, sensing elements, configuration, and unbounded strain gage. Capacitive transducer - various arrangements, Inductive transducer, LVDT, Passive types: RTD materials & range, relative resistance vs. temperature characteristics, thermistor characteristics, Active type: Thermocouple - characteristics.

UNIT 3 PHOTOELECTRIC, PIEZO ELECTRIC SENSORS, SIGNAL CONDITIONING CIRCUITS

Phototube, scintillation counter, photo multiplier tube (PMT), photovoltaic, photo conductive cells, photo diodes, phototransistor, comparison of photoelectric transducers. Optical displacement sensors and optical encoders. Piezoelectric active transducer- Equivalent circuit and its characteristics, Fiber-optic, Flow and liquid level, and Electrochemical transducer. Functions of signal conditioning circuits, Preamplifiers, Concepts of passive filters, Impedance matching circuits, AC and DC Bridges

UNIT 4 DISPLAY AND RECORDING DEVICES

Digital voltmeter – Multi meter, Frequency, Period measurement, Time interval and pulse width measurement, Graphic recorders-strip chart, X-Y recorder, CRO – block diagram, CRT – vertical & horizontal deflection system, General purpose oscilloscope, Dual trace, Dual beam, Sampling oscilloscope, DSO, LCD monitor, PMMC writing systems, servo recorders, photographic recorder, magnetic tape recorder, Inkjet recorder, thermal recorder.

UNIT 5 MEDICAL APPLICATIONS OF SENSORS

Gas sensor, Microbial sensor, electro analytical sensor, Enzyme based sensor-- Glucose sensor, Electronic nose- halitosis, Advances in sensor technology: Lab-on-a –chip, Smart sensor, MEMS and Nano sensor.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Measure various electrical parameters with accuracy, precision, resolution.
CO2 - Select appropriate passive or active transducers for measurement of physical phenomenon.
CO3 - Select appropriate light sensors for measurement of physical phenomenon.
CO4 - Use AC and DC bridges for relevant parameter measurement.
CO5 - Employ Multimeter, CRO and different types of recorders for appropriate measurement.

TEXT BOOKS:

1. A.K.Sawhney, ―Electrical & Electronics Measurement and Instrumentation‖,10th edition, DhanpatRai& Co, New Delhi, 19th Revised edition 2011, Reprint 2014.
2. John G. Webster, ―Medical Instrumentation Application and Design‖, 4th edition, Wiley India Pvt Ltd,New Delhi, 2015.

REFERENCES:

1. Ernest O Doebelin and Dhanesh N Manik, Measurement systems, Application and design, 6th edition, McGraw-Hill, 2012.
2. Khandpur R.S, ―Handbook of Biomedical Instrumentation‖, 3rdedition,Tata McGraw-Hill, New Delhi, 2014.
3. Leslie Cromwell, ―Biomedical Instrumentation and measurement‖, 2nd edition, Prentice hall of India,

New Delhi, 2015.
4. Albert D.Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques‖, Prentice Hall of India, 1stedition, 2016

TEXT BOOKS:

1. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, —Pathologic Basis of Diseases‖, 7th edition,WB Saunders Co. 2005 (Units I & II).
2. Ananthanarayanan & Panicker, —Microbiology‖ Orientblackswan, 2017 10th edition. (Units III,IV and V)

REFERENCES:

1. Underwood JCE: General and Systematic Pathology Churchill Livingstone, 3rd edition, 2000.
2. Dubey RC and Maheswari DK. —A Text Book of Microbiology‖ Chand & Company Ltd, 2009

AECL2174	ANALOG AND DIGITAL ICS LABORATORY	L	T	P	C	Total Marks
		0	0	4	2	100

PREREQUISITES: AECT2164 Analog and Digital ICs

COURSE OBJECTIVES:

The students should be made to,

- Design digital logic and circuits
- Learn the function of different ICs
- Understand the applications of operation amplifier.
- Learn the working of multivibrators
- Design circuits for generating waveforms using ICs.

LIST OF EXPERIMENTS:

1. Study of logic gates, Half adder and Full adder
2. Encoder and BCD to 7 segment decoder
3. Multiplexer and demultiplexer using digital ICs
4. Universal shift register using flip flops
5. Design of mod-N counter
6. Inverting, non-inverting amplifier and comparator
7. Integrator and Differentiator
8. Active filter – first order and second order LPF and HPF
9. Current to Voltage convertor and Voltage to Current Convertor
10. Comparator, Peak detector and Average detector
11. Instrumentation amplifier using IC741
12. Wein bridge oscillator
13. Multivibrator using IC555 Timer
14. Timer
15. Phase Lock Loop
16. 16 A/D and D/A convertor

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Design Circuits using logic gates
CO2. Build Circuits for different application using opamp
CO3. Differentiate between oscillator and wave form generator
CO4. Convert Signals from Analog to Digital Vice versa

LAB EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

1. Digital Trainer Kit - 15 Nos.
   (with 5 V, Variable and fixed frequency Clock, Bread Board, Four Seven Segment displays, LEDs for output display, Logic 1 and 0 Input switches)

2. Logic ICs - 50Nos each
   (7400, 7402, 7404, 7408, 7410, 7420, 7432,7447, 7448, 7474, 7476, 7483, , 7485, 7486, 7490, 7495, 74151, 741 Common Anode and cathode 7-segment displays, LEDs)
3. NE555 – 50 nos
4. PLL - 50 nos
5. A/D and D/A convertors – 50 nos
6. Resistors - 50 nos
7. capacitors - 50 nos
8. IC Power supply (5 V fixed) - 15 Nos
9. Bread Boards - 15 Nos

ABML2102	PATHOLOGY AND MICROBIOLOGY LABORATORY	L	T	P	C	Total Marks
		0	0	4	2	100

PREREQUISITE ABMT2106 Pathology and Microbiology.

COURSE OBJECTIVES:

The students should be made to,

- Use Compound microscope
- Practice on chemical examinations, Cryoprocessing, Histopathological examinations etc

LIST OF EXPERIMENTS:

1. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood)
2. Study of parts of compound microscope
3. Histopathological slides of benign and malignant tumours.
4. Manual paraffin tissue processing and section cutting (demonstration)
5. Cryo processing of tissue and cryosectioning (demonstration)
6. Basic staining – Hematoxylin and eosin staining.
7. Special stains – cresyl fast Blue (CFV)- Trichrome – oil red O – PAS
8. Simple stain.
9. Capsule stain
10. Gram stain.
11. AFB stain.
12. Antigen-Antibody reaction Immuno electrophoresis
13. Antigen-Antibody reaction Immuno electrophoresis
14. Bleeding time and clotting time.
15. Haematology slides of anemia and leukemia.
16. Study of bone marrow charts.
17. Slides of malarial parasites, micro filaria and leishmania donovani.

TEXT BOOK :

1. Textbook of Medical Laboratory Technology, Ramnik Sood, 6thEdition, Jaypee Brothers Medical Publishers, 2009

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. perform practical experiments on tissue processing, cryoprocessing, staining processes etc.

LAB EQUIPMENTS FOR 30 STUDENTS:

1. Wax dispenser 1 No
2. Slide warming 1 No
3. Microtome 1 No
4. Microscope

5. Microphotographic unit 1 No
6. Slides 1 box
7. Coverslip 1 box
8. Distillation Unit 1 No
9. Water bath normal 1 No
10. Incubator 1 No
11. Autoclave 1 No
12. Oven 1 No

V SEMESTER

ABMT3108	BIOMEDICAL INSTRUMENTATION	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: ABMT2103 Anatomy and Human Physiology , AECT2101 Electron Devices and Circuits.

COURSE OBJECTIVES:

The students should be made to,

- Illustrate origin of bio potentials and its propagations
- understand the different types of electrodes and its placement for various recordings
- design bio amplifier for various physiological recordings
- learn the different measurement techniques for non-physiological parameters.
- Summarize different biochemical measurements.

UNIT 1 BIOPOTENTIAL ELECTRODES

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half-cell potential, Contact impedance, polarization effects of electrode – non polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - motion artifacts, measurement with two electrodes.

UNIT 2 BIOPOTENTIAL MEASUREMENTS

Bio signals characteristics – frequency and amplitude ranges. ECG – Einthoven's triangle, standard 12 lead system, Principles of vector cardiography.EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode. Recording of ERG, EOG and EGG

UNIT 3 SIGNAL CONDITIONING CIRCUITS

Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier, Impedance matching circuit, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier., Power line interference, Right leg driven ECG amplifier, Band pass filtering

UNIT 4 MEASUREMENT OF NON-ELECTRICAL PARAMETERS

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods -Auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers, Systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

UNIT 5 BIOCHEMICAL MEASUREMENT AND BIOSENSORS

Biochemical sensors - pH, pO2 and pCO2, Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors, Blood gas analyzers -

colorimeter, Sodium Potassium Analyser, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description) – Bio Sensors – Principles – amperometric and voltometric techniques.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Differentiate different bio potentials and its propagations.
CO2. Illustrate different electrode placement for various physiological recordings
CO3. Design bio amplifier for various physiological recordings
CO4. Explain various technique for non-electrical physiogical measurements
CO5. Demonstrate different biochemical measurement techniques.

TEXT BOOK:

1. Leslie Cromwell, Biomedical Instrumentation and measurements, 2nd edition, Prentice hall of India, New Delhi, 2015.

REFERENCES:

1. John G. Webster, Medical Instrumentation Application and Design‖ 4th edition, Wiley India Pvt Ltd,New Delhi, 2015.
2. Joseph J. Carr and John M. Brown, Introduction to Biomedical Equipment Technology‖ Pearson Education, 2004.
3. Myer Kutz, Standard Handbook of Biomedical Engineering and Design‖ McGraw Hill Publisher, 2003.
4. Khandpur R.S, Handbook of Biomedical Instrumentation‖ 3rd edition, Tata McGraw-Hill New Delhi

AECT3111	DIGITAL SIGNAL PROCESSING	L	T	P	C	Total Marks
		3	1	0	4	100

PREREQUISITE: AECT2103 Signals and Systems

COURSE OBJECTIVES:

The students should be made to,

- learn discrete Fourier transform and its properties
- know the characteristics of IIR and FIR filters learn the design of infinite and finite impulse response filters for filtering undesired signals
- understand Finite word length effects
- study the concept of Multirate and adaptive filters

UNIT 1 DISCRETE FOURIER TRANSFORM

Discrete Signals and Systems- A Review – Introduction to DFT – Properties of DFT – Circular Convolution - Filtering methods based on DFT – FFT Algorithms –Decimation in time Algorithms, Decimation in frequency Algorithms – Use of FFT in Linear Filtering.

UNIT 2 IIR FILTER DESIGN

Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.

UNIT 3 FIR FILTER DESIGN

Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques – Finite word length effects in digital Filters: Errors, Limit Cycle, Noise Power Spectrum.

UNIT 4 FINITE WORDLENGTH EFFECTS

Fixed point and floating point number representations – ADC –Quantization- Truncation and Rounding errors - Quantization noise – coefficient quantization error – Product quantization error – Overflow error – Roundoff noise power - limit cycle oscillations due to product round off and overflow errors – Principle of scaling

UNIT 5 DSP APPLICATIONS

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor – Adaptive Filters: Introduction, Applications of adaptive filtering to equalization.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. apply DFT for the analysis of digital signals & systems
CO2. design IIR and FIR filters
CO3. characterize finite Word length effect on filters
CO4. design the Multirate Filters
CO5. apply Adaptive Filters to equalization

TEXT BOOK:

1. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.

REFERENCES:

1. Emmanuel C..Ifeachor, & Barrie.W.Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007.
3. A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.
4. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.

ABMT3109	DIAGNOSTIC AND THERAPEUTIC EQUIPMENT I	L	T	P	C	Total Marks
		3	0	0	3	100

PREQUISITE: ABMT3108 Biomedical Instrumentation

COURSE OBJECTIVES:

The student should be made to:

- Understand the medical devices applied in measurement of parameters related to cardiology, neurology and the methods of continuous monitoring and transmitting them
- Learn some of the cardiac assist devices
- Learn to measure the signals generated by muscles
- Understand the need and use of some of the extracorporeal devices

UNIT 1 CARDIAC EQUIPMENT

Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor, Holter Monitor, Phonocardiography, Plethysmography. Cardiac Pacemaker- Internal and External Pacemaker– Batteries, AC and DC Defibrillator- Internal and External

UNIT 2 NEUROLOGICAL EQUIPMENT

Clinical significance of EEG, Multi channel EEG recording system, Epilepsy, Evoked Potential–Visual, Auditory and Somatosensory, MEG (Magneto Encephalo Graph). EEG Bio Feedback Instrumentation.

UNIT 3 SKELETAL MUSCULAR EQUIPMENT

Generation of EMG, recording and analysis of EMG waveforms, fatigue characteristics, Muscle stimulators, nerve stimulators, Nerve conduction velocity measurement, EMG Bio Feedback Instrumentation.

UNIT 4 PATIENT MONITORING AND BIOTELEMETRY

Patient monitoring systems, ICU/CCU Equipments, Infusion pumps, bed side monitors, Central consoling controls. Radio Telemetry (single, multi), Portable and Landline Telemetry unit, Applications in ECG and EEG Transmission.

UNIT 5 EXTRA CORPOREAL DEVICES AND SPECIAL DIAGNOSTIC TECHNIQUES

Need for heart lung machine, functioning of bubble, disc type and membrane type oxygenerators, finger pump, roller pump, electronic monitoring of functional parameter. Hemo Dialyser unit, Lithotripsy, Principles of Cryogenic technique and application, Endoscopy, Laproscopy. Thermography – Recording and clinical application, ophthalmic instruments.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Use different medical devices applied in measurement of parameters related to cardiology, neurology
CO2. Explain about cardiac assist devices, its continuous monitoring and transmission
CO3. Measure signals generated by muscles
CO4. Understand the concepts of patient monitoring system and biotelemetry
CO5. Describe the extracorporeal devices and techniques

TEXT BOOK:

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003.

REFERENCES:

1. Myer Kutz, "Standard Handbook of Biomedical Engineering & Design", Mc Graw Hill, 2003.
2. L.A Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", 3rd Edition, 2008
3. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Pearson Education, New Delhi, 2007.
4. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson education, 2004.

5. John G.Webster, "Medical Instrumentation Application and Design", third edition, John Wiley and Sons, New York, 2006

ABML3103	BIOMEDICAL INSTRUMENTATION LABORATORY	L	T	P	C	Total Marks
		0	0	4	2	100

PREQUISITE: ABMT3108 Biomedical Instrumentation

COURSE OBJECTIVES:

The student should be made to,

- Get hands-on training on designing of bio signal acquisition system and measurement of physiological parameters, biochemical parameters.

LIST OF EXPERIMENTS:

1. Design of pre amplifiers to acquire bio signals along with impedance matching circuit using suitable IC's
2. Design of ECG Amplifiers with appropriate filter to remove power line and other artifacts.
3. Design of EMG amplifier
4. Design a suitable circuit to detect QRS complex and measure heart rate
5. Design of frontal EEG amplifier
6. Design of EOG amplifier to detect eye blink
7. Design a right leg driven ECG amplifier.
8. Design and study the characteristics of optical Isolation amplifier
9. Design a Multiplexer and Demultiplexer for any two biosignals.
10. Measurement of pulse-rate using Photo transducer.
11. Measurement of pH and conductivity.
12. Measurement of blood pressure using sphygmomanometer.
13. Measurement and recording of peripheral blood flow
14. Design a PCB layout for any bio amplifier using suitable software tool.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Design preamplifiers and amplifiers for various bio signal recordings.

CO2. Measure various non-electrical parameters using suitable sensors/transducers

CO3. Design PCB layout for any bio amplifier.

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS:

1. pH meter and conductivity meter: 1 No.
2. Photo transducer for pulse measurement: 1 No.
3. Sphygmomanometer and Stethoscope: 1 No.
4. Blood flow measurement system: 1 No.
5. Multiparameter (ECG, EMG, EEG) Simulator: 2 No.
6. Function generator, DSO, Regulated Power supplies, Bread boards – 8 each
7. IC LM 324, AD 620, INA series (126,128 etc.), 555 Timer: 20 each
8. Opto Isolator IC: MCT2E – 1 No.
9. Software tool for PCB design: 1

AECL3175	DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C	Total Marks
		0	0	4	2	100

PREQUISITE: AECT3111 Digital Signal Processing

COURSE OBJECTIVES:

The student should be made to:

- To implement Linear and Circular Convolution
- To implement FIR and IIR filters
- To study the architecture of DSP processor
- To demonstrate Finite word length effect

LIST OF EXPERIMENTS:

MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of sequences (functional & random) & correlation
2. Linear and Circular Convolutions
3. Spectrum Analysis using DFT
4. FIR filter design
5. IIR filter design
6. Multirate Filters
7. Equalization

DSP PROCESSOR BASED IMPLEMENTATION

1. Study of architecture of Digital Signal Processor
2. MAC operation using various addressing modes
3. Linear Convolution
4. Circular Convolution
5. FFT Implementation
6. Waveform generation
7. IIR and FIR Implementation
8. Finite Word Length Effect

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Carry out simulation of DSP systems
CO2. Demonstrate their abilities towards DSP processor based implementation of DSP systems
CO3. Analyze Finite word length effect on DSP systems
CO4. Demonstrate the applications of FFT to DSP
CO5. Implement adaptive filters for various applications of DSP

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS (**2 students per system**)

PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards) 15 Units

List of software required:

MATLAB with Simulink and Signal Processing Tool Box
or Equivalent Software in desktop systems - 15 Nos
Signal Generators (1MHz) –15 Nos
CRO (20MHz) -15 Nos

VI SEMESTER

AMBT1101	PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: None

COURSE OBJECTIVES:

- To enable the students to study the evolution of Management
- To study the functions and principles of management and to learn the application of the principles in an organization.
- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT 1 INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT 2 PLANNING

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT 3 ORGANISING

Nature and purpose – Formal and informal organization – organization chart – organization structure– types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management**.**

UNIT 4 HUMAN VALUES

Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, speed and area tradeoff

UNIT 5 ENGINEERING ETHICS

Senses of "Engineering Ethics" – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg"s theory – Gilligan"s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

COURSE OUTCOMES:

At the end of the course, the student should be able to:
CO1: Apply the tools and techniques of management to manufacturing and services processes.
CO2: Realize the responsibilities and rights in the society.
CO3: Apply ethics in society & discuss the ethical issues related to engineering

TEXT / REFERENCE BOOKS

1. Stephen P. Robbins & Mary Coulter, "Management", 10th Edition, Prentice Hall (India) Pvt. Ltd., 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education, 2011.
4. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
5. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
6. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
7. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
8. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
9. World Community Service Centre, "Value Education", Vethathiri publications, Erode, 2011.

AMBT1101	DIAGNOSTIC AND THERAPEUTIC EQUIPMENT II	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: ABMT3109 Diagnostic and Therapeutic Equipment I

COURSE OBJECTIVES:

The student should be made to:

- Gather basic knowledge about measurements of parameters related to respiratory system
- Learn measurement techniques of sensory responses
- Understand different types and uses of diathermy units.
- Know ultrasound imaging technique and its use in diagnosis
- Know the importance of patient safety against electrical hazard

UNIT 1 RESPIRATORY MEASUREMENT STSTEM

Instrumentation for measuring the mechanics of breathing – Spirometer -Lung Volume and vital capacity, measurements of residual volume, pneumotachometer – Airway resistance

measurement, Whole body plethysmography, Intra-Alveolar and Thoracic pressure measurements, Apnea Monitor. Types of Ventilators – Pressure, Volume, Time controlled. Flow, Patient Cycle Ventilators, Humidifiers, Nebulizers, Inhalators.

UNIT 2 SENSORY MEASUREMENT

Psycho Physiological Measurements-for testing and sensory Responses, Electro occulograph, Electro retinograph, Audiometer-Pure tone, Speech. EGG (Electrogastrograph), galvanic skin resistance (GSR).

UNIT 3 DIATHERMY

IR and UV lamp and its application. Short wave diathermy, ultrasonic diathermy, Microwave diathermy, Electro surgery machine - Current waveforms, Tissue Responses, Electro surgical current level, Hazards and safety procedures.

UNIT 4 ULTRASONIC TECHNIQUE

Diagnosis: Tissue Reaction, Basic principles of Echo technique, display techniques A, B and M mode, B Scan, Application of ultrasound as diagnostic tool – Echocardiogram, Echoencephalogram, abdomen, obstetrics and gynecology, ophthalmology.

UNIT 5 PATIENT SAFETY

Physiological effects of electricity – important susceptibility parameters – Macro shock – Micro shock hazards – Patient's electrical environment – Isolated Power system – Conductive surfaces – Electrical safety codes and standards – Basic Approaches to Protection against shock, Protection equipment design, Electrical safety analyzer – Testing the Electric system

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Explain about measurements of parameters related to respiratory system
CO2. Describe the measurement techniques of sensory responses
CO3. Analyze different types and uses of diathermy units
CO4. Discuss ultrasound imaging techniques and its usefulness in diagnosis
CO5. Outline the importance of patient safety against electrical hazard

TEXT BOOK:

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003.

REFERENCES:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007
2. John G. Webster, "Medical Instrumentation Application and Design", John Willey and Sons, 2006.
3. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2004.
4. Richard Aston "Principles of Biomedical Instrumentation and Measurement", Merril Publishing Company, 1990.
5. L.A Geddas and L.E.Baker "Principles of Applied Biomedical Instrumentation" 2004.
6. John G. Webster, "Bioinstrumentation", John Willey and sons, New York, 2004.
7. Myer Kutz "Standard Handbook of Biomedical Engineering & Design", McGraw-Hill Publisher, 2003.

AECT2107	MICRO PROCESSOR AND MICROCONTROLLER	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: AECT2164 – Analog and Digital IC's

COURSE OBJECTIVES:

The student should be made to:

- Study the Architecture of 8086 microprocessor.
- Learn the design aspects of I/O and Memory Interfacing circuits.
- Study about communication and bus interfacing.
- Study the Architecture of 8051 microcontroller..

UNIT 1 THE 8086 MICROPROCESSOR

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT 2 8086 SYSTEM BUS STRUCTURE

8086 signals – Basic configurations – System bus timing –System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure - Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

UNIT 3 I/O INTERFACING

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

UNIT 4 MICROCONTROLLER

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT 5 INTERFACING MICROCONTROLLER

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Write programs on 8086 microprocessor.
CO2. Design I/O circuits. Design and implement
CO3. Design Memory Interfacing circuits.
CO4. Design and implement 8051 microcontroller based systems.
CO5. Compute programming for interfacing Microcontroller

TEXT BOOK:

1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education,2011

REFERENCE:

1. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware:,TMH,2012

ABML3104	DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS LABORATORY	L	T	P	C	Total Marks
		0	0	4	2	100

PREREQUISITE: ABMT3109 Diagnostic and Therapeutic Equipment I

COURSE OBJECTIVES:

The student should be made to

- To demonstrate recording and analysis of different Bio potentials
- To examine different therapeutic modalities.

LIST OF EXPERIMENTS:

1. Measurement of visually evoked potential
2. Galvanic skin resistance (GSR) measurement
3. Study of shortwave and ultrasonic diathermy
4. Measurement of various physiological signals using biotelemetry
5. Study of hemodialysis model
6. Electrical safety measurements
7. Measurement of Respiratory parameters using spirometry.
8. Study of medical stimulator
9. Analyze the working of ESU – cutting and coagulation modes
10. Recording of Audiogram
11. Study the working of Defibrillator and pacemakers
12. Analysis of ECG, EEG and EMG signals
13. Study of ventilators
14. Study of Ultrasound Scanners
15. Study of heart lung machine model

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Measure different bioelectrical signals using various methods
CO2. Assess different non-electrical parameters using various methodologies
CO3. Illustrate various diagnostic and therapeutic techniques
CO4. Examine the electrical safety measurements
CO5. Analyze the different bio signals using suitable tools.

LAB REQUIREMENTS FOR 30 STUDENTS

1. Visually evoked potential setup: 1 No.
2. GSR setup: 1 No.
3. Multi-output power supply (+15v, -15v, +30V variable, +5V, 2A): 2 Nos.
4. Short wave Diathermy 1 No.
5. Ultrasound diathermy 1 No.
6. Multiparameter biotelemetry system 1 No.
7. Electrical Safety Analyser 1 No. ,
8. Spirometry with associated analysis system: 1 No.
9. ECG Simulator 1 No. ,
10. Medical stimulator 1 No
11. Surgical diathermy with analyzer 1 No ,
12. Audiometer 1No
13. Pacemaker and Defibrillator: 1 No. each ,
14. Haemodialysis model and Heart lung Model: 1 No. each ,
15. Ventilator: 1 No.
16. Ultrasound Scanner: 1 No. Software to Analyze ECG, EEG and EMG: 1 No.

AECL2170	MICRO PROCESSOR AND MICROCONTROLLER LABORATORY	L	T	P	C	Total Marks
		0	0	4	2	100

PREREQUISITE: AECT2107 Microprocessor and Microcontroller

COURSE OBJECTIVES:

The student should be made to:

- Introduce ALP concepts and features
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Differentiate Serial and Parallel Interface
- Interface different I/Os with Microprocessors
- Be familiar with MASM

LIST OF EXPERIMENTS:

8086 Programs using kits and MASM

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching
5. Password checking, Print RAM size and system date
6. Counters and Time Delay

Peripherals and Interfacing Experiments

1. Traffic light control
2. Stepper motor control
3. Digital clock
4. Key board and Display
5. Printer status
6. Serial interface and Parallel interface
7. A/D and D/A interface and Waveform Generation

8051 Experiments using kits and MASM

1. Basic arithmetic and Logical operations
2. Square and Cube program, Find 2's complement of a number
3. Unpacked BCD to ASCII

COURSE OUTCOMES:

On the completion of the course, the student should be able to:

CO1. Write ALP Programmes for fixed and Floating Point and Arithmetic
CO2. Interface different I/Os with processor
CO3. Generate waveforms using Microprocessors
CO4. Execute Programs in 8051
CO5. Explain the difference between simulator and Emulator

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE:

1. 8086 development kits - 30 nos
2. Interfacing Units - Each 10 nos
3. Microcontroller - 30 nos

SOFTWARE:

1. Intel Desktop Systems with MASM - 30 nos
2. 8086 Assembler
3. 8051 Cross Assembler

VII SEMESTER

ABMT4132	RADIOLOGICAL EQUIPMENT	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: ABMT3110 – Diagnostic and Therapeutic Equipment II

COURSE OBJECTIVES:

The student should be made to:

- Understand generation of x-rays and its uses in imaging.
- Learn different types of radio diagnostic techniques.
- Know techniques used for visualizing different sections of the body.
- Learn radiation therapy methodologies and the radiation safety.

UNIT 1 MEDICAL X-RAY EQUIPMENT

Nature of X-rays- X-Ray absorption – Tissue contrast. X- Ray Equipment (Block Diagram) – X-Ray Tube, the collimator, Bucky Grid, power supply, Digital Radiography- discrete digital detectors, storage phosphor and film scanning, X-ray Image Intensifier tubes – Fluoroscopy – Digital Fluoroscopy. Angiography, cine Angiography. Digital subtraction Angiography. Mammography.

UNIT 2 COMPUTED TOMOGRAPHY

Principles of tomography, CT Generations, X- Ray sources- collimation- X- Ray detectors- Viewing systems- spiral CT scanning – Ultra fast CT scanners. Image reconstruction techniques- back projection and iterative method.

UNIT 3 MAGNETIC RESONANCE IMAGING

Fundamentals of magnetic resonance- Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession – Induction of magnetic resonance signals – bulk magnetization – Relaxation processes T1 and T2. Block Diagram approach of MRI system- system magnet (Permanent, Electromagnet and Super conductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, Electronic components, fMRI.

UNIT 4 NUCLEAR MEDICINE SYSTEM

Radio Isotopes- alpha, beta, and gamma radiations. Radio Pharmaceuticals. Radiation detectors – gas filled, ionization chambers, proportional counter, GM counter and scintillation Detectors, Gamma camera- Principle of operation, collimator, photo multiplier tube, X-Y positioning circuit, pulse height analyzer. Principles of SPECT and PET.

UNIT 5 RADIATION THERAPY AND RADIATION SAFETY

Radiation therapy – linear accelerator, Telegamma Machine. SRS –SRT,-Recent Techniques in radiation therapy - 3DCRT – IMRT – IGRT and Cyber knife- radiation measuring instruments- Dosimeter, film badges, Thermo Luminescent dosimeters- electronic dosimeter- Radiation protection in medicine- radiation protection principles.

COURSE OUTCOMES:

On the completion of the course, the student should be able to:

CO1. Describe the working principle of X ray machine and its application.
CO2. Illustrate the principle computed tomography.
CO3. Interpret the technique used for visualizing various sections of the body using

magnetic resonance imaging

CO4. Demonstrate the applications of radio nuclide imaging.

CO5. Outline the methods of radiation safety.

TEXT BOOK:

1. Steve Webb, The Physics of Medical Imaging, Adam Hilger, Philadelpia, 1988 (Units I, II, III & IV).
2. R.Hendee and Russell Ritenour "Medical Imaging Physics", Fourth Edition William, Wiley-Liss, 2002.

REFERENCES:

1. Gopal B. Saha "Physics and Radiobiology of Nuclear Medicine"- Third edition Springer, 2006.
2. B.H.Brown, PV Lawford, R H Small wood , D R Hose, D C Barber, "Medical physics and biomedical Engineering", - CRC Press, 1999.
3. Myer Kutz, "Standard handbook of Biomedical Engineering and design", McGraw Hill, 2003.
4. P.Ragunathan, "Magnetic Resonance Imaging and Spectroscopy in Medicine

ABMT413	NEURAL NETWORKS AND FUZZY	L	T	P	C	Total Marks
3	SYSTEMS	3	0	0	3	100

PREREQUISITE: AECT3111 – Digital Signal Processing

COURSE OBJECTIVES:

The students will be made

- To understand the basic concepts of artificial neural networks
- To study the various ANN Models
- To familiarize about the Self organizing maps and competitive networks
- To study the basic concepts of fuzzy Logic systems
- To apply the concepts of ANN and Fuzzy Logic in Biomedical applications.

UNIT 1 ARTIFICIAL NEURAL NETWORKS-AN OVERVIEW

Neural Networks Basics-Biological Neural nets, Processing elements-Mc Culloh PittsModel, Types of Learning, Network Parameters-Weights, Activation, ThresholdFunctions, Hebb Rule, Delta Rule, Perception learning Algorithm

UNIT 2 ANN MODELS

Mapping, training of Feed forward networks-Perception, Mapping, training ofRecurrent Networks-Hopfield Network, Radial Basis Function Network, Training ofFeed Forward Back Propagation Network, Applications of BPN

UNIT 3 SELF ORGANIZING MAPS (SOM)

Self organizing maps-Pattern clustering, SOM-Topological Mapping, Kohonen"s SOM, K-means clustering algorithm, competitive models-Min, Max Net, Adaptive Resonance Theory (ART)-Introduction, Network and Processing in ART, Associative memory model, Basics of support vector machine (SVM) and radial.

UNIT 4 INTRODUCTION TO FUZZY LOGIC SYSTEM

Fuzzy logic-Basic concepts -Fuzzy Vs Crisp set, Linguistic variables, Membership functions, Fuzzy IF-THEN rules, Variable inference techniques, De-fuzzification techniques, Basic fuzzy inference algorithm.

UNIT 5 NEURAL NETWORK, FUZZY LOGIC APPLICATIONS IN MEDICINE

Neural Networks in Biomedical Applications, Cancer, Cardiovascular Applications, Medical Image Analysis using neural networks, Fuzzy Logic Applications, Fuzzy Logic Controller, Neuro fuzzy systems- Applications in medicine

COURSE OUTCOMES:

On completion of the course the students should be able to

CO1. Explain the fundamentals of pattern recognition and neural networks.

CO2. Design and apply different pattern recognition techniques.
CO3. Apply the ANN and Fuzzy concepts in medicine.
CO4. Design a system using Fuzzy and ANN.
CO5. Apply the neural networks and fuzzy logic in medicine

TEXT BOOK:

1. Mohamad H. Hassoun, "Fundamentals of Artificial Neural Network",Cambridge, The MIT Press, First edition, 1995.
2. Laurene Fausett, "Fundamentals of Neural Networks: Architectures,Algorithms, and Applications", Pearson Education India, Third edition,2008.

REFERENCE:

1. C.M.Bishop, "Pattern Recognition and Machine Learning", Springer-Verlag,2006
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", John Wiley andSons, Second edition,1995
3. B.Yegnanarayana, "Artificial Neural Networks", Prentice Hall of India, Third edition 2006.

AECT3128	DIGITAL IMAGE PROCESSING	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: AECT3111- Digital Signal Processing

COURSE OBJECTIVES:

The student should be made to:

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

UNIT 1 DIGITAL IMAGE FUNDAMENTALS

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNIT 2 IMAGE ENHANCEMENT

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT 3 IMAGE RESTORATION

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

UNIT 4 IMAGE SEGMENTATION

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing-erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT 5 IMAGE COMPRESSION AND RECOGNITION

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

COURSE OUTCOMES:

On Completion of the course, the students should be able to:

CO1. Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
CO2. Operate on images using the techniques of smoothing, sharpening and enhancement.
CO3. Understand the restoration concepts and filtering techniques.
CO4. Learn the basics of segmentation, features extraction, compression and recognition methods for color models.
CO5. Program for image compression

TEXT BOOK/ REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson, Third Edition, 2010.
2. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson, 2002.
3. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.
4. D,E. Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.
5. William K. Pratt, Digital Image Processing', John Wiley, New York, 2002
6. Milan **Sonka,** , Vaclav **Hlavac**, Roger **Boyle,** Image processing, analysis and machine vision', Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

AECL3180	DIGITAL IMAGE PROCESSING LABORATORY	L	T	P	C	Total Marks
		0	0	4	2	100

PREREQUISITE: AECT3128 Digital Image Processing

COURSE OBJECTIVES:

The student should be made:

- To practice the basic image processing techniques.
- To understand the functions of transforms.
- To know the effect of quantization.
- To explore the applications of image processing.

LIST OF EXPERIMENTS

Simulation using MATLAB (Image processing Tool Box) or equivalent software

1. Image sampling and quantization
2. Analysis of spatial and intensity resolution of images.
3. Intensity transformation of images.
4. DFT analysis of images
5. Transforms (Walsh, Hadamard, DCT, Haar)
6. Histogram Processing
7. Image Enhancement-Spatial filtering
8. Image Enhancement- Filtering in frequency domain
9. Image segmentation – Edge detection, line detection and point detection
10. Basic Morphological operations.
11. Basic Thresholding functions
12. Analysis of images with different color models.

MINI PROJECTS:

1. Applications to Biometric and security
2. Applications to Medical Images

3. Texture analysis with statistical properties
4. Boundary detection

COURSE OUTCOMES:

On completion of the course, the student should be able to:

CO1. Perform filtering operations in the image
CO2. Use transforms and analyse the characteristics of the image.
CO3. Write program to analyse the texture of the image
CO4. Implement project on simple image processing applications.
CO5. Apply image processing technique to solve real world problems

Equipments for a batch of 30 students (2 students per experiment):

1. PCs with related accessories- 15
2. MATLAB (licensed) or any equivalent software with Image processing tool box
3. Image processing software tools.

ABMP4101	PROJECT PHASE – I	L	T	P	C	Total Marks
		0	0	6	3	100

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

The student should be made to:

- Develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same and to train the students in preparing project reports and to face reviews and viva voce examination**.**

STRATEGY:

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

COURSE OUTCOMES:

At the end of the course, the student should be able to:

On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

VIII SEMESTER

ABMT413	QUALITY ASSURANCE AND	L	T	P	C	Total Marks
1	SAFETY IN HOSPITAL					

		3	**0**	**0**	**3**	**100**

PREREQUISITE: None

COURSE OBJECTIVES:

The student should be made

- To provide basic knowledge on the concept of Healthcare Quality management towards continuous improvement of patient care .
- To make the students aware of the role of biomedical engineer in hospitals, especially in the management of electrical supply, maintenance of electrical safety

UNIT 1 STANDARDIZATION OF QUALITY MEDICAL CARE IN HOSPITALS

Define Quality- Need for Standarization & Quality Management**,** TQM in Health care organization- Quality assurance methods ,QA in (Medical Imaging & Nuclear medicine) Diagnostic services – Classification of equipments

UNIT 2 REGULATORY REQUIREMENT FOR HEALTH CARE

FDA regulations, Accreditation for hospitals - JCI, NABH and NABL, Other regulatory Codes.

UNIT 3 HOSPITAL SAFETY

Security & Safety of Hospital -Property, Staff & Patients**,** Radiation safety, Safety precautions, hazardous effects of radiation, allowed levels of radiation, ICRP regulations for radiation safety, Disposal of Biological waste.

UNIT 4 ELECTRICAL & FIRE SAFETY

Sources of shocks, macro & micro shocks -Hazards, monitoring and interrupting the Operation from leakage current- Elements of fire, causes of fire , Action to be taken in case of fire in a Hospital.

UNIT 5 ASSESSING QUALITY HEALTH CARE

Patient Safety Organization- Governmental & Independent,Measuring Quality care – Evaluation of hospital services – six sigma way, Quality Assurance in Hospitals Sop's – Patient Orientation for Total Patient Satisfaction. 5S techniques

COURSE OUTCOMES:

On completion of the course, the students should be able

CO1. To develop knowledge and insight into the procedures used in quality control.
CO2. To understand regulatory requirement for healthcare.
CO3. To develop knowledge on hospital safety
CO4. To develop knowledge on electrical and fire safety
CO5. To asses quality in health care

REFERENCES:

1. B.M.Sakharkar, Principles of Hospital administration and Planning, JAYPEE Brothers, Medical Publishers (P) Ltd.
2. Cesar A. Cacere & Albert Zana, The Practice of Clinical Engg. Academic press, New Yark, 1977.
3. Joseph F Dyro —Clinical Engineering Handbook — Elsevier Publishers,2004.
4. Karen Parsley, Karen Parsley Philomena Corrigan‖Quality improvement in Healthcare, 2 nd edition Nelson Thrones Pub,2002
5. K.Shridhara Bhat, Quality Management, Himalaya Publishing House.
6. Webster J.G and Albert M.Cook, Clinical Engg, Principles & Practices, Prentic Hall Inc., Engle wood Cliffs, New Jersy, 1979.
7. Sharon Myers —Patient Safety & Hospital Accreditation - A Model for Ensuring Success‖ Springer Publishers 2012

ABMT4130	HUMAN VALUES AND MEDICAL ETHICS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: None

COURSE OBJECTIVES:

The Students should be made

- To create awareness on core values that shape their professional as well as personal life
- To understand various social issues, industrial standards, code of ethics and role of professional ethics in medical field.

UNIT 1 INTRODUCTION TO MEDICAL ETHICS

Definition of Medical ethics, Scope of ethics in medicine, American medical Association code of ethics, CMA code of ethics- Fundamental Responsibilities ,The Doctor And The Patient, The Doctor And The Profession, Professional Independence, The Doctor And Society.

UNIT 2 ETHICAL THEORIES & MORAL PRINCIPLES

Theories-Deontology & Utilitarianism ,Casuist theory, Virtue theory, The Right Theory. Principles- Non- Maleficence, Beneficence, Autonomy, Veracity, Justice. Autonomy & Confidentiality issues in medical practice, Ethical Issues in biomedical research, Bioethical issues in Human Genetics & Reproductive Medicine

UNIT 3 HOSPITAL ACCREDITATION STANDRADS

Accreditation - JCI Accreditation & its Policies. Patient centered standards, Healthcare Organization management standards -Indian Perspective.

UNIT 4 HOSPITAL SAFETY STANDARDS

Life Safety Standards- Protecting Occupants, Protecting the Hospital From Fire, Smoke, and Heat, Protecting Individuals From Fire and Smoke, Providing and Maintaining Fire Alarm Systems, Systems for Extinguishing Fires Environment of Care Standards-Minimizing EC Risks, Smoking Prohibitions, Managing Hazardous Material and Waste, Maintaining Fire Safety Equipment, Features, Testing, Maintaining, and Inspecting Medical Equipment

UNIT 5 MEDICAL EQUIPMENT SAFETY STANDARDS

General requirements for basic safety & essential performance of medical equipments.IEC 60601 standards- Base Standard-general requirement of electrical medical devices, Collateral Standards- EMC radiation protection &programmable medical device system, Particular Standards-type of medical device

OUTCOMES:

On Completion of the course, the student should be able to:

CO1. Understand medical ethics
CO2. Develop knowledge in ethical theories and moral principles
CO3. Know the hospital accreditation standards
CO4. Develop knowledge in hospital safety standards
CO5. Understand medical equipment safety standards

REFERENCES:

1. Biomedical Ethics: A Canadian Focus. Johnna Fisher (ed.), Oxford University Press Canada 2009.
2. Bioethics-—An Introduction for the biosciences‖, 2nd edition 2008, Ben Mepham, Oxford.
3. Domiel A Vallero —Biomedical Ethics for Engineers‖, Elsevier Pub.1st edition, 2007.
4. Joint Commission Accreditation Standards for Hospitals ,2nd edition 2003.
5. NilsHoppe and JoseMiola - Medical law and Medical Ethics - Cambridge University Press-2014.
6. Robert M Veatch‖ Basics of Bio Ethics‖, Second Edition. Prentice- Hall,Inc 2003

7. Physical Environment Online: A Guide to The Joint Commission_s Safety Standards is published by HCPro, Inc. 2010.

ABMP4102	PROJECT PHASE – II	L	T	P	C	Total Marks
		0	0	16	8	100

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

The student should be made to:

- develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same and to train the students in preparing project reports and to face reviews and viva voce examination**.**

STRATEGY:

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

OUTCOMES:

At the end of the course, the student should be able to:

On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

PROGRAMME ELECTIVES
Group – I: Biomedical Instrumentation

ABMT2107	BIOSENSORS AND MEASUREMENTS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: AECT2101 Electron Devices and Circuits.

COURSE OBJECTIVES:

The students should be made to,

- Understand the purpose of measurement, the methods of measurements, errors associated with measurements.
- Know the principle of transduction, classifications and the characteristics of different transducers
- Know the different bridges for measurement.
- Know the different display and recording devices.

UNIT 1 SCIENCE OF MEASUREMENT

Measurement System – Instrumentation - Classification and Characteristics of Transducers - Static and Dynamic - Errors in Measurements and their statistical analysis – Calibration - Primary and secondary standards.

UNIT 2 DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS

Strain Gauge: Gauge factor, sensing elements, configuration, and unbounded strain gage. Capacitive transducer - various arrangements, Inductive transducer, LVDT, Passive types: RTD materials & range, relative resistance vs. temperature characteristics, thermistor characteristics, Active type: Thermocouple - characteristics.

UNIT 3 PHOTOELECTRIC, PIEZO ELECTRIC SENSORS, SIGNAL CONDITIONING CIRCUITS

Phototube, scintillation counter, photo multiplier tube (PMT), photovoltaic, photo conductive cells, photo diodes, phototransistor, comparison of photoelectric transducers. Optical displacement sensors and optical encoders. Piezoelectric active transducer- Equivalent circuit and its characteristics, Fiber-optic, Flow and liquid level, and Electrochemical transducer. Functions of signal conditioning circuits, Preamplifiers, Concepts of passive filters, Impedance matching circuits, AC and DC Bridges

UNIT 4 DISPLAY AND RECORDING DEVICES

Digital voltmeter – Multi meter, Frequency, Period measurement, Time interval and pulse width measurement, Graphic recorders-strip chart, X-Y recorder, CRO – block diagram, CRT – vertical & horizontal deflection system, General purpose oscilloscope, Dual trace, Dual beam, Sampling oscilloscope, DSO, LCD monitor, PMMC writing systems, servo recorders, photographic recorder, magnetic tape recorder, Inkjet recorder, thermal recorder.

UNIT 5 MEDICAL APPLICATIONS OF SENSORS

Gas sensor, Microbial sensor, electro analytical sensor, Enzyme based sensor-- Glucose sensor, Electronic nose- halitosis, Advances in sensor technology: Lab-on-a –chip, Smart sensor, MEMS and Nano sensor.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Measure various electrical parameters with accuracy, precision, resolution.

CO2 - Select appropriate passive or active transducers for measurement of physical phenomenon.

CO3 - Select appropriate light sensors for measurement of physical phenomenon.

CO4 - Use AC and DC bridges for relevant parameter measurement.

CO5 - Employ Multimeter, CRO and different types of recorders for appropriate measurement.

TEXT BOOKS:

3. A.K.Sawhney, —Electrical & Electronics Measurement and Instrumentation‖,10th edition, DhanpatRai& Co, New Delhi, 19th Revised edition 2011, Reprint 2014.
4. John G. Webster, —Medical Instrumentation Application and Design‖, 4th edition, Wiley India Pvt Ltd,New Delhi, 2015.

REFERENCES:

5. Ernest O Doebelin and Dhanesh N Manik, Measurement systems, Application and design, 6th edition, McGraw-Hill, 2012.
6. Khandpur R.S, —Handbook of Biomedical Instrumentation‖, 3rdedition,Tata McGraw-Hill, New Delhi, 2014.
7. Leslie Cromwell, —Biomedical Instrumentation and measurement‖, 2nd edition, Prentice hall of India, New Delhi, 2015.
8. Albert D.Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques‖, Prentice Hall of India, 1stedition, 2016

ABMT3111	BIOMECHANICS AND BIOFLUIDICS	L	T	P	C	Total Marks
		3	0	0	3	100

PRPEREQUISITE: ABMT2103 Anatomy and Human Physiology

COURSE OBJECTIVES:

The student should be made

- An understanding on the physiology and anatomy of studied systems,
- A capability to analyse cardiac, respiratory, soft tissue and orthopedic mechanics

UNIT 1 INTRODUCTION TO MECHANICS

Principles of Mechanics, Vector mechanics, Mechanics of motion - Newton's laws of motion, Kinetics, Kinematics of motion, Fluid mechanics – Euler equations and Navier Stoke's equations, Viscoelasticity, Constitutive equations, Stress transformations, Strain energ y function.

UNIT 2 BIOFLUID MECHANICS

Introduction, viscosity and capillary viscometer, Rheological properties of blood, laminar flow, Couette flow and Hagen-poiseuille equation, turbulent flow. Cardiovascular system - biological and mechanical valves development, artificial heart valves testing of valves, Structure, functions, material properties and modeling of Blood vessels, Rheology of Blood In Microvessels: Fahraeus - Lindquist effect and inverse effect, distribution of suspended particles in anarrow rigid tube. Nature of red blood cells in tightly fitting tubes, hematocrit in very narrow tube.

UNIT 3 BIOSOLID MECHANICS

Hard Tissues: Bone structure & composition mechanical properties of bone, cortical and cancellous bones, viscoelastic properties, Maxwell & Voight models – anisotropy.**Soft Tissues:** Structure, functions, material properties and modeling of Soft Tissues: Cartilage,Tendon, Ligament, Muscle.

UNIT 4 BIOMECHANICS OF JOINTS AND IMPLANTS

Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, free body diagrams, types of joint, biomechanical analysis of elbow, shoulder, spinal column, hip knee and ankle. Design of orthopedic implant, specifications for a prosthetic joint, biocompatibility, requirement of a biomaterial, characteristics of different types of biomaterials, manufacturing process of implants, fixation of implants.

UNIT 5 MODELLING AND ERGONOMICS

Introduction to Finite Element Analysis, Analysis of bio mechanical systems using Finite element methods, Graphical design. Ergonomics- Gait analysis, Design of work station, Sports biomechanics, Injury mechanics.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Discuss on Cardiovascular and pulmonary system in human body.
CO2. Explain blood properties ,especially the anatomy and physiology of blood vessels
CO3. Knowledge on Hard and soft tissues
CO4. Explain the mechanics of joints
CO5. Model using Finite element Analysis.

TEXT BOOKS:

1. Y.C Fung, "Biomechanics- Mechanical properties of living tissues", 2nd Edition, Springer-Verlag, 1993.

REFERENCES:

1. David A. Rubenstein, Weiyin, Mary D. Frame, "Biofluid Mechanics- An Introduction to fluid Mechanics, Macrocirculation andMicrocirculation", Springer, 2013.
2. Silver Frederick H. Biomaterials, Medical Devices & Tissue Engineering: Chapman & Hall, London, 1994**.**
3. Nihanth ozkai, D.A Mc Donald ,"Biomechanics, Blood flow in arteries", Edward Arnold ltd, 1998.
4. D.O Cooney, Biomedical Engineering Principles. Marcel Dekker, INC New York.1976.

		L	T	P	C	Total Marks
ABMT3113	**REHABILITATION ENGINEERING**	**3**	**0**	**0**	**3**	**100**

PREREQUISITE: ABMT3110 Diagnostic and Therapeutic Equipment II

COURSE OBJECTIVES:

The students should be made to,

- To understand the rehabilitation concepts and Rehabilitation team members for future development and applications.
- To study various Principles of Rehabilitation Engineering.
- To understand different types of Therapeutic Exercise Technique.
- To understand the tests to assess the hearing loss, development of electronic devices to compensate for the loss and various assist devices for visually and auditory impaired.
- To study the various orthotic devices and prosthetic devices to overcome orthopedic problems.

UNIT 1 INTRODUCTION TO REHABILITATION

What is Rehabilitation, Epidemiology of Rehabilitation, Health, Levels of Prevention, Preventive Rehabilitation, Diagnosis of Disability, Functional Diagnosis, Importance of Psychiatry in Functional diagnosis, Impairment disability handicap, Primary & secondary Disabilities, Rehabilitation team Classification of members, The Role of Psychiatrist, Occupational therapist, Physical therapist, Recreation therapist, Prosthetist - Orthotist, Speech pathologist, Rehabilitation nurse, Social worker, Corrective therapist, Psychologist, Music therapist, Dance therapist & Biomedical engineer.

UNIT 2 PRINCIPLES OF REHABILITATION

Introduction, The Human Component, Principles of Assistive Technology Assessment, Principles of Rehabilitation Engineering- Key Engineering Principles, Key Ergonomic Principles - Practice of Rehabilitation and Assistive Technology.

UNIT 3 THERAPEUTIC EXERCISE TECHNIQUE

Co-ordination exercises, Frenkels exercises, Gait analyses-Pathological Gaits, Gait Training, Relaxation exercises-Methods for training Relaxation, Strengthening exercises-Strength training, Types of Contraction, Mobilisation exercises, Endurance exercises.

UNIT 4 MANAGEMENT OF COMMUNICATION & VIRTUAL REALITY

Impairment-introduction to communication, Aphasia, Types of aphasia, Treatment of aphasic patient, Augmentative communication-general form of communication, types of visual aids, Hearing aids, Types of conventional hearing aid, Writing aids. Introduction to virtual reality, Virtual reality based rehabilitation, Hand motor recovery systems with Phantom haptics, Robotics and Virtual Reality Applications in Mobility Rehabilitation.

UNIT 5 ORTHOTIC, PROSTHETIC DEVICES & RESTORATION TECHNIQUE

General orthotics, Classification of orthotics-functional & regional, General principles of Orthosis, Calipers- FO, AFO, KAFO, HKAFO. Prosthetic devices: Hand and arm replacement, Body powered prosthetics, Myoelectric controlled prosthetics and Externally powered limb prosthetics. Functional Electrical Stimulation systems-Restoration of hand function, restoration

of standing and walking, Hybrid Assistive Systems (HAS).

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Gain adequate knowledge about the needs of rehabilitations and its future development.

CO2. Have an in depth idea about Engineering Concepts in Sensory & Motor rehabilitation.

CO3. Apply the different types of Therapeutic Exercise Technique to benefit the society.

CO4. Design and apply different types Hearing aids, visual aids and their application in biomedical field and hence the benefit of the society. \

CO5. Gain in-depth knowledge about different types of models of Hand and arm replacement.

TEXTBOOKS:

1. Sunder 'Textbook of Rehabilitation', Jaypee Brothers Medical Publishers Pvt. Ltd, New Delhi, 2nd Edition, Reprint 2007
2. Joseph D.Bronzino, The Biomedical Engineering Handbook, Third edition-3 volume set, Taylor & Francis, 2006

REFERENCES:

1. Horia- Nocholai Teodorecu, L.C.Jain ,Intelligent systems and technologies in rehabilitation Engineering; CRC; December 2000.
2. Keswick. J., What is Rehabilitation Engineering, Annual Reviews of Rehabilitation-Springer- Verlag, New York, 1982.
3. Warren E. Finn,Peter G. LoPresti; Handbook of Neuroprosthetic Methods CRC; edition 2002.
4. Rory A Cooper (Editor), Hisaichi Ohnabe (Editor), Douglas A. Hobson (Editor), 'An Introduction to Rehabilitation Engineering (Series in Medical Physics and Biomedical Engineering' CRC Press, 2006.

ABMT3114	PHYSIOLOGICAL MODELING	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: Biocontrol Systems

COURSE OBJECTIVES:

The students should be made,

- To explain the application of Physiological models and vital organs.
- To Formulate the methods and techniques for analysis and synthesis of dynamic models
- To describe the dynamic models, simulate and visualize, dynamic responses of physiological models using software.
- To describe nonlinear models of physiological systems
- To compute the Simulation of physiological systems

UNIT 1 INTRODUCTION TO PHYSIOLOGICAL MODELING

Approaches to modeling: The technique of mathematical modeling, classification of models, characteristics of models. Time invariant and time varying systems for physiological modeling.Introduction to physiology (homeostasis, cell biology) Modeling physicalsystems, linearmodels of physiological systems,the Laplace transform, Transfer functions and block diagram analysis Physiology.

UNIT 2 MODELING OF DYNAMIC PHYSIOLOGICAL SYSTEM

Dynamic systems and their control, modeling and block diagrams, the pupil control systems(Human Eye), general structure of control systems, the dynamic response characteristics of the pupil control system, open &close loop systems instability, automatic aperture control.

UNIT 3 NONLINEAR MODELS OF PHYSIOLOGICAL SYSTEMS

Nonparametric Modeling-Volterra Models.Wiener Models. Efficient Volterra Kernel Estimation.Parametric Modeling- Basic Parametric Model Forms and Estimation Procedures-Volterra Kernels of Nonlinear Differential Equations. Discrete-Time Volterra Kernels of NARMAX Models.

UNIT 4 COMPARTMENTENTAL PHYSIOLOGICAL MODEL

Modeling the body as compartments, behaviour in simple compartmental system,

pharmacokinetic model, and multi compartmental system. Physiological modeling: Electrical analogy of blood vessels, model of systematic blood flow and model of coronary circulation.Mathematical modeling of the system: Thermo regulation, 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.

UNIT 5 SIMULATION OF PHYSIOLOGICALSYSTEMS

Simulation of physiologicalsystemsusing Open CV / MATLAB software. Biological receptors: - Introduction, receptor characteristics, transfer function models of receptors, receptor and perceived intensity. Neuromuscular model, Renal System, Drug Delivery Model.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Explain the application of Physiological models
CO2. Describe the methods and techniques for analysis and synthesis of Linear and dynamic system
CO3. Develop differential equations to describe the compartmental physiological model
CO4. Describe Nonlinear models of physiological systems
CO5. Illustrate the Simulation of physiological systems

TEXT BOOKS:

1. Michel C Khoo, —Physiological Control Systems -Analysis, simulation and estimation‖, Prentice Hall of India, 2001.
2. Marmarelis, —Nonlinear Dynamic Modeling of Physiological Systems‖, Wiley-IEEE Press,2004.

REFERENCES:

1. Benjamin C Kuo, —Automatic control systems‖, Tenth Edition, McGraw-Hill Education, 2017.
2. DavidTWestwick, Robert E. Kearney, Identification of Nonlinear PhysiologicalSystems, Wiley-IEEE Press, 2003.
3. V.Z. Marmarelis, —Advanced methods of physiological modeling‖ , *Springer*, 1989
4. L.Stark,‖ Neurological Control System, Plenum Press‖,1968.
5. John H Milsum , —Biological control systems‖, McGraw Hill 1966
6. MinruiFei, Shiwei Ma, Xin Li, Xin Sun, Li Jia and Zhou Su,—Advanced Computational Methods in Life System Modeling and Simulation‖, *Springer*,2017

ACST3110	COMPUTER NETWORKING	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: None.

COURSE OBJECTIVES:

The students should be made to,

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms

UNIT 1 FUNDAMENTALS & LINK LAYER

Building a network – Requirements - Layering and protocols - Internet Architecture – Network software – Performance ; Link layer Services - Framing - Error Detection - Flow control

UNIT 2 MEDIA ACCESS & INTERNETWORKING

Media access control - Ethernet (802.3) - Wireless LANs – 802.11 – Bluetooth - Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP,ICMP)

UNIT 3 ROUTING

Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)

UNIT 4 TRANSPORT LAYER

Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management - Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

UNIT 5 APPLICATION LAYER

Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Identify the components required to build different types of networks
CO2. Choose the required functionality at each layer for given application
CO3. Identify solution for each functionality at each layer
CO4. Trace the flow of information from one node to another node in the network
CO5. Demonstrate the concepts of application layer

TEXT BOOK:

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A systems approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.

REFERENCES:

1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.
2. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
4. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw – Hill, 2011.

ABMT3115	BIOSIGNAL PROCESSING	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: None.

COURSE OBJECTIVES:

The students should be made to,

- Understand characteristics of some of the most commonly used biomedical signals, including ECG, EEG, EOG, and EMG.
- Understand choice of filters to remove noise and artifacts from biomedical signals.
- Apply established engineering methods to analyse ECG signal problems.
- Apply established engineering methods to analyse neurological signals.
- Analyse various biomedical signals through advanced techniques

UNIT 1 INTRODUCTION TO BIOMEDICAL SIGNALS

Biosignal Characteristics of Electro Cardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG), Electroretinogram (ERG), Electrogastrogram (EGG), Electroneurogram (ENG), Event related potentials (ERPs), Phonocardiogram (PCG), Speech signal, Objectives of Biomedical signal analysis, Difficulties in Biomedical signal analysis, Computer-aided diagnosis.

UNIT 2 FILTERING FOR REMOVAL OF ARTIFACTS

Time-domain Filters - synchronized averaging, Moving Average Filters, Derivative-based

operators to remove low-frequency artifacts. Frequency-domain filters - Removal of High Frequency noise, Removal of low frequency noise, Removal of periodic artifacts, optimal filter-Wiener filter, Adaptive filters for removal of interference.

UNIT 3 CARDIOVASCULAR APPLICATIONS

Noise & Artifacts, ECG Signal Processing: Baseline Wandering, Power line interference, Muscle noise filtering – QRS detection, Adaptive noise canceling in ECG, improved adaptive filtering in FECG, Wavelet detection in ECG – structural features, matched filtering, adaptive wavelet detection, detection of overlapping wavelets. Computation of diagnostic signal parameters of ECG like Heart rate and QRS detection using Multivariate analysis (PCA and ICA). Segmentation of PCG, intensity patterns, Spectral modeling and analysis of PCG signals

UNIT 4 NEUROLOGICAL APPLICATIONS

EEG rhythms & waveforms, EEG applications- Epilepsy, sleep disorders, brain computer interface. Modeling EEG- linear, stochastic models - Nonlinear modeling of EEG - artifacts in EEG & their characteristics and processing – Nonparametric spectral analysis, Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis - correlation analysis of EEG channels - coherence analysis of EEG channels. Evoked potentials- noise characteristics, Noise reduction by linear filtering.

UNIT 5 ANALYSIS ON WAVESHAPE, SIGNAL CLASSIFICATION AND RECOGNITION

Modeling intramuscular EMG-Intramuscular signal decomposition-Fractal analysis of EMG signals. Statistical analysis of VAG signals. Analysis on amplitude and latency of MEG signals. Analysis of ERP effect. Signal classification and recognition – Statistical signal classification, linear discriminant function, direct feature selection and ordering, Back propagation neural network based classification. Analysis of EEG using Empirical mode decomposition (EMD).

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Draw different types of biomedical signals and identify their spectral components.
CO2. Use different filters on biomedical signals and judge filter performance.
CO3. Identify physiological interferences and artifacts affecting ECG signal.
CO4. Compute power and correlation spectra of EEG signal.
CO5. Propose an algorithm to classify biomedical signals.

TEXT BOOKS:

1. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, —Pathologic Basis of Diseases‖, 7th edition,WB Saunders Co. 2005 (Units I & II).
2. Ananthanarayanan & Panicker, —Microbiology‖ Orientblackswan, 2017 10th edition. (Units III,IV and V)

REFERENCES:

1. Underwood JCE: General and Systematic Pathology Churchill Livingstone, 3rd edition, 2000
2. Dubey RC and Maheswari DK. —A Text Book of Microbiology‖ Chand & Company Ltd, 2009

ABMT4127	HOSPITAL TRAINING AND EQUIPMENT MANAGEMENT	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: ABMT3110 Diagnostic and Therapeutic Equipment II.

COURSE OBJECTIVES:

The students should be made to,

- To develop an understanding of the various setups of hospital, health care codes and equipment management, so as to enable the student to work in the hospital environment.

UNIT 1 HEALTH SYSTEM

Health organisation of the country, the State, the Cities and the Region, Health Financing System, Health services, Functions of Hospitals, Types of Hospitals, Primary Health Care –An Introduction, Ambulatory care.

UNIT 2 HOSPITAL ORGANISATION AND MANAGEMENT

Management of Hospital Organisation, Nursing Sector, Medical Sector, Central Services, Technical Department, Definition and Practice of Management by Objective, Transactional Analysis Human Relation in Hospital, Importance of Team Work, Legal aspect in Hospital Management.

UNIT 3 REGULATORY REQUIREMENT AND HEALTH CARE CODES

FDA Regulation, Joint Commission of Accreditation for Hospitals, National Fire Protection Association Standard, IRPQ.

UNIT 4 TRAINED TECHNICAL PERSONNEL

Function of Clinical Engineer, Role to be performed in Hospital, Manpower requirement for different types of hospitals, Professional Registration, Structure in Hospital.

UNIT 5 EQUIPMENT MAINTENANCE MANAGEMENT

Organising Maintenance Operations, Paper Work Control, Maintenance Job Planning, Maintenance Work Measurement and Standards, Preventive Maintenance, Maintenance Budgeting and Forecasting, Maintenance Training, Contract Maintenance.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. To apprehend the organisation structure in hospitals, the duties of personnel & the health codes, the training required for technical work for equipment management.
CO2. Understand the Hospital Organization and Management.
CO3. Explain the regulatory requirement and health care codes.
CO4. Train the technical personnel.
CO5. Maintain the equipment and Manage it.

REFERENCES:

1. Cesar A.Caceres and Albert Zara,The Practice of Clinical Engineering, Academic Press, New York,1977.
2. Hans Pfeiff,Vera Dammann (Ed.),Hospital Engineering in Developing Countries, Z Report, Eschbom,1986
3. Jacob Kline, Handbook of Bio Medical Engineering, Academic Press Inc. San Deigo 1988
4. R.C.Goyal, Human Resource Management in Hospital, Prentice Hall of India, 3rd edition,2000.
5. Webster.J.G. and Albert M.Cook,Clinical Engineering Principles and Practices Prentice Hall Inc.,Englewood Cliffs, New Jersey, 1979.

ABMT3116	VIRTUAL INSTRUMENTATION	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: None

COURSE OBJECTIVES:

The students should be made to,

- To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues
- To understand virtual reality, augmented reality and using them to build Biomedical engineering applications

- To know the intricacies of these platform to develop PDA applications with better optimality

UNIT 1 INTRODUCTION

The three I's of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces-Output Devices: Graphics displays-sound displays & haptic feedback.

UNIT 2 VR DEVELOPMENT PROCESS

Geometric modeling - kinematics modeling- physical modeling - behaviour modeling - model Management.

UNIT 3 CONTENT CREATION CONSIDERATIONS FOR VR

Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality environment

UNIT 4 VR ON THE WEB & VR ON THE MOBILE

JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)-frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics

UNIT 5 APPLICATIONS

Medical applications-military applications-robotics applications- Advanced Real time Tracking-other applications- games, movies, simulations, therapy

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Analyse & Design a system or process to meet given specifications with realistic engineering constraints.
CO2. Identify problem statements and function as a member of an engineering design team.
CO3. Utilize technical resources
CO4. Propose technical documents and give technical oral presentations related to design mini project results.
CO5. Apply the concepts in Military and in robotics.

TEXT BOOKS:

1. C. Burdea & Philippe Coiffet, —irtual Reality Technology‖ Second Edition, Gregory, John Wiley & Sons, Inc.,2008
2. Jason Jerald. 2015. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA.

REFERENCES:

1. Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016. ISBN: 9780321883575
2. Practical Augmented Reality: A Guide to the Technologies, Applications, and Human

Factors for AR and VR (Usability),Steve Aukstakalnis, Addison-Wesley Professional; 1 edition, 2016.

3. The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything, Robert Scoble & Shel Israel, Patrick Brewster Press; 1 edition, 2016.
4. Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, Tony Parisi, O'Reilly Media; 1 edition, 2015.
5. Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages, Tony Parisi, O'Reilly Media; 1 edition, 2014.
6. Learning Three.js: The JavaScript 3D Library for WebGL - Second Edition, Jos Dirksen, Packt Publishing - ebooks Account; 2nd Revised ed. Edition 2015.

ABMT4128	TROUBLE SHOOTING OF MEDICAL	L	T	P	C	Total Marks

	INSTRUMENTS	3	0	0	3	100

PREREQUISITE: AECT2101 Electron Devices and Circuits.

COURSE OBJECTIVES:

The students should be made to,

- To provide adequate technical information on operating principles of medical instruments to attain mastery in fault detection and corrective measures
- To provide knowledge to students to enable them to troubleshoot the various equipments used in hospitals.

UNIT 1 FUNDAMENTAL TROUBLESHOOTING

Making of an Electronic Equipment, causes of Equipment Failure, Troubleshooting Process & Fault finding Aids, Troubleshooting Techniques, Grounding Systems in Electronic Equipment, Temperature Sensitive Intermittent Problems, and Correction Action to repair the Equipment.

UNIT 2 TESTING OF PASSIVE COMPONENTS&SEMICONDUCTOR DEVICES

Testing: resistors, capacitors & inductors, causes of failure for electronic components,testing procedure for semiconductor devices: special diodes, bipolar transistors, field effect transistor (FET), and thyristor.

UNIT 3 FAULT DIAGNOSIS IN ANALOG & DIGITALINTEGRATED CIRCUITS

Fault Diagnosis in Op-Amp Circuits, Digital Troubleshooting Methods, Digital IC Troubleshooters, Circuit board Troubleshooting.

UNIT 4 BIOMEDICAL EQUIPMENT TROUBLESHOOTING –I

Trouble shooting of ECG Machine, EEG Machine, Defibrillator Electrosurgical unit, Anaesthesia machine, Autoclaves & sterilizers, Endoscope.

UNIT 5 BIOMEDICAL EQUIPMENT TROUBLESHOOTING –II

Troubleshooting of Incubators, Nebulizer, Oxygen Concentrators, Oxygen cylinders & flow meters, Pulse Oximeter, Sphygmomanometers, Suction Machine, X-Ray Machine Troubleshooting.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Diagnose the cause of problem.
CO2. Test the passive components and semiconductor devices.
CO3. Diagnose fault in analog and in digital Integrated circuits.
CO4. Troubleshoot ECG, EEG and Defibrillator
CO5. Troubleshoot Incubators, Nebulizers and other equipment.

TEXT BOOK :

1. Khandpur R S, "Troubleshooting Electronic Equipment- Includes Repair &Maintenance", Tata McGraw-Hill, Second Edition 2009
2. Dan Tomal & Neal Widmer, "Electronic Troubleshooting", McGraw Hill, 3rd Edition 2004.

REFERENCES

1. Nicholas Cram & Selby Holder, "Basic Electronic Troubleshooting forBiomedical Technicians", TSTC Publishing, 2ndEdition 2010
2. World Health Organisation, "Maintenance & Repair of Laboratory, Diagnosticimaging & Hospital Equipment", Geneva,1994
3. Ian R McClelland , "X-ray Equipment maintenance & repairs workbook forRadiographers & Radiological Technologists", World Health Organisation,Geneva, 2004

4. Ministry of Health & Family Welfare, "Medical Equipment MaintenanceManual- A first line maintenance guide for end users", New Delhi, October2010
5. Joseph J Panichello, "X-Ray Repair : A Comprehensive Guide to theInstallation & Servicing of Radiographic Equipment", Charles C ThomasPublisher Ltd, 2nd Edition 2005

ABMT4129	MEDICAL IMAGING TECHNIQUES	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: AECT2101 Electron Devices and Circuits.

COURSE OBJECTIVES:

The students should be made,

- To understand need for Quality assurance and Quality assurance tests for radiography, methods of recording sectional images.
- To study the functioning of radioisotopic imaging equipments.
- To know about MRI, image acquisition and reconstruction and MRI safety.
- To understand the mathematical concept needed in image processing.
- To study 3D image display techniques and its clinical applications.

UNIT 1 ULTRASOUND IN MEDICINE

Production of ultrasound – properties and principles of image formation, capture and display – principles of A-mode, B-mode and M-mode display – Doppler ultra sound and colour flow mapping – applications of diagnostic ultra sound.

UNIT 2 X-RAY COMPUTED TOMOGRAPHY

Priniciples of sectional imaging – scanner configuration – data acquisition system – image
formation principles – conversion of x-ray data in to scan image – 2-D image reconstruction techniques –Iteration and Fourier method – types of CT scanners.

UNIT 3 MAGNETIC RESONANCE IMAGING

Priniciples of MRI pulse sequence – image acquisition and reconstruction techniques – MRI instrumentation magnetic gradient system RF coils – receiver system functional MRI – Application of MRI

UNIT 4 RADIO ISOTOPIC IMAGING INFRA RED IMAGING

Rectilinear scanners – linear scanners – SPECT – PET Gamma camera radio nuclides for imaging – emission computed CT. Physics of thermography – imaging systems – pyroelectric vidicon camera clinical thermography – liquid crystal thermography.

UNIT 5 MATHEMATICS OF IMAGE FORMATION AND IMAGE PROCESSING COMPUTER REQUIREMENT FOR IMAGING SYSTEM

Concept of object and image, general image processing problem, discrete fourier representation and models for imaging, image restoration, image sampling, perception of moving images. Single/ multi user system, transferring of images, processing speed, display of medical images, 3-D image display and its clinical applications.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Study about various medical image acquisition methods.
CO2. Gain sound knowledge about CT, Fluoroscopy and Image quality
CO3. Understand the concepts of Neuro Magnetic Imaging and MRI.
CO4. Analyze the principle and operation modes of Ultrasound Imaging.

TEXT BOOK:

1. Steve Webb, "The physics of medical imaging", Adam Hilger, Bristol, England, Philadelphia, USA, 1988.

REFERENCES:

1. A. C. Kak, "principles of computed tomography", IEEE press, Newyork
2. G. A. Hay, "Medical Image formation perception and measurement",
3. Divyendu Sinha & Edward R.Dougherty, "Introduction to Computer Based Imaging Systems", PHI, 2003.

Group – II: Nano Biosystems

ABMT3117	BIOMEDICAL NANOTECHNOLOGY	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: ABMT2103 Anatomy and Human Physiology

COURSE OBJECTIVES:

The student should be made

- To provide a broad view of the nascent field of nanoscience and nanotechnology to undergraduates
- To explore the basics of nanomaterial synthesis and characterization.
- To introduce the applications of nanotechnology

UNIT 1 INTRODUCTION TO NANOTECHNOLOGY

Basic Structure of Nanoparticles- Kinetics in Nanostructured Materials- Zero dimensional, size and shape of nanoparticles; one-dimensional and two dimensional nanostructures- clusters of metals and semiconductors, bionano-particles.

UNIT 2 FABRICATION AND CHARACTERIZATION OF NANOMATERIALS

Types of Nanomaterials (Quantum Dots, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs, Nanotubes); Gas, liquid, and solid –phase synthesis of nanomaterials; Lithography techniques (Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electrospinning.Bio-synthesis of nanomaterials.

UNIT 3 PROPERTIES AND MEASUREMENT OF NANOMATERIALS

Optical Properties: Absorption, Fluorescence, and Resonance; Methods for the measurement of nanomaterials; Microscopy measurements: SEM, TEM, AFM and STM. Confocal and TIRF imaging.

UNIT 4 NANO STRUCTURES

Carbon Nanotubes, Fullerenes, Nanowires, Quantum Dots. Applications of nanostructures. Reinforcement in Ceramics, Drug delivery, Giant magnetoresistance, etc. Cells response to Nanostructures.

UNIT 5 APPLICATIONS OF NANOTECHNOLOGY

Nano electronics, Nanosensors, Nanotechnology in Diagnostics applications, Environmental and Agricultural Applications of nanotechnology, Nano technology for energy systems

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Use the knowledge of one's own role and those of other professions to address the healthcare needs of populations and patients served.
CO2. Get knowledge of the general principles of physics, chemistry, electronics and biology that play a role on the nanometer scale
CO3. Understand the materials and their properties at the atomic and nanometer level, including an understanding of the intimate relationship between material scale (nanostructure) and the properties/functionality of materials
CO4. Understand the essential concepts used in nanotechnology, synthesis and fabrication

CO5. Demonstrate the socioeconomic impact of nanotechnology and ethical issues associated with it.

TEXT BOOKS:

1. Springer Handbook of Nanotechnology by Bharat Bhushan 2004.(Unit I – V)
2. Encyclopedia of Nanotechnology - Hari Singh Nalwa 2004. (Unit I – V)

REFERENCES:

1. Nanomaterials, Nanotechnologies and Design: an Introduction to Engineers and Architects, D. Michael Ashby, Paulo Ferreira, Daniel L. Schodek, Butterworth-Heinemann, 2009
2. Handbook of Nanophase and Nanostructured Materials (in four volumes), Eds: Z.L. Wang, Y. Liu, Z. Zhang, Kluwer Academic/Plenum Publishers, 2003
3. Handbook of Nanoceramics and their Based Nanodevices (Vol. 2) Edited by Tseung-Yuen Tseng and Hari Singh Nalwa, American Scientific Publishers
4. Handbook of Nanophase and Nanostructured Materials (in four volumes), Eds: Z.L. Wang, Y. Liu, Z. Zhang, Kluwer Academic/Plenum Publishers, 2003.

ABMT3118	NEURAL ENGINEERING	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: ABMT2103 Anatomy and Human Physiology

COURSE OBJECTIVES:

The student should be made

- To discuss the physiological concepts of nerve impulse generation and Electromyography.
- To discuss about EEG and its various applications
- To Explore Evoked potentials and its importance in medicine
- To introduce various techniques to study central and peripheral nerve function
- To discuss the electrophysiological evaluation in special situations.

UNIT 1 NERVE EXCITABILITY AND ELECTROMYOGRAPHY

Nerve Excitability: Functional insights derived from axonal structures, Nerve excitability findings in Neurologic diseases: Chemotherapy induced neurotoxicity, Porphyric Neuropathy, Inflammatory Neuropathy and its Treatment, Spinal Cord Injury; Nerve conduction studies, Microneurography and its potential clinical applications.Clinical Electromyography (EMG), Quantitative EMG,Neuromuscular Ultrasound as a compliment to the electrodiagnostic evaluation, Electrophysiologic study of Disorders of Neuromuscular Junction:, H-Reflex and F-Reflex, Blink reflex and other cranial nerve reflexes, Electrophysiological evaluation of movement disorders, Evaluation of autonomic nervous system.

UNIT 2 ELECTROENCEPHALOGRAPHY

Electroencephalography (EEG): General Principles and Clinical Applications, Neonatal and Paediatric EEG, EEG Artefacts and Benign Variants, Video EEG monitoring for epilepsy, Invasive Clinical Neurophysiology in Epilepsy and movement disorders, Topographic mapping, Frequency analysis and other quantitative techniques in EEG, Intraoperative EEG monitoring during carotid endarterectomy and cardiac surgery, Magnetoencephalography.

UNIT 3 EVOKED POTENTIALS

Evoked Potentials and Related Techniques: Visual Evoked potentials (VEPs), Electroretinography and other diagnostic approaches to the Visual System, VEPs in infants and children, Brainstem Auditory Evoked Potentials (AEPs), Brainstem AEPs in infants and children, Somatosensory evoked potentials, Diagnostic and therapeutic role of Magnetic stimulation in neurology.

UNIT 4 FUNCTIONAL NEUROIMAGING AND COGNITION

Historical and physiological perspective, Functional neuroimaging methods: PET and fMRI,

Network analyses, Functional neuroimaging of: Attention, Visual recognition, Semantic memory, Language, Episodic memory, Working memory, Cognitive aging, Neuro-psychologically impaired patients

UNIT 5 ELECTROPHYSIOLOGICAL EVALUATION IN SPECIAL SITUATION

Electrophysiological evaluation of sacral function: Bladder, bowel and sexual function, Vestibular laboratory testing, Polysomnographic evaluation of sleep disorders, Electrophysiologic evaluation of: brain death, patients in the intensive care unit, patients with suspected neurotoxic disorders.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Understand the physiology behind generation of nerve impulses.
CO2. Describe various techniques that are used to evaluate the functioning of central and peripheral nervous system.
CO3. Differentiate between a normal and abnormal signal coming from a healthy and a diseased nervous system respectively.
CO4. Explain the neuro imaging and cognition.
CO5. Discuss electrophysiological evaluation in special situation.

TEXT BOOKS:

1. Michael J. Aminoff, et. al., —minoff's electrodiagnosis in Clinical Neurology‖ Sixth Edition, Elsevier Saunders, 2012.
2. Kim E. Baretteet. al., —anong's review of Medical Physiology‖ 23rd Edition, McGraw Hill Medical, 2010.

REFERENCES:

1. Eric R. Kandelet. al., —rinciples of Neural Science‖,McGraw-Hill, New York, 2012.
2. R. Cooper, et. al, —echniques in Clinical Neurophysiology: A Practical Manual , Elsevier, Amsterdam, The Netherlands, 2005.
3. Holodny, Andrei I., et al, —unctional neuroimaging: a clinical approach‖ Informa Health Care, 2008.

ABMT3119	WEARABALE SYSTEMS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: None.

COURSE OBJECTIVES:

The student should be made

- Study about sensors and its application in wearable systems
- Learn about applications of wearable systems

UNIT 1 SENSORS

Need for wearable systems, Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, pneumography, Wearable ground reaction force sensor, GSR, Radiant thermal sensor, Wearable motion sensors, CMOS – Based Biosensors, E-Textiles, Bio compatibility

UNIT 2 SIGNAL PROCESSING

Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, Constraint on sampling frequency for reduced energy consumption, light weight signal processing, Rejection of irrelevant information, Data mining

UNIT 3 ENERGY HARVESTING FOR WEARABLE DEVICES

Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.

UNIT 4 WIRELESS HEALTH SYSTEMS

Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication techniques.

UNIT 5 APPLICATIONS OF WEARABLE SYSTEMS

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, Multi parameter monitoring, Neural recording, Gait analysis, Sports Medicine, Smart Fabrics

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Explain need of wireless health systems and the application of wearable systems.
CO2. Process the signal.
CO3. Discuss the energy harvesting for wearable devices.
CO4. Explain the wireless health systems.
CO5. Apply the concepts of wearable system.

TEXT BOOKS:

1. Annalisa Bonfiglio,Danilo De Rossi ,"Wearable Monitoring Systems", Springer, 2011.
2. Sandeep K.S. Gupta,Tridib Mukherjee,Krishna Kumar Venkatasubramanian, "Body Area Networks Safety,Security, and Sustainability," Cambridge University Press, 2013.

REFERENCES:

1. Hang,Yuan-Ting,"wearable medical sensors and systems",Springer-2013
2. Mehmet R. Yuce,Jamil Y.Khan, "Wireless Body Area Networks Technology, Implementation and Applications",Pan Stanford Publishing Pvt.Ltd, Singapore, 201
3. Guang-Zhong Yang(Ed.), "Body Sensor Networks, "Springer, 2006
4. Andreas Lymberis, Danilo de Rossi ,'Wearable eHealth systems for Personalised Health Management - State of the art and future challenges ' IOS press, The Netherlands, 2004

ABMT3120	BODY AREA NETWORKS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: None.

OBJECTIVES:

The student should be made to:

- Learn about body area networks' and different hardwares related to it
- Provide knowledge in the applications of Body Area Networks.

UNIT 1 INTRODUCTION

Definition, BAN and Healthcare, Technical Challenges- Sensor design, biocompatibility, Energy Supply, optimal node placement, number of nodes, System security and reliability, BSN Architecture– Introduction

UNIT 2 HARDWARE FOR BAN

Processor-Low Power MCUs, Mobile Computing MCUs ,Integrated processor with radio transceiver, Memory ,Antenna-PCB antenna, Wire antenna, Ceramic antenna, External antenna, Sensor Interface, Power sources- Batteries and fuel cells for sensor nodes.

UNIT 3 WIRELESS COMMUNICATION AND NETWORK

RF communication in Body, Antenna design and testing, Propagation, Base Station-Network topology-Stand –Alone BAN, Wireless personal Area Network Technologies-IEEE 802.15.1,IEEE P802.15.13, IEEE 802.15.14, Zigbee

UNIT 4 COEXISTENCE ISSUES WITH BAN

Interferences – Intrinsic - Extrinsic, Effect on transmission, Counter measures- on physical layer and data link layer, Regulatory issues-Medical Device regulation in USA and Asia,

Security and Self protection-Bacterial attacks, Virus infection ,Secured protocols, Self protection.

UNIT 5 APPLICATIONS OF BAN

Monitoring patients with chronic disease, Hospital patients, Elderly patients, Cardiac arrhymias monitoring, Multi patient monitoring systems, Multichannel Neural recording, Gait analysis, Sports Medicine, Electronic pill

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Explain about working of Body Area Network

CO2 - Discuss the applications of BAN.

TEXT BOOKS:

1. Annalisa Bonfiglio, Danilo De Rossi ,"Wearable Monitoring Systems", Springer, 2011.(Unit I, II, III & V).
2. Sandeep K.S. Gupta,Tridib Mukherjee,Krishna Kumar Venkatasubramanian, "Body Area Networks Safety, Security, and Sustainability," Cambridge University Press, 2013. (Unit IV).

REFERENCES:

1. Zhang, Yuan-Ting, "Wearable Medical Sensors and Systems",Springer, 2013.
2. Guang-Zhong Yang(Ed.), "Body Sensor Networks, "Springer, 2006.
3. Mehmet R. Yuce,Jamil Y.Khan, "Wireless Body Area Networks Technology, Implementation , and applications",Pan Stanford Publishing Pte.Ltd,Singapore, 2012

ABMT3121	BioMEMS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: None.

OBJECTIVES:

The student should be made to:

- Learn various MEMS fabrication techniques.
- Understand different types of sensors and actuators and their principles of operation at the micro scale level.
- Know the application of MEMS in different field of medicine.

UNIT 1 MEMS MATERIALS AND FABRICATION

Typical MEMs and Microsystems, materials for MEMS - active substrate materials-Silicon and its compounds, Silicon piezoresistors, Gallium Arsenide, quartz, polymers. Micromachiningphotolithography, thin film deposition, doping, etching, bulk machining, wafer bonding, LIGA

UNIT 2 MECHANICAL AND THERMAL SENSORS AND ACTUATORS

Mechanics for MEMs design- static bending of thin plates, mechanical vibration, thermomechanics, fracture and thin film mechanics. Mechanical sensors and actuators –

beam and cantilever – microplates, strain, pressure and flow measurements, Thermal sensors and actuators- actuator based on thermal expansion, thermal couples, thermal resistor, Shape memory alloys- Inertia sensor, flow sensor

UNIT 3 ELECTROSTATIC AND PIEZOELECTRIC SENSORS AND ACTUATORS

Parallel plate capacitor, pull in effect, Electrostatic sensors and actuators- Inertia sensor, Pressure sensor, flow sensor, tactile sensor, comb drive. Properties of piezoelectric materials, Piezoelectric sensor and actuator – inchworm motor, inertia sensor, flow sensor.

UNIT 4 MICROFLUIDIC SYSTEMS

Fluid dynamics, continuity equation, momentum equation, equation of motion, laminar flow in circular conduits, fluid flow in microconduits, in submicrometer and nanoscale. Microscale fluid, expression for liquid flow in a channel, fluid actuation methods, dielectrophoresis, microfluid dispenser, microneedle, micropumps-continuous flow system, micromixers

UNIT 5 APPLICATIONS OF BIOMEMS

CAD for MEMs, Drug delivery, micro total analysis systems (MicroTAS) detection and measurement methods, microsystem approaches to polymerase chain reaction (PCR),DNA sensor, MEMS based drug delivery

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Discuss various MEMS fabrication techniques.

CO2 - Explain different types of sensors and actuators and their principles of operation at the micro Scale level.

CO3 - Apply MEMS in different field of medicine.

TEXT BOOKS:

1. Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata McGraw Hill PublishingCompany, New Delhi, 2002. (Unit I, II, III & IV).

2. Wanjun Wang, Stephen A.Soper, "BioMEMs: Technologies and Applications", CRC Press, NewYork, 2007.(Unit V)

REFERENCES:

1. Marc J. Madou "Fundamentals of Microfabrication: the Science of Miniaturization", CRC Press,2002.

2. Nadim Maluf, Kirt Williams. "An introduction to Microelectro Mechancial Systems Engineering",Second Edition, Artech House Inc, MA, 2004.

3. Chang Liu,' Foundations of MEMS', Pearson Education International, New Jersey, USA,2006

4. Nitaigour Premchand Mahalik, "MEMS", Tata McGraw Hill Publishing Company, New Delhi,2007

ABMT3122	MEDICAL PHYSICS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: None

OBJECTIVES:

The student should be made

- To Study effects of sound and light in human body
- To study effects of radiation in matter and how isotopes are produced

UNIT 1 NON IONIZING RADIATION AND ITS MEDICAL APPLICATION

Non-ionizing Electromagnetic Radiation: Overview of non-ionizing radiation effects-Low Frequency Effects- Higher frequency effects. Physics of light, Measurement of light and its unit-limits of vision and color vision an overview, Thermography– Application

UNIT 2 SOUND IN MEDICINE

Physics of sound, Normal sound levels –ultrasound fundamentals – Generation of ultrasound (Ultrasound Transducer) - Interaction of Ultrasound with matter; Cavitations, Reflection, Transmission- Scanning systems – Artefacts- Ultrasound- Doppler-Double Doppler shift-Clinical Applications

UNIT 3 PRINCIPLES OF RADIOACTIVE NUCLIDES

Radioactive Decay – Spontaneous Emission – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology ,Decay series, Production of radionuclides – Cyclotron produced Radionuclide- Reactor produced Radio- nuclide-fission and electron Capture reaction, radionuclide Generator-Technetium generator.

UNIT 4 INTERACTION OF RADIATION WITH MATTER

Interaction of charged particles with matter –Specific ionization, Linear energy transfer range, Bremsstrahlung, Annihilation,Interaction of X and Gamma radiation with matter- Photoelectric effect, Compton Scattering , Pair production, Attenuation of Gamma Radiation ,Interaction of neutron with matter and their clinical significance.

UNIT 5 BASIC RADIATION QUANTITIES

Introduction -exposure- Inverse square law-KERMA-Kerma and absorbed dose –stopping power - relationship between the dosimetric quantities - Bremsstrahlung radiation, Bragg's curve-concept of LD 50- Stochastic and Non-stochastic effects, Different radiation Unit, Roentgen, gray, Sievert.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Analyze mechanics involved with various physiological systems.
CO2. Perform derivation of mathematical models related to blood vessels
CO3. xplain the principles of radioactive nuclides.
CO4. Apply the knowledge on interaction of radiation with matter
CO5. Acquire basic knowledge on basic radiation quantities.

TEXT BOOKS:

1. John R Cameran , James G Skofronick "Medical Physics" John-Wiley & Sons. 1978.
2. W.J.Meredith and J.B. Massey " Fundamental Physics of Radiology" Varghese Publishing house. 1992

REFERENCES:

1. P.Uma Devi, A.Nagarathnam , B S SatishRao , "Intorduction to Radiation Biology" B.I Chur Chill Livingstone pvt Ltd, 2000
2. S.Webb " The Physics of Medical Imaging", Taylor and Francis, 1988
3. J.P.Woodcock, Ultrasonic,Medical Physics Handbook series 1, Adam Hilger, Bristol, 2002
4. HyltonB.Meire and Pat Farrant "Basic Ultrasound" John Wiley & Sons, 1995

ABMT3123	MEDICAL OPTICS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: APHT1101 Physics

OBJECTIVES:

The students should be made to,

- The optical properties of the tissues and the applications of laser in diagnosis and therapy.

UNIT 1 OPTICAL PROPERTIES OF THE TISSUES

Fundamental Properties of light - Refraction, Reflection, Laws (Snell's law and Fresnel law) Scattering, Absorption, Light transport inside the tissue, Tissue properties, Laser Characteristics as applied to medicine and biology, Laser tissue Interactions – Photo chemical, Photo thermal and Photo mechanical interactions, Fluorescence, Speckles, Photo ablative processes.

UNIT 2 INSTRUMENTATION IN PHOTONICS

Instrumentation for absorption, Scattering and emission measurements, Excitation light sources – high pressure arc lamps, LEDs, Lasers, Optical filters – Prism and Monochromators, Polarizers, Optical detectors – Single Channel and Multichannel detectors, Time resolved and phase resolved detection methods, Optical fibers – Total Internal Reflection.

UNIT 3 SURGICAL THERAPEUTIC APPLICATIONS OF LASERS

Lasers in ophthalmology, Dermatology, Dentistry, Urology, Otolaryngology, Tissue welding and Soldering.

UNIT 4 NON THERMAL DIAGNOSTIC APPLICATIONS

Optical coherence tomography, Elastography, Laser Induced Fluorescence (LIF)-Imaging, FLIM Raman Spectroscopy and Imaging, FLIM – Holographic and Speckle applications of lasers in biology and medicine.

UNIT 5 DIAGNOSTIC AND THERAPEUTIC TECHNIQUES

Near field imaging of biological structures, *In vitro* clinical diagnostics, Phototherapy, Photodynamic therapy (PDT) - Principles and mechanisms - Oncological and non-oncological applications of PDT - Biostimulation effect – applications - Laser Safety Procedures.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Demonstrate knowledge of the fundamentals of optical properties of tissues
CO2 - Analyze the components of instrumentation in Medical Photonics and Configurations
CO3 - Describe surgical applications of lasers.
CO4 - Describe photonics and its diagnostic applications.
CO5 - Investigate emerging techniques in medical optics

TEXT BOOKS:

1. Tuan Vo Dirh, —iomedical Photonics – Handbook‖ CRC Press, Bocaraton, 2014.
2. Paras N. Prasad, —ntroduction to Biophotonics‖ A. John Wiley and Sons, Inc. Publications, 2003

REFERENCES:

1. Markolf H.Niemz, —aser-Tissue Interaction Fundamentals and Applications‖ Springer, 2007
2. G.David Baxter —herapeutic Lasers – Theory and practice‖ Churchill Livingstone publications Edition- 2001.
3. Leon Goldman, M.D., & R.James Rockwell, Jr., Lasers in Medicine‖ Gordon and Breach, Science Publishers Inc., 1975.

ACST3136	SOFT COMPUTING TECHNIQUES	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: None

OBJECTIVES:

The students should be made to,

- Soft computing refers to principle components like fuzzy logic, neural networks and genetic algorithm, which have their roots in Artificial Intelligence.
- Healthy integration of all these techniques has resulted in extending the capabilities of the technologies to more effective and efficient problem solving methodologies

UNIT 1 NEURAL NETWORKS-1(INTRODUCTION & ARCHITECTURE)

Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.

UNIT 2 NEURAL NETWORKS-II (BACK PROPAGATION NETWORKS)

Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications.

UNIT 3 FUZZY LOGIC-I (INTRODUCTION)

Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

UNIT 4 FUZZY LOGIC –II (FUZZY MEMBERSHIP, RULES)

Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.

UNIT 5 GENETIC ALGORITHM(GA)

Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Identify and describe soft computing techniques and their roles in building intelligent machines
CO2. Recognize the feasibility of applying a soft computing methodology for a particular problem
CO3. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems
CO4. Apply genetic algorithms to combinatorial optimization problems
CO5. Apply neural networks to pattern classification and regression problems
CO6. Effectively use existing software tools to solve real problems using a soft computing approach
CO7. Evaluate and compare solutions by various soft computing approaches for a given problem

TEXT BOOKS:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India.
2. 2. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press.

REFERENCES:

1. Siman Haykin,"Neural Netowrks"Prentice Hall of India
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.

3. Kumar Satish, "Neural Networks" Tata Mc Graw Hill

ABMT4131	ARTIFICIAL ORGANS AND IMPLANTS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: None

OBJECTIVES:

The students should be made to,

- To have an overview of artificial organs & transplants
- To describe the principles of implant design with a case study
- To explain the implant design parameters and solution in use
- To study about various blood interfacing implants
- To study about soft tissue replacement and hard tissue replacement

UNIT I ARTIFICIAL ORGANS & TRANSPLANTS

ARTIFICIAL ORGANS:-

Introduction, outlook for organ replacements, design consideration, evaluation process.

TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, individual organs – kidney, liver, heart and lung, bone marrow, cornea.

UNIT II PRINCIPLES OF IMPLANT DESIGN

Principles of implant design, Clinical problems requiring implants for solution, Permanent versus absorbable devices, the missing organ and its replacement, Tissue engineering, scaffolds, cells and regulators criteria for materials selection, Case study of organ regeneration.

UNIT III IMPLANT DESIGN PARAMETERS AND ITS SOLUTION

Biocompatibility, local and systemic effects of implants, Design specifications for tissue bonding and modulus matching, Degradation of devices, natural and synthetic polymers, corrosion, wear and tear, Implants for Bone, Devices for nerve regeneration.

UNIT IV BLOOD INTERFACING IMPLANTS

Neural and neuromuscular implants, heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, artificial kidney- dialysis membrane and artificial blood.

UNIT V IMPLANTABLE MEDICAL DEVICES AND ORGANS

Gastrointestinal system, Dentistry, Maxillofacial and craniofacial replacement, Soft tissue repair, replacement and augmentation, recent advancement and future directions.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Gain adequate knowledge about artificial organs & transplants
CO2. Get clear idea about implant design and its parameters and solution
CO3. Have in-depth knowledge about blood interfacing implants
CO4. Explain different types of soft tissue replacement and hard tissue replacement

TEXT BOOKS:

1. Kopff W.J, Artificial Organs, John Wiley and sons, New York, 1st edition, 1976.
2. Park J.B., —Biomaterials Science and Engineering‖, Plenum Press, 1984.

REFERENCES:

1. J D Bronzino, Biomedical Engineering handbook Volume II, (CRC Press / IEEE Press), 2000.
2. R S Khandpur, Handbook of Biomedical Instrumentation,Tata McGraw Hill, 2003

3. Joon B Park, Biomaterials – An Introduction, Plenum press, New York, 1992.
4. Yannas, I. V, —Tissue and Organ Regeneration in Adults‖, New York, NY: Springer, 2001. ISBN:9780387952147.
5. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph.D, Bronzino, —Clinical Engineering‖, CRC Press, 1st edition,2010. 6. Standard Handbook of Biomedical Engineering & Design – Myer Kutz, McGraw- Hill, 2003

ABMT4132	BRAIN COMPUTER INTERFACE AND ITS APPLICATIONS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: ABMT4114 Neural Networks and Fuzzy Logic.

COURSE OBJECTIVES:

The student should be made

- Understand the basic concepts of brain computer interface
- Study the various signal acquisition methods
- Learn about the signal processing methods used in BCI
- Understand the various machine learning methods of BCI.
- Learn the various applications of BCI

UNIT 1 INTRODUCTION TO BCI

Introduction - Brain structure and function, Brain Computer Interface Types - Synchronous and Asynchronous -Invasive BCI -Partially Invasive BCI - Non Invasive BCI, Structure of BCI System, BCI Monitoring Hardware, EEG, ECoG, MEG, fMRI.

UNIT 2 BRAIN ACTIVATION

Brain activation patterns - Spikes, Oscillatory potential and ERD, Slow cortical potentials, Movement related potentials-Mu rhythms, motor imagery, Stimulus related potentials - Visual Evoked Potentials – P300 and Auditory Evoked Potentials, Potentials related to cognitive tasks.

UNIT 3 FEATURE EXTRACTION METHODS

Data Processing – Spike sorting, Frequency domain analysis, Wavelet analysis, Time domain analysis, Spatial filtering -Principal Component Analysis (PCA), Independent Component Analysis (ICA), Artefacts reduction, Feature Extraction - Phase synchronization and coherence

UNIT 4 MACHINE LEARNING METHODS FOR BCI

Classification techniques –Binary classification, Ensemble classification, Multiclass Classification, Evaluation of classification performance, Regression - Linear, Polynomial, RBF‘s, Perceptron‘s, Multilayer neural networks, Support vector machine, Graph theoretical functional connectivity analysis

UNIT 5 APPLICATIONS OF BCI

Case Studies - Invasive BCIs: decoding and tracking arm (hand) position, controlling prosthetic devices such as orthotic hands, Cursor and robotic control using multi electrode array implant, Cortical control of muscles via functional electrical stimulation. Noninvasive BCIs:P300 Mind Speller, Visual cognitive BCI, Emotion detection. Ethics of Brain Computer Interfacing.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Comprehend and appreciate the significance and role of this course in the present contemporary world.

CO2 - Evaluate concept of BCI.

CO3 - Assign functions appropriately to the human and to the machine.

CO4 - Select appropriate feature extraction methods

CO5 - Use machine learning algorithms for translation.

TEXT BOOKS:

1. Rajesh.P.N.Rao, —Brain-Computer Interfacing: An Introduction‖, Cambridge University Press, First edition, 2013.
2. Jonathan Wolpaw, Elizabeth Winter Wolpaw, —Brain Computer Interfaces: Principles and practice‖, Oxford University Press, USA, Edition 1, January 2012

REFERENCES:

1. Ella Hassianien, A &Azar.A.T (Editors), —Brain-Computer Interfaces Current Trends and Applications‖ Springer, 2015.
2. Bernhard Graimann, Brendan Allison, GertPfurtscheller, "Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer, 2010
3. Ali Bashashati, MehrdadFatourechi, Rabab K Ward, Gary E Birch,‖A survey of signal Processing algorithms in brain–computer interfaces based on electrical brain signals‖Journal of Neural Engineering, Vol.4, 2007, PP.32-57
4. Arnon Kohen, —Biomedical Signal Processing‖ Vol I and II, CRC Press Inc, Boca Rato, Florida.
5. Bishop C.M., —Neural networks for Pattern Recognition‖ Oxford, Clarendon Press, 1995.
6. Andrew Webb, —Statistical Pattern Recognition‖ Wiley International, Second Edition, 2002.

ABMT4133	NANO TECHNOLOGY AND APPLICATIONS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: ACYT1101 Chemistry, APHT1101 Physics.

COURSE OBJECTIVES:

The students should be made to,

- To know basic nanotechnological principles and characterization methods
- To understand the essential features of biology and nanotechnology that are converging to create the new areas of bionanotechnology and nanomedicine

UNIT 1 INTRODUCTION OF NANOPARTICLES

Overview of nanotechnology from medical perceptive, different types of nanobiomaterials and nanostructure interactions. Synthesis, characterization, and properties smart nanomaterials, Surface modification, biofunctionalization of nanomaterials.Nanocarriers (e.g. liposomes, polymer capsules, polymer nanoparticles, porous materials, nanogels, dendrimers, microemulsions, inorganic nanoparticles, carbon nanotubes, lipoproteins, solid lipid nanoparticles).

UNIT 2 PROTEIN AS NANOSTRUCTURES

Protein based nanostructures building blocks and templates – Proteins as transducers and amplifiers – nanobioelectronic devices and polymer nanocontainers – microbial production of inorganic nanoparticles – magnetosomes.

UNIT 3 DNA AS NANOSTRUCTURES

DNA based nanostructures – Topographic and Electrostatic properties of DNA – Hybrid conjugates of gold nanoparticles – DNA oligomers – use of DNA molecules in nanomechanics

UNIT 4 NANOPARTICLES IN DIAGNOSIS

Introduction to nanoparticles in diagnostics— nuclear imaging, optical imaging, PET, Micro PET, cardio vascular disease studies, imaging and therapy of thrombosis, emerging Ethical issues and toxicology of nanomaterials.

UNIT 5 NANOTHERAPEUTICS

Nanoparticles as carriers in drug delivery- design, manufacture and physiochemical properties, transport across biological barriers, nanotechnology in Cancer therapy, lung infectious disease, bone treatment, nano particles for oral vaccination and skin disease.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Follow the newest findings in the area of nanomedicine and implement the perspectives in own research.
CO2 - Explain nanoparticles in diagnosis
CO3 - Discuss nanotherapeutics

REFERENCES

1. CM, Niemeyer,C.A. Mirkin., Nanobiotechnology – Concepts, Applications and Perspectives – 2004. Edited by Wiley – VCH.
2. Harry F. Tibbals, Medical Nanotechnology and Nanomedicine, CRC Press, 2010.
3. Nicholas A. Kotov., Nanoparticle Assemblies and Superstructures, CRC, 2006.
4. T. Pradeep.,Nano: The Essentials: McGraw – Hill education – 2007.
5. VinodLabhasetwar, Diandra L. Leslie-Pelecky, Biomedical Applications of Nanotechnology, John Wiley & Sons, 2007.

Group – III: Bioinformatics

ABMT3124	TELEHEALTH TECHNOLOGY	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: AECT3113 Analog and Digital Communication

COURSE OBJECTIVES:

The students should be made to,

- Learn the key principles for telemedicine and health
- Understand telemedical technology.
- Know telemedical standards, mobile telemedicine and it applications.

UNIT 1 FUNDAMENTALS OF TELEMEDICINE

History of telemedicine, definition of telemedicine, tele-health, tele-care, scope, Telemedicine Systems, benefits & limitations of telemedicine.

UNIT 2 TYPE OF INFORMATION & COMMUNICATION INFRASTRUCTURE FOR TELEMEDICINE

Audio, video, still images, text and data, fax-type of communications and network: PSTN, POTS, ANT, ISDN, internet, air/ wireless communications, GSM satellite, micro wave, Mobile health and ubiquitous healthcare.

UNIT 3 ETHICAL AND LEGAL ASPECTS OF TELEMEDICINE

Confidentiality, patient rights and consent: confidentiality and the law, the patient-doctor relationship, access to medical records, consent treatment - data protection & security, jurisdictional issues, intellectual property rights.

UNIT 4 PICTURE ARCHIVING AND COMMUNICATION SYSTEM

Introduction to radiology information system and ACS, DICOM, PACS strategic plan and needs assessment, technical Issues, PACS architecture.

UNIT 5 APPLICATIONS OF TELEMEDICINE

Teleradiology, telepathology, telecardiology, teleoncology, teledermatology, telesurgery, e

Health and Cyber Medicine.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Apply multimedia technologies in telemedicine

CO2 - Explain protocols behind encryption techniques for secure transmission of data

CO3 - Apply telehealth in healthcare.

TEXTBOOKS:

1. Norris A C, essentials of Telemedicine and Telecare‖ John Wiley, New York, 2002.
2. H K Huang, ACS and Imaging Informatics: Basic Principles and Applications‖Wiley, New Jersey, 2010.

REFERENCES

1. Olga Ferrer Roca, Marcelo Sosa Iudicissa, handbook of Telemedicine‖ IOS Press, Netherland, 2002.
2. Khandpur R S, handbook of Biomedical Instrumentation‖ Tata McGraw Hill, New Delhi, 2003.
3. Keith J Dreyer, Amit Mehta, James H Thrall, acs: A Guide to the Digital Revolution‖ Springer, New York, 2002.
4. Khandpur R S, TELEMEDICINE – Technology and Applications‖ PHI Learning Pvt Ltd., New Delhi, 2017.

ABMT3125	BIOSTATISTICS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: ACYT1101 Chemistry, APHT1101 Physics.

COURSE OBJECTIVES:

The students should be made to,

- To understand the advance statistical science and its application to problems of human health and disease, with the ultimate goal of advancing the public's health.

UNIT 1 INTRODUCTION

Introduction, Some basic concepts, Measurement and Measurement Scales, Simple randomsample, Computers and biostatistical analysis, Introduction to probability, likelihood & odds, distribution variability**.**

UNIT 2 STATISTICAL PARAMETERS

Statistical parameters p-values, computation, level chi square test and distribution and hypothesis testing-single population proportion, difference between two population proportions, single population variance, ratio of two population variances and tests of goodness of fit, tests of independence, tests of homogeneity.

UNIT 3 REGRESSION AND CORRELATION ANALYSIS

Introduction, regression model, sample regression equation, evaluating the regression equation, using the regression equation, correlation model, correlation coefficient.

UNIT 4 INTERPRETING DATA

Interpreting life tables clinical trails, epidemical reading andinterpreting of epidemical studies,

application in community health.

UNIT 5 META ANALYSIS AND ANALYSIS OF VARIANCE

META analysis for research activities, purpose and reading of META analysis, kind of data used for META analysis,completely randomized design, randomized complete block design, repeated measures design, factorial experiment.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Apply statistical science to problems of human health and disease.

CO2 - Advance the public's health.

TEXTBOOKS:

1. Norris A C, essentials of Telemedicine and Telecare‖ John Wiley, New York, 2002.
2. H K Huang, ACS and Imaging Informatics: Basic Principles and Applications‖Wiley, New Jersey, 2010.

REFERENCES

1. Wayne W. Daniel, "Biostatistics-A Foundation for Analysis in the Health Sciences" John Wiley & Sons Publication, 6th Edition.
2. Marcello Pagano and Kimberlee Gauvreu"Principles of Biostatistics", , Thomson Learning Publication, 2006.
3 Ronald N Forthofer and Eun Sul Lee"Introduction to Biostatistics", Academic Press

		L	T	P	C	Total
ABMT3126	**BIOMETRIC SYSTEMS**					**Marks**
		3	**0**	**0**	**3**	**100**

PREREQUISITE: AECT3113 Analog and Digital Communication.

COURSE OBJECTIVES:

The students should be made to,

- To understand the technologies of fingerprint, iris, face and speech recognition
- To understand the general principles of design of biometric systems and the underlyingtrade-offs.
- To recognize personal privacy and security implications of biometrics based identificationtechnology.
- To identify issues in the realistic evaluation of biometrics based systems.

UNIT 1 INTRODUCTION TO BIOMETRICS

Introduction and back ground – biometric technologies – passive biometrics – active biometrics -Biometric systems – Enrollment – templates – algorithm – verification – Biometric applications –biometric characteristics- Authentication technologies –Need for

strong authentication - Protectingprivacy and biometrics and policy – Biometric applications – biometric characteristics

UNIT 2 FINGERPRINT TECHNOLOGY

History of fingerprint pattern recognition - General description of fingerprints - Finger print featureprocessing techniques - fingerprint sensors using RF imaging techniques – fingerprint qualityassessment – computer enhancement and modeling of fingerprint images – fingerprint enhancement– Feature extraction – fingerprint classification – fingerprint matching

UNIT 3 FACE RECOGNITION AND HAND GEOMETRY

Introduction to face recognition, Neural networks for face recognition – face recognition fromcorrespondence maps – Hand geometry – scanning – Feature Extraction - Adaptive Classifiers -Visual-Based Feature Extraction and Pattern Classification - feature extraction – types of algorithm –Biometric fusion.

UNIT 4 MULTIMODAL BIOMETRICS AND PERFORMANCE EVALUATION

Voice Scan – physiological biometrics –Behavioral Biometrics - Introduction to multimodal biometricsystem – Integration strategies – Architecture – level of fusion – combination strategy –training andadaptability – examples of multimodal biometric systems – Performance evaluation- StatisticalMeasures of Biometrics – FAR – FRR – FTE – EER – Memory requirement andallocation.

UNIT 5 BIOMETRIC AUTHENTICATION

Introduction - Biometric Authentication Methods - Biometric Authentication Systems – Biometricauthentication by fingerprint -Biometric Authentication by Face Recognition. -. Expectation-Maximization theory - Support Vector Machines. Biometric authentication by fingerprint –biometricauthentication by hand geometry- Securing and trusting a biometric transaction – matching location –local host - authentication server – match on card (MOC) – Multibiometrics and Two-FactorAuthentication

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1. Demonstrate knowledge engineering principles underlying biometric systems.
CO2. Analyze design basic biometric system applications.
CO3. Design a system for face recognition
CO4. Design a system for multimodal biometrics and performance evaluation
CO5. Apply the concepts for biometric authentication

TEXTBOOKS:

1. James Wayman, Anil Jain, Davide Maltoni, Dario Maio, "Biometric Systems, Technology Design
and Performance Evaluation", Springer, 2005 (Units I, II, III & IV)
2. S.Y. Kung, S.H. Lin, M.W.Mak, "Biometric Authentication: A Machine Learning Approach"
Prentice Hall, 2005(Unit V)

REFERENCES

1. Paul Reid, "Biometrics for Network Security", Pearson Education, 2004.
2. Nalini K Ratha, Ruud Bolle, "Automatic fingerprint Recognition System", Springer, 2003.
3. L C Jain, I Hayashi, S B Lee, U Halici, "Intelligent Biometric Techniques in Fingerprint and FaceRecognition" CRC Press, 1999.
4. John Chirillo, Scott Blaul, "Implementing Biometric Security", John Wiley, 2003.
5. Arun A. Ross, Karthik Nanda Kumar, Anil K. Jain, "Handbook of Multibiometrics", Springer, 2006.

AECT3114	EMBEDDED AND REAL TIME SYSTEMS	L	T	P	C	TOTAL MARKS
		3	0	0	3	100

PREREQUISITES: Microprocessor and Microcontroller

COURSE OBJECTIVES

The students should be made to

- Learn the architecture and programming of ARM processor.
- Be familiar with the embedded computing platform design and analysis.
- Be exposed to the basic concepts of real time Operating system.
- Learn the system design techniques and networks for embedded systems

UNIT 1 INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

UNIT 2 EMBEDDED COMPUTING PLATFORM DESIGN

The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

UNIT 3 PROCESSES AND OPERATING SYSTEMS

Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE.

UNIT 4 SYSTEM DESIGN TECHNIQUES AND NETWORKS

Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors.

UNIT 5 CASE STUDY

Data compressor - Alarm Clock - Audio player - Software modem-Digital still camera - Telephone answering machine-Engine control unit – Video accelerator.

COURSE OUTCOMES

Upon Completion of the course, the students will be able to:

CO1: Describe the architecture and programming of ARM processor.
CO2: Outline the concepts of embedded systems
CO3: Use the system design techniques to develop software for embedded systems
CO4: Differentiate between the general purpose operating system and the real time operating system
CO5: Model real-time applications using embedded-system concepts.

TEXT / REFERENCE BOOKS

1. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", Third Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
2. Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Third Edition Cengage Learning, 2012.
3. David. E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.
4. Raymond J.A. Buhr, Donald L.Bailey, "An Introduction to Real-Time Systems- From Design to Networking with C/C++", Prentice Hall, 1999.
5. C.M. Krishna, Kang G. Shin, "Real-Time Systems", International Editions, Mc Graw Hill 1997
6. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dream Tech Press, 2005.
7. Sriram V Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", Tata Mc Graw Hill, 2004.

ACST2104	PROGRAMMING AND DATA STRUCTURES	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITES: Microprocessor and Microcontroller

COURSE OBJECTIVES

The students should be made to

- To impart the basic concepts of data structures and algorithms.
- To understand basic concepts about stacks, queues, lists, trees and graphs.
- To understand about sorting and hashing techniques

UNIT 1 INTRODUCTION

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

UNIT 2 ABSTRACT DATA TYPES

ADT's Abstract Data Types, Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

UNIT 3 LINKED LISTS, STACKS AND QUEUES

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

UNIT 4 TREES AND GRAPHS

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, General Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. Red Black tree, B Tree, B+ Tree: definitions, algorithms and analysis.

Graph: Basic Terminologies and Representations, Graph search and Traversal algorithms: BFS, DFS, Minimum Spanning Tree: Prim's and Kruskal's Algorithm, Shortest Path Algorithm: Dijkstra's, Bellman Ford, Floyd-Warshall Algorithm and complexity analysis.

UNIT 5 SORTING AND HASHING

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance And Comparison among all the methods, Hashing: Static Hashing Techniques, Collision resolution techniques, Dynamic Hashing techniques.

COURSE OUTCOMES

Upon Completion of the course, the students will be able to:

CO1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.

CO2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.

CO3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.

CO4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.

CO5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

TEXT / REFERENCE BOOKS

1. Mark Allen Weiss,"Data Structures and Algorithm Analysis in C++", Pearson Education, 2014.
2. Reema Thareja,"Data Structures Using C", Oxford University Press, 2011

REFERENCES

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Tata Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman,"Data Structures and Algorithms", Pearson Education,1983.
3. Stephen G. Kochan,"Programming in C", Pearson Education, 2015
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed,"Fundamentals of Data Structures in C", University Press, 2008

AECT2165	INTERNET OF THINGS IN HEALTHCARE	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITES: None

COURSE OBJECTIVES

The students should be made to

- Identify and design the new models for market strategic interaction.
- Analyze various protocols for IOT
- Building state of the art architecture in IOT
- Analyze and design different models for network dynamics
  Analyze applications of IoT in real time scenario.

UNIT 1 FUNDAMENTALS OF IOT

Introduction-Characteristics-Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoT vs M2M. , M2M towards IoT-the global context, A use case example, Differing Characteristics.

UNIT 2 IOT DESIGN METHODOLOGY

IoT systems management – IoT Design Methodology – Specifications Integration and Application Development. **IoT-An Architectural Overview**– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT3 IOT REFERENCE ARCHITECTURE

Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **Real-World Design Constraints-** Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control. Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

UNIT 4 IOT PROTOCOLS

IOT Protocols Standards – Effort – M2M and WSN Protocols – SCADA and RFID Protocols –Issues with IoT Standardization – Unified Data Standards – IEEE 802.15.4 – BACNet Protocol, Mod Bus, Zig bee Architecture – Network Layer – APS Layer, Security.

UNIT 5 IOT APPLICATIONS

The role of the IOT for increased autonomy and agility in collaborative production environments – Resource management in the IOT. Clustering, synchronization and software agents. Applications - Smart grid – Electrical vehicle charging.

COURSE OUTCOMES

Upon Completion of the course, the students will be able to:

CO1. Analyze various protocols for IoT
CO2. Develop web services to access/control IoT devices.
CO3. Deploy an IoT application and connect to the cloud
CO4. Analyze applications of IoT in real time scenario

TEXT / REFERENCE BOOKS

3. Mark Allen Weiss,"Data Structures and Algorithm Analysis in C++", Pearson Education, 2014.
4. Reema Thareja,"Data Structures Using C", Oxford University Press, 2011

REFERENCES

5. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Tata Mcgraw Hill, 2002.
6. Aho, Hopcroft and Ullman,"Data Structures and Algorithms", Pearson Education,1983.
7. Stephen G. Kochan,"Programming in C", Pearson Education, 2015
8. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed,"Fundamentals of Data Structures in C", University Press, 2008

ACST3115	BIG DATA ANALYTICS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITES: None

COURSE OBJECTIVES

The students should be made to

- Understand big data for business intelligence.
- Learn business case studies for big data analytics.
- Understand nosql big data management.
- Perform map-reduce analytics using Hadoop and related tools

UNIT 1 INTRODUCTION TO BIG DATA

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big Data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT 2 DATA MODELS

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

UNIT 3 HADOOP

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

UNIT 4 MAP REDUCE

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats

UNIT 5 HADOOP TOOLS

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration. Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries

COURSE OUTCOMES

Upon Completion of the course, the students will be able to:

CO1. Describe big data and use cases from selected business domains

CO2. Explain NoSQL big data management

CO3. Install, configure, and run Hadoop and HDFS

CO4. Perform map-reduce analytics using Hadoop

CO5. Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

TEXT BOOKS

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.

REFERENCES

2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
4. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
5. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
6. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
7. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
8. Alan Gates, "Programming Pig", O'Reilley, 2011.

ACST3144	GRID AND CLOUD COMPUTING	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITES: None

COURSE OBJECTIVES

The students should be made to

- Understand how Grid computing helps in solving large scale scientific problems.
- Gain knowledge on the concept of virtualization that is fundamental to cloud computing.
- Learn how to program the grid and the cloud.
- Understand the security issues in the grid and the cloud environment.

UNIT 1 INTRODUCTION

Evolution of Distributed computing: Scalable computing over the Internet – Technologies for network based systems – clusters of cooperative computers - Grid computing Infrastructures – cloud computing - service oriented architecture – Introduction to Grid Architecture and standards – Elements of Grid – Overview of Grid Architecture.

UNIT 2 GRID SERVICES

Introduction to Open Grid Services Architecture (OGSA) – Motivation – Functionality Requirements – Practical & Detailed view of OGSA/OGSI – Data intensive grid service models – OGSA services.

UNIT 3 VIRTUALIZATION.

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software - Pros and Cons of cloud computing – Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation.

UNIT 4 PROGRAMMING MODEL

Open source grid middleware packages – Globus Toolkit (GT4) Architecture , Configuration – Usage of Globus – Main components and Programming model - Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system, HDFS concepts, command line and java interface, dataflow of File read & File write.

UNIT 5 SECURITY

Trust models for Grid security environment – Authentication and Authorization methods – Grid security infrastructure – Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS

availability in the cloud, Key privacy issues in the cloud.

COURSE OUTCOMES

Upon Completion of the course, the students will be able to:

CO1:Apply grid computing techniques to solve large scale scientific problems.
CO2:Apply the concept of virtualization.
CO3:Use the grid and cloud tool kits.
CO4:Apply the security models in the grid and the cloud environment.

TEXT BOOK:

1. Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet", First Edition, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

REFERENCES:

1. Jason Venner, "Pro Hadoop- Build Scalable, Distributed Applications in the Cloud",APress, 2009
2. Tom White, "Hadoop The Definitive Guide", First Edition. O"Reilly, 2009.
3. Bart Jacob (Editor), "Introduction to Grid Computing", IBM Red Books, Vervante, 2005
4. Ian Foster, Carl Kesselman, "The Grid: Blueprint for a New Computing Infrastructure", 2nd Edition, Morgan Kaufmann, 2004
5. Frederic Magoules and Jie Pan, "Introduction to Grid Computing" CRC Press, 2009.
6. Daniel Minoli, "A Networking Approach to Grid Computing", John Wiley Publication, 2005.
7. Barry Wilkinson, "Grid Computing: Techniques and Applications", Taylor and Francis Group, 2010.

ACST3136	MACHINE LEARNING TECHNIQUES	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITES: None

COURSE OBJECTIVES

The students should be made to

- Gain knowledge on the basics of statistical concepts used in machine learning
- To understand the basics of machine learning
- To understand the concepts of machine learning methodology
- Gain knowledge on the applications of machine learning in real life use cases

UNIT 1 BASICS OF STATISTICS

Matrices and vectors, matrix addition, scalar multiplication, matrix-vector multiplication, matrix-matrix multiplication, matrix inverse and transpose, distance measures (Eucledian, Manhattan, Mahalanobis, Minkowisky's)- Descriptive Statistics, Basic Probability & Distributions, Hypothesis testing, correlation, co-variance, normal distribution, Basics of Inferential Statistics, Sample , Population, regression

UNIT 2 BASICS OF MACHINE LEARNING

Data Analytics, Machine learning, Business Applications- Defintions of Supervised learning, Linear Regression, Logistic Regression- Definition of Un-supervised learning, K-Means clustering, Agglomerative Clustering- Definition, Basics of Re-inforcement Learning with Examples

UNIT 3 MACHINE LEARNING METHODOLOGY (CRISP DM)

Steps in CRISP-DM methodology, Introduction Data Types- Handling missing data (imputation), ordering data, normalization, data merging, data manipulation, data transformation- Dimentionality reduction, Multicollinearity, Factor Analysis, PCA (Principle component Analysis)

UNIT 4 KEY CONCEPTS IN MACHINE LEARNING

Sample selection, Training data, Test data & Validation- modeling assumptions, assessment of modeling algorithms, parameter setting, model description- Linear Regression, Multiple Linear Regression(stepwise All), Binary Logistic Regression (Stepwise

All), Multi Logistic Regression, GBM (Gradient Boosting Algorithm)- Model Validation, Confusion Matrix, ROC curve, cross Validation, AIC, R2 Value, Lift, Gain, K-fold Validation,Bootstraping & Bagging, overfitting vs under-fitting diagnosis- Frequency of model execution, frequency of model update, monitoring- sampling algorithms (over sampling and under sampling), random over sampling, SMOTE, Random under-sampling,

UNIT 5 MACHINE LEARNING ALGORITHMS WITH REAL LIFE USE CASES

K-Means clustering and Hierarchical clustering- KNN classification, Decision trees (ID3, CHAID), Naïve-Bayes , Random Forests, Support Vector Machines

COURSE OUTCOMES

Upon Completion of the course, the students will be able to:

CO1. Understand the statistical concepts used in machine learning
CO2. Understand the key concepts in machine learning
CO3. Gain knowledge on machine learning algorithms with real life use cases

TEXT BOOK

1.Ethem Alpaydin, "Introduction to Machine Learning", Second Edition,MIT Press

REFERENCES

1.Stephen Marsland," Machine Learning: An Algorithmic Perspective", http://www.amazon.com/Machine-Learning-Algorithmic-PerspectiveRecognition/dp/1420067184 .
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning". http://research.microsoft.com/en-us/um/people/cmbishop/prml/.
3. Tom Mitchell, "Machine Learning", http://www.cs.cmu.edu/~tom/mlbook.html.

ABMT4134	ROBOTICS AND AUTOMATION IN MEDICINE	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: AECT3113 Analog and Digital Communication.

COURSE OBJECTIVES:

The students should be made to,

- Understand the basics of Robotics, Kinematics.
- Understand the basics of Inverse Kinematics.
- Explore various kinematic motion planning solutions for various Robotic configurations.
- Explore various applications of Robots in Medicine.

UNIT 1 INTRODUCTION

Introduction Automation and Robots, Classification, Application, Specification, Notations, Direct Kinematics Dot and cross products, Coordinate frames, Rotations, Homogeneous coordinates Link coordination arm equation – Five-axis robot, Four-axis robot, Six-axis robot

UNIT 2 KINEMATICS

Inverse Kinematics – General properties of solutions tool configuration, Five axis robots, Three-Four axis, Six axis Robot, Workspace analysis and trajectory planning work envelope and examples, workspace fixtures, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion.

UNIT 3 ROBOT VISION

Robot Vision Image representation, Template matching, Polyhedral objects, Shane analysis, Segmentation – Thresholding, region labeling, Shrink operators, Swell operators, Euler numbers, Perspective transformation, Structured illumination, Camera calibration.

UNIT 4 PLANNING

Task Planning Task level programming, Uncertainty, Configuration, Space, Gross motion, Planning, Grasp Planning, Fine-motion planning, Simulation of planar motion, Source and Goal scenes, Task Planner simulation.

UNIT 5 APPLICATIONS

Applications in Biomedical Engineering – Bio Engineering Biologically Inspired Robots, Neural Engineering, Application in Rehabilitation – Interactive Therapy, Bionic Arm, Clinical and Surgical – Gynaecology, Orthopaedics, Neurosurgery

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Understand the basics of robotic systems.

CO2 - Design basic Robotics system and formulate Kinematics.

CO3 - Construct Inverse Kinematic motion planning solutions for various Robotic configurations.

CO4 - Design Robotic systems for Medical application.

.

TEXTBOOKS:

1. Robert Schilling, —Fundamentals of Robotics-Analysis and control‖, Prentice Hall, 2003.
2. J.J.Craig, —Introduction to Robotics‖, Pearson Education, 2005.

REFERENCES

1. Staugaard, Andrew C,—Robotics and Artificial Intelligence: An Introduction to Applied Machine Learning‖, Prentice Hall Of India, 1987
2. Grover, Wiess, Nagel, Oderey, —Industrial Robotics: Technology, Programming and Applications‖, McGraw Hill, 1986.
3. Wolfram Stadler, —Analytical Robotics and Mechatronics‖, McGraw Hill, 1995.
4. Saeed B. Niku, —Introduction to Robotics: Analysis, Systems, Applications‖, Prentice Hall, 2001.
5. K. S. Fu, R. C. Gonzales and C. S. G. Lee, —Robotics‖, McGraw Hill, 2008.

ABMT4135	VIRTUAL REALITY AND ITS APPLICATION IN MEDICINE	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITE: None

COURSE OBJECTIVES:

The students should be made,

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To impart the fundamental aspects, principles of virtual reality technology
- To gain knowledge about applications of virtual reality

UNIT 1 INTRODUCTION

The three I's of virtual reality-commercial VR technology and the five classic components of a VR system - **Input Devices :**(Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces- **Output Devices:** Graphics displays-sound displays & haptic feedback.

UNIT 2 MODELING

Geometric modeling - kinematics modeling- physical modeling - behavior modeling - model management.

UNIT 3 HUMAN FACTORS

Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality

environment

UNIT 4 VR PROGRAMMING

Introducing Java 3D-loading and manipulating external models-using a lathe to make shapes. 3D Sprites- animated 3D sprites-particle systems.

UNIT 5 APPLICATIONS

Medical applications--robotics applications- Advanced Real time Tracking-other applications-games, movies, simulations, therapy

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Comprehend and appreciate the significance and role of this course in the present contemporary world

CO2 - understand the basic concepts of Virtual reality

CO3 - expose the concept of Virtual Reality Programming with toolkits.

CO4 - Design of various modeling concepts.

CO5 - Develop the Virtual Reality applications in different areas

.

TEXTBOOKS:

1. C. Burdea & Philippe Coiffet, —Virtual Reality Technology‖, Second Edition, Gregory, John Wiley & Sons, Inc.,2008 2. Andrew Davison, —Killer Game Programming in Java‖, Oreilly SPD, 2005.

REFERENCES

1.John Vince, —Introduction to Virtual Reality‖, Springer-Verlag Ltd., 2004. 2. William R.Sherman, Alan B.Craig :Understanding Virtual Reality – Interface, Application, Design‖, The Morgan Kaufmann Series, 2003.

ABMT4136	BIOINFORMATICS	L	T	P	C	Total Marks
		3	0	0	3	100

PREREQUISITES: Programming and Data Structures, Big Data Analytics

COURSE OBJECTIVES:

The students should be made to,

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To learn ICT applications in medicine with an introduction to health informatics.
- To understand the theories and practices adopted in Hospital Information Systems in the light of medical standards, medical data formats and recent trends in Hospital Information Systems

UNIT 1 INTRODUCTION

Introduction to genomics: Information flow in biology, DNA sequence data, experimental approach to genome sequence data, genome information resources.

UNIT 2 PROTEIN SEQUENCING

Functional proteomics: Protein sequence and structural data, protein information resources and secondary data bases.

UNIT 3 MODELLING

Computation genomics: Internet basics, biological data analysis and application, sequence and data bases, NCBI model, file format, Perl programming, bioperl, introduction and overview of human genomic project.

UNIT 4 SEQUENCE ALIGNMENT

Sequence alignment and data base search: Protein primary sequence analysis, DNA sequence analysis, pair wise sequence alingnment, FASTA algorithm, BLAST, multiple sequence alignment, DATA base searching using BLAST and FASTA.

UNIT 5 DATA BASES

Structural data bases: Small molecules data bases, protein information resources, protein data bank, genebank, swissport, enterz..

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 - Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

CO2 - Discuss about health informatics and different ICT applications in medicine.

CO3 - Explain the function of Hospital Information Systems

CO4 - Analyze medical standards

TEXT BOOKS

1. Andrzej Polanski, Marek Kimmel, Bioinformatics, Springer publications, 2007

REFERENCES

1. Introduction to bioinformatics, Atwood, Pearson education.
2. Introduction to bioinformatics, Arther M.Lesk-OUP
3. Bioinformatics sequences and genome analysis, David W.Mount, 2nd. Edn. CBS publishers.
4. Introduction to bioinformatics computer skills, Cynthia Gibas and Per Jambeck, 2001 SPD.