Bachelor of Technology
B.Tech., Biomedical Engineering
Revised
Regulations, Curriculum & Syllabus

Effective from the academic year 2013-2014

of

PONDICHERRY UNIVERSITY
PUDUCHERRY – 605 014.

PONDICHERRY UNIVERSITY
BACHELOR OF TECHNOLOGY PROGRAMMES
(EIGHT SEMESTERS)

REGULATIONS

1. Conditions for Admission:

(a) Candidates for admission to the first semester of the 8 semester B.Tech Degree programme should be required to have passed :

The Higher Secondary Examination of the (10+2) curriculum (Academic Stream) prescribed by the Government of Tamil Nadu or any other examination equivalent there to with minimum of 45% marks (40% marks for OBC and SC/ST candidates) in aggregate of subjects – Mathematics, Physics and any one of the following optional subjects: Chemistry / Biotechnology/ Computer Science / Biology (Botany & Zoology) or an Examination of any University or Authority recognized by the Executive Council of the Pondicherry University as equivalent thereto.

(B) For Lateral entry in to third semester of the eight semester B.Tech programme :

The minimum qualification for admission is a pass in three year diploma or four year sandwich diploma course in engineering / technology from an AICTE approved institution with at least 45% marks (40% marks for OBC and SC/ST candidates) in aggregate in the subjects covered from 3rd to final semester or a pass in B.Sc. degree from a recognized university as defined by UGC with at least 45% marks (40% marks for OBC and SC/ST candidates) and passed XII standard with mathematics as a subject.

Provided that in case of students belonging to B.Sc Stream shall clear the subjects of Engineering Graphics and Engineering Mechanics of the first year Engineering program along with the second year subjects.

Provided further that, the students belonging to B.Sc Stream shall be considered only after filling the supernumerary seats in this category with students belonging to the Diploma stream.

The list of diploma programs approved for admission for each of the degree programs is given in **Annexure A**.

2. Age Limit :

The candidate should not have completed 21 years of age as on 1st July of the academic year under consideration. For Lateral Entry admission to second year of degree programme, there is no age limit. For SC/ST candidates, the age limit is relaxable by 3 years.

3. Duration of Programme :

The Bachelor of Technology degree programme shall extend over a period of 8 consecutive semesters spread over 4 academic years – two semesters

constituting one academic year. The duration of each semester shall normally be 15 weeks

4. Eligibility for the award of Degree:

No candidate shall be eligible for the award of the degree of Bachelor of Technology, unless he/she has undergone the course for a period of 8 semesters (4 academic years) / 6 semesters (3 academic years for Lateral Entry candidates) in the faculty of Engineering and has passed the prescribed examinations in all the semesters.

5. Branches of Study:

Brach I - Civil Engineering
Branch II - Mechanical Engineering
Branch III - Electronics & Communication Engineering
Branch IV - Computer Science & Engineering
Branch V - Electrical & Electronics Engineering
Branch VI - Chemical Engineering
Branch VII - Electronics & Instrumentation Engineering
Branch VIII - Information Technology
Branch IX - Instrumentation & Control Engineering
Branch X - Biomedical Engineering

or any other branches of study as and when offered. The branch allocation shall be ordinarily done at the time of admission of the candidate to the first semester.

6. Subjects of Study:

The subjects of study shall include theory and practical courses as given in the curriculum and shall be in accordance with the prescribed syllabus. The subjects of study for the first two semesters shall be common for all branches of study.

7. Examinations:

The theory and practical examinations shall comprise continuous assessment throughout the semester in all subjects as well as university examinations conducted by Pondicherry University at the end of the semester (November / December or April / May).

(a) Theory courses for which there is a written paper of 75 marks in the university examination**.**

The Internal Assessment marks of 25 has to be distributed as 10 marks each for two class tests and 5 marks for class attendance in the particular subject. The distribution of marks for attendance is as follows.

5 marks for 95% and above

4 marks for 90% and above but below 95%

3 marks for 85% and above but below 90%

2 marks for 80% and above but below 85%

1 mark for 75% and above but below 80%

In total, three tests are to be conducted and the better two are to be considered for assessment.

(b) Practical courses for which there is a university practical examination of 50 marks**:**

The internal assessment marks of 50 has to be distributed as 20 marks for the periodic practical works and records submitted thereof, 15 marks for an internal practical examination, 5 marks for an internal viva voce, and 10 marks for class attendance in the particular subject. The distribution of marks is as given below.

10 marks for 95% and above
8 marks for 90% and above but below 95%
6 marks for 85% and above but below 90%
4 marks for 80% and above but below 85%
2 marks for 75% and above but below 80%

8. Requirement for appearing for University Examination:

A candidate shall be permitted to appear for university examinations at the end of any semester only if:

(i) He / She secures not less than 75% overall attendance arrived at by taking into account the total number of periods in all subjects put together offered by the institution for the semester under consideration.

(Candidates who secure overall attendance greater than 60% and less than 75% have to pay a condonation fee as prescribed by University along with a medical certificate obtained from a medical officer not below the rank of Asst. Director)

(ii) He / She earns a progress certificate from the Head of the institution for having satisfactorily completed the course of study in all the subjects pertaining to that semester.

(iii) His / Her conduct is found to be satisfactory as certified by the Head of the institution.

A candidate who has satisfied the requirement (i) to (iii) shall be deemed to have satisfied the course requirements for the semester.

9. Procedure for completing the course:

A candidate can join the course of study of any semester only at the time of its normal commencement and only if he/she has satisfied the course requirements for the previous semester and further has registered for the university examinations of the previous semester in all the subjects as well as all arrear subjects if any.

However, the entire course should be completed within 14 consecutive semesters (12 consecutive semesters for students admitted under lateral entry).

10. Passing Minimum :

(i) A candidate shall be declared to have passed the examination in a subject of study only if he/she secures not less than 50% of the total marks (Internal Assessment plus University examination marks) and not less than 40% of the marks in University examination.

(ii) A candidate who has been declared "Failed" in a particular subject may reappear for that subject during the subsequent semesters and secure a pass. However, there is a provision for revaluation of failed or passed subjects provided he/she fulfills the following norms for revaluation.

(a) Applications for revaluation should be filed within 4 weeks from the date of declaration of results or 15 days from the date of receipt of marks card whichever is earlier.

(b) The candidate should have attended all the college examinations as well as university examinations.

(c) If a candidate has failed in more than four papers in the current university examination, his/her representation for revaluation will not be considered.

(d) The request for revaluation must be made in the format prescribed duly recommended by the Head of the Institution along with the revaluation fee prescribed by the University.

Further the University examination marks obtained in the latest attempt shall alone remain valid in total suppression of the University examination marks obtained by the candidate in earlier attempts.

11 Award of Letter Grades:

The assessment 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 points, will be awarded as per the range of total marks (out of 100) obtained by the candidate, as detailed below:

Range of Total Marks	Letter Grade	Grade Points
90 to 100	S	10
80 to 89	A	9
70 to 79	B	8
60 to 69	C	7
55 to 59	D	6
50 to 54	E	5
0 to 49	F	0
Incomplete	FA	

'F' denotes failure in the course. 'FA' denotes absent / detained as per clause 8.

After results are declared, grade sheets will be issued to the students. The grade sheets will contain the following details:

(a) The college in which the candidate has studied.

(b) The list of courses enrolled during the semester and the grades scored.

(c) The Grade Point Average (GPA) for the semester and The Cumulative Grade Point Average (CGPA) of all enrolled subjects from first semester onwards.

(d) GPA is the ratio of sum of the products of the number of credits (C) of courses registered and the corresponding grades points (GP) scored in those courses, taken for all the courses and sum of the number of credits of all the courses

$$GPA = \left(Sum\ of\ \ (C \times GP) / Sum\ of\ \ C \right)$$

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. FA grades are to be excluded for calculating GPA and CGPA.

The conversion of CGPA into percentage marks is as given below

$$\%\, Marks = (CGPA - 0.5) \times 10$$

12 Award of Class and Rank:

(i) A candidate who satisfies the course requirements for all semesters and who passes all the examinations prescribed for all the eight semesters (six semesters for lateral entry candidates) within a maximum period of 7 years (6 years for lateral entry candidates) reckoned from the commencement of the first semester to which the candidate was admitted shall be declared to have qualified for the award of degree.

(ii) A candidate who qualifies for the award of the degree passing in all subjects pertaining to semesters 3 to 8 in his/her first appearance within 6 consecutive semesters (3 academic years) and in addition secures a CGPA of 8.50 and above for the semesters 3 to 8 shall be declared to have passed the examination in **FIRST CLASS** with **DISTINCTION**.

(iii) A candidate who qualifies for the award of the degree by passing in all subjects relating to semesters 3 to 8 within a maximum period of eight semesters after his/her commencement of study in the third semester and in addition secures CGPA not less than 6.5 shall declared to have passed the examination in **FIRST CLASS**.

(iv) All other candidates who qualify for the award of degree shall be declared to have passed the examination in **SECOND CLASS**.

(v) For the Award of University ranks and Gold Medal for each branch of study, the CGPA secured from 1st to 8th semester alone should be considered and it is mandatory that the candidate should have passed all the subjects from 1st to 8th semester in the first attempt. Rank certificates would be issued to the first ten candidates in each branch of study.

13. Provision for withdrawal :

A candidate may, for valid reasons, and on the recommendation of the Head of the Institution be granted permission by the University to withdraw from writing the entire semester examination as one Unit. The withdrawal application shall be valid only if it is made earlier than the commencement of the last theory examination pertaining to that semester. Withdrawal shall be permitted only once during the entire course. Other conditions being satisfactory, candidates who withdraw are also eligible to be awarded DISTINCTION whereas they are not eligible to be awarded a rank.

14. Discontinuation of Course:

If a candidate wishes to temporarily discontinue the course for valid reasons, he/she shall apply through the Head of the Institution in advance and obtain a written order from the University permitting discontinuance. A candidate after temporary discontinuance may rejoin the course only at the commencement of the semester at which he/she discontinued, provided he/she pays the prescribed fees to the University. The total period of completion of the course reckoned from the commencement of the first

semester to which the candidate was admitted shall not in any case exceed 7 years, including of the period of discontinuance.

15. Revision of Regulations and Curriculum:

The University may from time to time revise, amend or change the regulations of curriculum and syllabus as and when found necessary.

ANNEXURE – A

B.Tech courses in which admission is sought	Diploma courses eligible for admission
Civil Engineering	Civil Engineering Civil and Rural Engineering Architectural Assistantship Architecture Agricultural Engineering
Mechanical Engineering	Mechanical Engineering Automobile Engineering Agricultural Engineering Mechanical and Rural Engineering Refrigeration and Air-conditioning Agricultural Engineering & Farm Equipment Technology Metallurgy Production Engineering Machine Design & Drafting Machine tool maintenance and Repairs Printing Technology / Engineering Textile Engineering / Technology Tool Engineering
Electrical and Electronics Engineering Electronics & Communication Engineering Electronic and Instrumentation Engineering Instrumentation and Control Engineering	Electrical Engineering Electrical and Electronics Engineering Electronics and Instrumentation Engineering Instrumentation Engineering / Technology Electronics and Communication Engg. Electronics Engineering Medical Electronics Instrumentation and Control Engineering Applied Electronics
Bio Medical Engineering	Chemical Engineering Chemical Technology Petrochemical Technology Petroleum Engineering Ceramic Technology Plastic Engineering Paper & Pulp Technology / Polymer Technology
Information Technology Computer Science & Engineering	Computer Science and Engineering Computer Technology Electrical and Electronics Engineering Electronics & Communication Engineering Electronics & Instrumentation Engineering Instrumentation Engineering / Technology Information Technology

CURRICULUM & SYLLABUS

B.Tech (BIOMEDICAL ENGINEERING)

(With effect from Academic year 2013-14)

SEMESTER I

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
T101	Mathematics – I	3	1	0	4	25	75	100
T102	Physics	4	0	0	4	25	75	100
T103	Chemistry	4	0	0	4	25	75	100
T110	Basic Civil and Mechanical Engineering	4	0	0	4	25	75	100
T111	Engineering Mechanics	3	1	0	4	25	75	100
T112	Communicative English	4	0	0	4	25	75	100
	PRACTICAL							
P104	Physics lab	0	0	3	2	50	50	100
P105	Chemistry lab	0	0	3	2	50	50	100
P106	Workshop Practice	0	0	3	2	50	50	100
	TOTAL	22	2	9	30	300	600	900

SEMESTER II

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
T107	Mathematics – II	3	1	0	4	25	75	100
T108	Material Science	4	0	0	4	25	75	100
T109	Environmental Science	4	0	0	4	25	75	100
T104	Basic Electrical and Electronics Engineering	3	1	0	4	25	75	100
T105	Engineering Thermodynamics	3	1	0	4	25	75	100
T106	Computer Programming	3	1	0	4	25	75	100
	PRACTICAL							
P101	Computer Programming Lab	0	0	3	2	50	50	100
P102	Engineering Graphics	0	0	3	2	50	50	100
P103	Basic Electrical & Electronics Lab	0	0	3	2	50	50	100
P107	NSS / NCC *	-	-	-	0	-	-	-
	TOTAL	22	4	9	30	300	600	900

To be completed in I and II semesters, under Pass / Fail option only and not counted for CGPA calculation

SEMESTER III

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
MA T31	MATHEMATICS-III	3	1	0	4	25	75	100
BM T32	ELECTRIC CIRCUIT ANALYSIS	3	1	0	4	25	75	100
BM T33	ELECTRONIC DEVICES AND CIRCUITS	4	0	0	4	25	75	100
BM T34	HUMAN ANATOMY AND PHYSIOLOGY	4	0	0	4	25	75	100
BM T35	DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING	4	0	0	4	25	75	100
BM T36	BIO CHEMISTRY	4	0	0	4	25	75	100
	PRACTICAL							
BM P31	ELECTRONIC DEVICES AND CIRCUITS LAB	0	0	3	2	50	50	100
BM P32	BIOCHEMISTRY AND HUMAN PHYSIOLOGY LAB	0	0	3	2	50	50	100
BM P33	DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING LAB	0	0	3	2	50	50	100
	TOTAL	22	2	9	30	300	600	900

SEMESTER IV

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
MA T41	MATHEMATICS IV	3	1	0	4	25	75	100
BM T42	MEDICAL PHYSICS	4	0	0	4	25	75	100
BM T43	DIGITAL LOGIC THEORY AND DESIGN	3	1	0	4	25	75	100
BM T44	ELECTRICAL AND ELECTRONIC INSTRUMENTS	4	0	0	4	25	75	100
BM T45	LINEAR INTEGRATED CIRCUITS	4	0	0	4	25	75	100
BM T46	BIOMEDICAL SENSORS AND TRANSDUCERS	4	0	0	4	25	75	100
	PRACTICAL							
BM P41	LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB	0	0	3	2	50	50	100
BM P42	BIOMEDICAL SENSORS AND TRANSDUCERS LAB	0	0	3	2	50	50	100
BM P43	SIMULATION LAB	0	0	3	2	50	50	100
BM P44	PHYSICAL EDUCATION *	-	-	-	0	-	-	-
	TOTAL	22	2	9	30	300	600	900

* Under pass/fail option only and not counted for CGPA calculation

SEMESTER V

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
BM T51	PROBABILITY AND RANDOM PROCESSES	3	1	0	4	25	75	100
BM T52	BIO CONTROL SYSTEMS	3	1	0	4	25	75	100
BM T53	PATHOLOGY AND MICROBIOLOGY	3	1	0	4	25	75	100
BM T54	MICROPROCESSOR AND ITS APPLICATIONS	4	0	0	4	25	75	100
BM T55	MEDICAL INSTRUMENTATION	4	0	0	4	25	75	100
BM E56	ELECTIVE- I	4	0	0	4	25	75	100
	PRACTICAL							
BM P51	MEDICAL INSTRUMENTATION LAB	0	0	3	2	50	50	100
BM P52	PATHOLOGY AND MICROBIOLOGY LAB	0	0	3	2	50	50	100
BM P53	MICROPROCESSOR & ITS APPLICATIONS LAB	0	0	3	2	50	50	100
BM P54	GENERAL PROFICIENCY-I	0	0	3	1	100	-	100
	TOTAL	21	3	12	31	400	600	1000

SEMESTER VI

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
BM T61	DIAGONISTIC AND THERAPEUTIC EQUIPMENTS	4	0	0	4	25	75	100
BM T62	TELEMEDICINE	3	1	0	4	25	75	100
BM T63	BIOMEDICAL SIGNAL PROCESSING	4	0	0	4	25	75	100
BM T64	EMBEDDED SYSTEM DESIGN	3	1	0	4	25	75	100
BM T65	MEDICAL INFORMATICS AND EXPERT SYSTEM	4	0	0	4	25	75	100
BM E66	ELECTIVE-II	4	0	0	4	25	75	100
	PRACTICAL							
BM P61	DIAGONISTIC AND THERAPEUTIC EQUIPMENTS LAB	0	0	3	2	50	50	100
BM P62	BIOMEDICAL SIGNAL PROCESSING LAB	0	0	3	2	50	50	100
BM P63	SYSTEM DESIGN USING MICROCONTROLLERS LAB	0	0	3	2	50	50	100
BM P64	GENERAL PROFICIENCY –II	0	0	3	1	100	-	100
	TOTAL	22	2	12	31	400	600	1000

SEMESTER VII

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
BM T71	BIOMATERIALS AND ARTIFICIAL ORGANS	4	0	0	4	25	75	100
BM T72	DIGITAL IMAGE PROCESSING	3	1	0	4	25	75	100
BM E73	ELECTIVE-III	4	0	0	4	25	75	100
BM E74	ELECTIVE-IV	4	0	0	4	25	75	100
	PRACTICAL							
BM P71	DIGITAL IMAGE PROCESSING LAB	0	0	3	2	50	50	100
BM P72	SEMINAR	0	0	3	1	100	-	100
BM P73	INDUSTRIAL VISIT/TRAINING	0	0	3	1	100	-	100
BM PW7	PROJECT WORK PHASE-I	0	0	3	4	100	-	100
	TOTAL	15	1	12	24	450	350	800

SEMESTER VIII

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
BM T81	PROFESSIONAL ETHICS PRACTICE	3	-	-	1	100	-	100
BM T82	HOSPITAL SAFETY AND MANAGEMENT	4	0	0	4	25	75	100
BM T83	BIOMECHANICS	4	0	0	4	25	75	100
BM E84	ELECTIVE-V	4	0	0	4	25	75	100
	PRACTICAL							
BM P81	COMPREHENSIVE VIVA -VOCE	-	-	-	1	50	50	100
BM PW8	PROJECT WORK PHASE-II	0	0	6	8	50	50	100
	TOTAL	15	0	6	22	275	325	600

TOTAL CREDITS	228

LIST OF ELECTIVES

SEMESTER V (ELECTIVE I)

CODE	SUBJECT	PERIODS			CREDITS
		L	T	P	
BM E51	Computer Architecture and Organization	4	0	0	4
BM E52	Elements of Biotechnology	4	0	0	4
BM E53	Basics of Electrical Engineering	4	0	0	4
BM E54	Communication Engineering	4	0	0	4
BM E55	Soft Computing	3	1	0	4

SEMESTER VI (ELECTIVE II)

CODE	SUBJECT	PERIODS			CREDITS
		L	T	P	
BM E61	Anesthesia	4	0	0	4
BM E62	Biometric Systems	4	0	0	4
BM E63	Medical Imaging Techniques	4	0	0	4
BM E64	VLSI Design	3	1	0	4
BM E65	Virtual Instrumentation	3	1	0	4

SEMESTER VII (ELECTIVE III & IV)

CODE	SUBJECT	PERIODS			CREDITS
		L	T	P	
BM E71	Nano Electronics	4	0	0	4
BM E72	Wearable Systems	4	0	0	4
BM E73	Tissue Engineering	4	0	0	4
BM E74	Bioinformatics	4	0	0	4
BM E75	Radiological Equipment	4	0	0	4
BM E76	Medical Optics	4	0	0	4

SEMESTER VIII (ELECTIVE V & VI)

CODE	SUBJECT	PERIODS			CREDITS
		L	T	P	
BM E81	Bio MEMS	4	0	0	4
BM E82	Assist Devices	4	0	0	4
BM E83	Entrepreneurship	4	0	0	4
BM E84	Speech Processing	3	1	0	4
BM E85	Physiological Modelling	3	1	0	4
BM E86	Prosthetic Engineering	4	0	0	4
BM E87	Rehabilitation Engineering	4	0	0	4

T101 MATHEMATICS – I

OBJECTIVES:

To introduce the idea of applying calculus concepts to problems in Engineering . To familiarize the student with functions of several variables.

To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

To introduce effective mathematical tools for the solutions of differential equations that model physical processes

UNIT I – CALCULUS

Curvature, radius of curvature, evolutes and involutes. Beta and Gamma functions and their properties.

UNIT II– FUNCTIONS OF SEVERAL VARIABLES

Partial derivatives, Total derivatives, Differentiation of implicit functions, Change of variables, Jacobians and their properties, Taylor's series for functions of two variables, Maxima and minima, Lagrange's method of undetermined multipliers.

UNIT III – MULTIPLE INTEGRALS AND APPLICATIONS

Multiple Integrals, change of order of integration and change of variables in double integrals (Cartesian to polar). Applications: Areas by double integration and volumes by triple integration (Cartesian and polar).

UNIT IV – DIFFERENTIAL EQUATIONS

Exact equations, First order linear equations, Bernoulli's equation, orthogonal trajectories, growth, decay and geometrical applications. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT V – DIFFERENTIAL EQUATIONS (Higher order)

Linear differential equations of higher order - with constant coefficients, the operator D, Euler's linear equation of higher order with variable coefficients, simultaneous linear differential equations, solution by variation of parameters method simple application to electric circuits.

Text Books

1. Venkataraman M.K, Engineering Mathematics-First year, National Publishing Company, Chennai, 2010(For Units I, III, IV & VI only)
2. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 41st Edition, 2011. (For Unit II only)

Reference Books

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. Kandasamy P. et al, Engineering Mathematics, Vol.1 & 2, S. Chand & Co., New Delhi.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New Delhi, 8th Edition.
5. Bali N. and Goyal M., Advanced Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 7th Edition, 2010.

T102 PHYSICS

OBJECTIVES:

To understand the concepts of physics and its significant contributions in the advancement of technology and invention of new products that dramatically transformed modern-day society.

To expose the students to different areas of physics which have direct relevance and applications to different Engineering disciplines

To understand the concepts and applications of Ultrasonics, optics and some optical devices, Lasers and Fiber optics, Nuclear energy sources and wave mechanics

UNIT I – ACOUSTICS & NDT

ultrasonics - *U*ltrasonic Waves Productions (Piezoelectric & Magnetostriction method) – Detections (Acoustic Grating) *NDT applications – Ultrasonic* Pulse Echo Method - Liquid Penetrant Method

Acoustics - Factors affecting Acoustic of Buildings (Reverberation, Loudness, Focusing, Echo, Echelon Effect and Resonance) and their Remedies - Sabine's formula for Reverberation Time – Doppler effect and its applications to Radars.(elementary ideas)

UNIT II – OPTICS

Interference - Air Wedge – Michelson's Interferometer - Wavelength Determination – Interference Filter – Antireflection Coatings

Diffraction - Diffraction Grating – Dispersive power of grating - Resolving Power of Grating & Prism

Polarisation Basic concepts of Double Refraction - Huygens Theory of Double Refraction-Quarter and Half Wave Plates – Specific Rotary Power – Laurent Half Shade Polarimeter

UNIT III – LASERS & FIBER OPTICS

Lasers - Principles of Laser – Spontaneous and Stimulated Emissions - Einstein's Coefficients – Population Inversion and Laser Action – types of Optical resonators (qualitative ideas) –

Types of Lasers - NdYAG, CO_2 laser, GaAs Laser-applications of lasers

Fiber Optics - Principle and Propagation of light in optical fiber – Numerical aperture and acceptance angle – Types of optical fibers (material, refractive index, mode)-applications to sensors and Fibre Optic Communication

UNIT IV – WAVE MECHANICS

Matter Waves – de Broglie Wavelength – Uncertainty Principle – Schrödinger Wave Equation – Time Dependent – Time Independent – Application to Particle in a One Dimensional potential Box – Quantum Mechanical Tunneling – Tunnel Diode.

UNIT V – NUCLEAR ENERGY SOURCE

General Properties of Nucleus (Size, Mass, Density, Charge) – Mass Defect – Binding Energy - Disintegration in fission –*Nuclear Reactor:* Materials Used in Nuclear Reactors.

– PWR – BWR – FBTR. Nuclear fusion reactions for fusion reactors-D-D and D-T reactions, Basic principles of Nuclear Fusion reactors.

Text Books

1.V Rajendran, Engineering Physics, *2nd Edition*, TMH, New Delhi *2011* (For Units I to IV only)

2. Arthur Beiser, Concepts of Modern Physics, 6th Edition, TMH, New Delhi reprinted 2008. (For Unit V only)

Reference Books

1. Ajoy Ghatak, Optics, 5th Edition TMH, New Delhi, 2012.
2. K. Thyagarajan and Ajoy Ghatak, Lasers Fundamentals and Applications, 2nd Edition, Springer 2010.
3. R. Murugesan, Modern Physics, S. Chand & Co, New Delhi 2006.
4. K.R.Nambiar, Lasers, New Age International, New Delhi, 2008.
5. Science of Engineering Materials, 2nd Edition, C.M. Srivastava and C. Srinivasan, New Age Int. (P) Ltd, New Delhi, 1997
6. Avadhanulu M N , Engineering Physics, Vol-I, S. Chand & Co, 2009.

T103 CHEMISTRY

OBJECTIVES

To know about the importance of Chemistry in Engineering domain
To understand the chemistry background of industrial process
To apply chemistry knowledge for engineering disciplines

UNIT I – WATER (9 Hours)

Hardness of water - units and calcium carbonate equivalent. Determination of hardness of water-EDTA method. Disadvantages of hardwater – boiler scale and sludge, caustic embrittlement, priming & foaming and boiler corrosion. Water softening methods – internal & external conditioning – Lime-Soda process, Zeolite process and Ion-exchange process. Desalination – reverse osmosis & electrodialysis.

UNIT II – POLYMERS

(9 Hours)

Classification, types of polymerization reactions – mechanism of radical, ionic and Ziegler-Natta polymerizations. Polymer properties – chemical resistance, crystallinity and effect of temperature, Mn and Mw. Thermoplastics and thermosets. Preparation, properties and uses of PVC, TEFLON, Nylons, Bakelite, Polyurithane, Rubbers – vulcanization, synthetic rubber, BuNa-S, BuNa-N, silicone and butyl rubber. Conducting polymers – classification and applications. Polymer composites – FRP – laminar composites. Moulding constituents of plastic, moulding techniques – compression, injection, transfer and extrusion moulding.

UNIT III - ELECTROCHEMICAL CELLS (9 Hours)

Galvanic cells, single electrode potential, standard electrode potential, electromotive series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes – hydrogen, calomel, Ag/AgCl & glass electrodes. Batteries – primary and secondary cells, Leclanche cell, Lead acid storage cell, Ni-Cd battery & alkaline battery. Fuel cells – H_2-O_2 fuel cell.

UNIT IV - CORROSION AND ITS CONTROL (9 Hours)

Chemical & electrochemical corrosion – Galvanic, pitting, stress and concentration cell corrosion. Factors influencing corrosion – corrosion control methods – cathodic protection and corrosion inhibitors. Protective coating – types of protective coatings – metallic coating – tinning and galvanizing, cladding, electroplating and anodizing.

UNIT V -PHASE RULE (9 Hours)

Definition and derivation of phase rule. Application to one component system – water and sulfur systems. Thermal analysis, condensed phase rule.Two component systems – Pb-Ag, Cu-Ni, and Mg-Zn systems.

Text book

1.P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai and Sons, New Delhi 15th Ed, 2010.

Reference Books

1.S. S. Dara, A Textbook of Engineering Chemistry, 11th Ed, S.Chand & Co., Ltd. New Delhi, 2008.
2.B. K. Sharma, Engineering Chemistry, 3rd edition Krishna Prakashan Media (P) Ltd., Meerut, 2001.
3.P. Kannan and A. Ravi Krishnan "Engineering Chemistry" Hi-Tech Sri Krishna Publications, Chennai, 9th Ed, 2009
4.N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, 2nd Ed. PHI Learning PVT., LTD, New Delhi, 2008.

T104 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

OBJECTIVES

To understand and gain basic knowledge about magnetic and electrical circuits, single phase and three phase power measurement and the operating principles of stationary and rotating machines

To understand the basic operation, functions and applications of PN junction diode, transistor, logic gates and flip flops.

To gain knowledge on various communication systems and network models and the use of ISDN

PART A - ELECTRICAL

UNIT – I - DC CIRCUITS

Definition of Voltage, Current, Power & Energy, circuit parameters, Ohm's law, Kirchoff's law & its applications – Simple Problems - Division of current in Series & parallel circuits - star/delta conversion - Node and mesh methods of analysis of DC circuits

UNIT – II - AC CIRCUITS

Concepts of AC circuits – rms value, average value, form and peak factors – Simple RLC series circuits – Concept of real and reactive power – Power factor - Introduction to three phase system - Power measurement by two wattmeter method.

UNIT – III – ELECTRICAL MACHINES AND POWER PLANTS

Law of Electromagnetic induction, Fleming's Right & Left hand rule - Principle of DC rotating machine, Single phase transformer and single phase induction motor (Qualitative approach only) - Simple layout of thermal and hydro generation (block diagram approach only).Fundamentals of fuses and circuit breakers

PART B – ELECTRONICS

UNIT – IV ELECTRONIC CIRCUITS

V-I Characteristics of diode - Half-wave rectifier and Full-wave rectifier – with and without capacitor filter - Transistor - Construction & working - Input and output characteristics of CB and CE configuration - Transistor as an Amplifier - Principle and working of Hartley oscillator and RC phase shift oscillator - Construction and working of JFET & MOSFET.

UNIT – V DIGITAL ELECTRONICS

Boolean algebra – Reduction of Boolean expressions - De-Morgan's theorem - Logic gates -Implementation of Boolean expressions - Flip flops - RS, JK, T and D.
Combinational logic - Half adder, Full adder and Subtractors.
Sequential logic - Ripple counters and shift registers.

UNIT – VI COMMUNICATION AND COMPUTER SYSTEMS

Model of communication system - Analog and digital - Wired and wireless channel.

Block diagram of various communication systems - Microwave, satellite, optical fiber and cellular mobile system.

Network model - PAN, LAN, MAN and WAN - Circuit and packet switching - Overview of ISDN.

Text Books

1. Kothari D P and Nagrath I J , Basic Electrical Engineering , Tata McGraw Hill,2009. (For Units I to III)
2. Rajendra Prasad , " Fundamentals of Electronic Engineering", Cengage learning, New Delhi, First Edition, 2011 (For Unit IV)
3. Morris Mano, "Digital design", PHI Learning, Fourth Edition, 2008 (For Unit V)
4. Wayne Tomasi, "Electronic Communication Systems- Fundamentals Theory Advanced", Sixth Edition, Pearson Education, 2004. (For Unit VI)

Reference Books

1. R.Muthusubramaniam, S.Salivahanan and K.A. Mureleedharan, Basic Electrical Electronics and Computer Engineering, Tata McGraw Hill, 2004..
2. J.B.Gupta, A Course in Electrical Power, Katson Publishing House, New Delhi, 1993.
3. David. A. Bell, "Electronic Devices and Circuits", PHI Learning Private Ltd, India, Fourth Edition, 2008

4. Donald P Leach, Albert Paul Malvino and Goutam Saha, “Digital Principles and Applications,” 6th edition, Tata McGraw Hill Publishing Company Ltd., New Delhi,2008.

5. S.K. Sahdev, Fundamentals of Electrical Engineering and Electronics, Dhanpat Rai & Co, 2013.
6. Jacob Millman and Christos C. Halkias, “Electronic Devices and Circuits” Tata McGraw Hill,2008
7. R.L. Boylestad and L. Nashelsky, “Electronic Devices and Circuit Theory”, PHI Learning Private Limited, Ninth Edition, 2008.
8. M.S.Sukhija and T.K.Nagsarkar, “ Basic Electrical and Electronics Engineering”, Oxford University Press, 2012.

T105 THERMODYNAMICS

OBJECTIVES

To understand the basics of the thermodynamic principles

To establish the relationship of these principles to thermal system behaviors To develop methodologies for predicting the system behavior

To establish the importance of laws of thermodynamics applied to energy systems

To explain the role of refrigeration and heat pump as energy systems

To develop an intuitive understanding of underlying physical mechanism and a mastery of solving practical problems in real world

UNIT I - BASIC CONCEPTS AND DEFINITIONS

Energy conversion and efficiencies - System, property and state - Thermal equilibrium - Temperature - Zeroth law of Thermodynamics – Pure substance - P, V and T diagrams – Thermodynamic diagrams.

UNIT II - FIRST LAW OF THERMODYNAMICS

The concept of work and adiabatic process - First law of thermodynamics - Conservation of Energy principle for closed and open systems - Calculation of work for different processes of expansion of gases

UNIT III - SECOND LAW OF THERMODYNAMICS

Equilibrium and the second law - Heat engines - Kelvin-Planck statement of second law of thermodynamics - Reversible and irreversible processes - Carnot principle - Clausius inequality- Entropy

UNIT IV - GAS POWER CYCLES

Air standard cycles: The air standard Carnot cycle - Air standard Otto cycle, diesel cycle, dual cycle and Brayton cycles and their efficiencies

UNIT V - REFRIGERATION CYCLES AND SYSTEMS

Reverse Carnot cycle - COP - Vapor compression refrigeration cycle and systems (only theory) - Gas refrigeration cycle - Absorption refrigeration system – Liquefaction – Solidification (only theory).

Text Books

1. Nag, P. K., “Engineering Thermodynamics”, 4th edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, 2008.

Reference Books

1. Arora, C.P., “Thermodynamics” , Tata Mc Graw Hill Publishing Co. Ltd., New Delhi,2010
2. Burghardt, M.D., “Engineering Thermodynamics with Applications”, 4th edition, Harper & Row, N.Y.,2009.
3. Huang, F.F., “Engineering Thermodynamics” 2nd edition , Macmillan Publishing Co. Ltd., N.Y.,2011
4. Cengel, Y.A. and Boles, M.A., "Thermodynamics - An Engineering Approach", 5th edition, Mc-Graw Hill, 2008
5. Wark, K., “Thermodynamics”, 4th edition ,Mc Graw Hill, N.Y.,2009.

T106 COMPUTER PROGRAMMING

OBJECTIVES

To introduce the basics of computers and information technology.
To educate problem solving techniques.
To impart programming skills in C language.
To practice structured programming to solve real life problems.

UNIT – I

History of Computers – Block diagram of a Computer – Components of a Computer system –Classification of computers - Hardware – Software – Categories of Software – Operating System – Applications of Computers – Network structure – Internet and its services – Intranet – Study of word processor – Preparation of worksheets.

UNIT – II

Problem solving techniques – Program – Program development cycle – Algorithm design – Flowchart - Pseudo code.

Introduction to C – History of C – Importance of C - C tokens – data types – Operators and expressions – I/O functions.

UNIT – III

Decision making statements – branching and looping – arrays – multidimensional arrays – Functions – Recursion – Passing array to functions.
Storage classes – Strings – String library functions.

UNIT – IV

Structures – Arrays and Structures – nested structures – passing structures to functions – user defined data types – Union.

Pointers – pointers and arrays – pointers and functions - pointers and strings - pointers and Structures.

UNIT – V

Files – operations on a file – Random access to files – command line arguments.
Introduction to preprocessor – Macro substitution directives – File inclusion directives – conditional compilation directives – Miscellaneous directives.

Text Books

1. Balagurusamy. E, “Programming in ANSI C”, Tata McGraw Hill, Sixth edition, 2012.

Reference Book

1. Vikas Verma, “A Workbook on C “,Cengage Learning, Second Edition,2012

2. Ashok N Kamthane, “Computer Programming”, Pearson education, Second Impression, 2008.

P101 COMPUTER PROGRAMMING LAB

OBJECTIVES

To study and understand the use of OS commands
To gain a hands on experience of compilation and execution of 'C' programs

LIST OF EXERCISES:

1. Study of OS Commands
2. Write a C program to find the Area of the triangle.
3. Write a C program to find the total and average percentage obtained by a student for 6 subjects.
4. Write a C program to read a three digit number and produce output like

   1 hundreds

   7 tens

   2 units

   for an input of 172.
5. Write a C program to check whether a given character is vowel or not using Switch – Case statement.
6. Write a C program to print the numbers from 1 to 10 along with their squares.
7. Write a C program to find the sum of 'n' numbers using for, do – while statements.
8. Write a C program to find the factorial of a given number using Functions.
9. Write a C program to swap two numbers using call by value and call by reference.
10. Write a C program to find the smallest and largest element in an array.
11. Write a C program to perform matrix multiplication.
12. Write a C program to demonstrate the usage of Local and Global variables.
13. Write a C program to perform various string handling functions: strlen, strcpy, strcat, strcmp.
14. Write a C program to remove all characters in a string except alphabets.
15. Write a C program to find the sum of an integer array using pointers.

16. Write a C program to find the Maximum element in an integer array using pointers.
17. Write a C program to create student details using Structures.
18. Write a C program to display the contents of the file on the monitor screen.
19. Create a File by getting the input from the keyboard and retrieve the contents of the file using file operation commands.
20. Write a C program to pass the parameter using command line arguments.

P102 ENGINEERING GRAPHICS

OBJECTIVES

To convey the basics of engineering drawing

To explain the importance of an engineering drawing
To teach different methods of making the drawing

To establish the importance of projects and developments made in drawing that are used in real systems

To explain the role of computer aided design _Auto Cad

To develop an intuitive understanding of underlying significance of using these drawings

UNIT

Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning

UNIT I

Conic sections, Involutes, Spirals, Helix. Projection of Points, Lines and Planes

UNIT II

Projection of Solids and Sections of Solids.

UNIT III

Development of surfaces - Intersection of surfaces (cylinder-cylinder, cylinder-cone)

UNIT IV

Isometric projections and Orthographic projections

UNIT V

Computer Aided Drafting: Introduction to Computer Aided Drafting hardware - Overview of application software - 2D drafting commands (Auto CAD) for simple shapes - Dimensioning.

Text Books

1. K.R. Gopalakrishna and Sudhir Gopalakrishna, Engineering Graphics, Inzinc Publishers, 2007.

Reference Books

1. N.D. Bhatt, Engineering Drawing, 49th edition, Chorotar Publishing House, 2006.
2. K. Venugopal, Engineering Drawing and Grahics + Auto CAD, 4th edition, New Age International Publication Ltd., 2004 .
3. David I cook and Robert N Mc Dougal, Engineering Graphics and Design With computer applications, Holt – Sounders Int. Edn. 1985.
4. James D Bethune and et. al., Modern Drafting, Prentice Hall Int., 1989.
5. K.V. Natarajan, A Text Book of Engineering Drawing, Dhanalakshmi Publishers, 2006.
6. BIS, Engineering Drawing practice for Schools & College, 1992.

P103 BASIC ELECTRICAL AND ELECTRONICS LAB

OBJECTIVES

To get an exposure on the basic electrical tools, applications and precautions

To gain training on different types of wiring used in domestic and industrial applications.

To detect and find faults in electrical lamp and ceiling fan

To get an exposure on the measurements of voltage and phase using CRO, basic operation and applications of devices such as PN junction diode and transistor

To gain a practical knowledge on the functions and application of basic logic gates and flip flops

ELECTRICAL LAB

LIST OF EXPERIMENTS

1. Electrical Safety, Precautions, study of tools and accessories.
2. Practices of different joints.
3. Wiring and testing of series and parallel lamp circuits.
4. Staircase wiring.
5. Doctor's room wiring.
6. Bed room wiring.
7. Godown wiring.
8. Wiring and testing a ceiling fan and fluorescent lamp circuit.
9. Study of different types of fuses, circuits breakers and A.C and D.C meters.

ELECTRONICS LAB

LIST OF EXPERIMENTS

1. Study of CRO

   (A) Measurement of AC and DC voltages

   (B) Frequency and phase measurements (using Lissajou's figures)

2. Verification of Kirchoff's Voltage and Current Laws

   Determine the voltage and current in given circuits using Kirchoff"s laws theoretically and verify the laws experimentally.

3. Characteristics and applications of PN junction diode. Forward and Reverse characteristics of PN junction diode.

   Application of Diode as Half wave Rectifier – Measurement of ripple factor with and without capacitor filter

4. Frequency Response of RC Coupled Amplifiers

   Determination of frequency response of given RC coupled amplifier - Calculation of bandwidth.

5. Study of Logic Gates

   (A) Verification of Demorgan's theorems

   (B) Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR, EX-NOR gates and Flipflops - JK, RS, T and D

   (C) Implementation of digital functions using logic gates and Universal gates.

T107 MATHEMATICS – II

OBJECTIVES

To develop the use of matrix algebra techniques for practical applications.

To introduce the concepts of Curl, Divergence and integration of vectors in vector calculus which is needed for many application problems.

To introduce Laplace transform which is a useful technique in solving many application problems and to solve differential and integral equations.

To acquaint the students with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic.

UNIT I – MATRICES

Eigenvalues and Eigen vectors of a real matrix, Characteristic equation, Properties of Eigenvalues and Eigenvectors. Cayley-Hamilton Theorem, Diagonalization of matrices. Reduction of a quadratic form to canonical form by orthogonal transformation. Nature of quadratic forms.

UNIT II – VECTOR CALCULUS

Gradient, divergence and curl, their properties and relations. Gauss divergence theorem and Stoke's theorem (without proof). Simple application problems.

UNIT III – LAPLACE TRANSFORM

Definition, Transforms of elementary functions, properties. Transform of derivatives and integrals. Multiplication by t and division by t. Transform of unit step function, transform of periodic functions. Initial and final value theorems.

UNIT IV – APPLICATIONS OF LAPLACE TRANSFORM

Methods for determining inverse Laplace Transforms, convolution theorem, Application to differential equations and integral equations. Evaluation of integrals by Laplace transforms.

UNIT V – FOURIER TRANSFORM

Fourier Integral theorem (statement only), Fourier transform and its inverse, properties. Fourier sine and cosine transforms, their properties, convolution and Parseval's identity.

Text books

1. Venkataraman M.K., Engineering Mathematics, National Publishing Company, Chennai, 2012
2. Kandasamy P. et al, Engineering Mathematics, Vol.2 & 3, S. Chand & Co., New Delhi.

Reference Books

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 41st Edition, 2011.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New Delhi.
5. Bali N. and Goyal M., Advanced Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 7th Edition, 2010.

T108 MATERIAL SCIENCE

OBJECTIVES:

To understand the importance of Material Science as a subject that revolutionized modern day technologies

To understand the significance of material science in the development of new materials and devices for all branches of Engineering

To impart knowledge to the Engineering students about some of the important areas of Materials Science so as to enable them perceive the significant contributions of the subject in Engineering and Technology

UNIT I - CRYSTAL STRUCTURE AND LATTICE DEFECTS

Crystal structure - Bravais Lattices , Crystal Systems - Coordination Number, Atomic Radius, Packing Factor for FCC & HCP structures – Miller Indices- Powder X Ray Diffraction Method

Lattice defects – Qualitative ideas of point, line, surface and volume defects

UNIT II – DIELECTRIC PROPERTIES

Dielectric Polarization and Mechanism –Temperature dependence of polarization, Internal or local Field - Clausius-Mossotti relation. Basic ideas of Dielectric loss - frequency dependence of dielectric constant – Measurement of Dielectric constant and loss using Scherring bridge – Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric materials and Applications

UNIT III – MAGNETIC PROPERTIES

Origin of atomic magnetic moment – Bohr magneton-Elementary Ideas of classification of magnetic materials (Dia, Para, Ferro, antiferro & Ferri). – Quantum theory of Para & Ferro Magnetism – Domain Theory of Hysteresis – Heisenberg Theory of Exchange Interaction (without derivation) – Qualitative ideas of Anti ferromagnetic Ordering – Structure and Properties of Ferrites – Properties of Soft & Hard Magnetic Materials – Applications. Magnetic data storage – Magnetic tapes, Hard disks, Magneto optical recording

UNIT IV – SEMICONDUCTORS AND SUPERCONDUCTORS

Semiconductors -Derivation of Carrier concentration in intrinsic Semiconductors –Basic ideas of Electrical conductivity in intrinsic and extrinsic semiconductors (without derivations) -temperature dependence of carrier concentration and electrical conductivity in semiconductors (qualitative ideas), Hall effect in Semiconductors -- Application of Hall Effect, Basic Ideas of Compound Semiconductors (II-VI & III-V)

Superconductivity - Basic concepts – transition temperature – Meissener effect – Type I and II superconductors – High Temperature Superconductors – 123 superconductor – Applications of superconductors.

UNIT V – ADVANCED MATERIALS

Liquid Crystals – Types – Application as Display Devices

Metallic Glasses – preparation by melt spinning. Twin roller system, properties and applications

Shape Memory alloys (SMA), Shape memory effect, Properties and applications of SMA *Nanomaterials*- Nano materials (one, Two & three Dimensional) –Methods of synthesis (PVD, CVD, Laser Ablation, Solgel, Ball-milling Techniques), Properties and applications of nanomaterials. carbon nanotubes– synthesis, Properties and applications.

Text books

1. V Rajendran, Engineering Physics, *2nd Edition*, TMH, New Delhi *2011.*

Reference Books

1. Ali Omar M, Elementary Solid State Physics, Addison Wesley Publishing Co., 2009.
2. William D Callister Jr., Material Science and Engineering, 6th Edition, John Wiley and sons, 2009.
3. Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley & sons, Singapore, 2007.
4. V Raghavan , Materials Science and Engineering- A First Course, 5th Edition, Prentice Hall of India, 2008.
5. B.S. Murty, P. Shankar, Baldev Raj, B.B. Rath, and James Murday, Text book of Nanoscience and Nanotechnology, Universities Press, Hyderabad 2012
6. M.N. Avadhanulu, Enginerring Physics- Volume-II, S.Chand &Co, New Delhi, 2009
7. Pillai S.O, Solid State Physics, 6th Edition – New Age International, 2005.

T109 ENVIRONMENTAL SCIENCE

OBJECTIVES

To know about the environment

To understand about environmental pollution

To apply the knowledge in understanding various environmental issues and problems

UNIT I – ENVIRONMENT AND ENERGY RESOURCES

Environmental segments – atmosphere, hydrosphere, lithosphere and biosphere. Atmospheric layers. Pollution definition and classification. Pollutants classification. Forest resources – use and over exploitation, deforestation, forest management. Water resources – use and conflicts over water, dams – benefits and problems. Mineral resources – mineral wealth of India, environmental effects of extracting and using mineral resources. Food resources – world food problems, environmental impact of modern Agriculture – fertilizer and pesticides. Energy resources – growing needs, renewable and non-renewable energy resources and use of alternate energy sources. From unsustainable to sustainable development.

UNIT II - ECOSYSTEM AND BIODIVERSITY

Concept of an ecosystem - structure and function of an ecosystem.Producers, consumers, and decomposers.Energy flow in the ecosystem. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of forest, grassland, desert and aquatic (fresh water, esturine and marine) ecosystems. Biodiversity – definition, genetic species and ecosystem diversity. Value of biodiversity - consumptive use, productive use, social, ethical, aesthetic and option values. Hot spots of biodiversity. Threats to biodiversity, habitat loss, poaching of wildlife, human wildlife conflicts. Endangered and endemic species. Conservation of biodiversity – in-situ and ex-situ conservation of biodiversity.

UNIT III - AIR POLLUTION

Definition and classification. Chemical and photochemical reaction in different layers of atmosphere. Causes, sources, effects and control measures of air pollutants - oxides of Nitrogen, oxides of Carbon, oxides of Sulfur, hydrocarbons, chloro-fluoro carbons and particulates. Mechanism and effects of air pollution phenomenon – Global Warming, Ozone Depletion, Acid Rain, Sulfurous Smog and Photochemical Smog.

UNIT IV- WATER AND LAND POLLUTION

Water pollution – causes and effects of organic water pollutants – pesticides, insecticides, detergents and surfactants. Causes and effects of inorganic water pollutants – heavy metal pollution due to Hg, Pb, Cr & Cu. Water pollution control and monitoring – DO, COD, BOD & TOC. Land Pollution – Solid waste management – causes, effect and control measures of urban and industrial wastes. Thermal and radioactive pollution.

UNIT V -POLLUTION CONTROL AND MONITORING

Basic concepts and instrumentation of IR, UV-VIS, atomic absorption spectrometry, Gas Chromatography and Conductometry. Analysis of air pollutants – NO_x, CO_x, SO_x, H_2S, Hydrocarbons and particulates.

Text Books:

1. K. Raghavan Nambiar, "Text Book of Environmental Studies" 2nd Ed, Scitech Publications (India) Pvt Ltd, India, 2010 (For Units I & II)
2. A. K. De, "Environmental chemistry" 7th Ed; New age international (P) Ltd, New Delhi, 2010. (For Units III, IV & IV)

Reference Books:

1. B.K. Sharma, "Environmental chemistry" 11th Ed, KRISHNA Prakashan Media (P) Ltd, Meerut, 2007.
2. S.S.Dara, and D.D. Mishra "A text book of environmental chemistry and pollution control, 5th Ed, S.Chandand Company Ltd, New Delhi, 2012.
3. Richard T. Wright, Environmental Science: Toward a Sustainable Future, 10th edition, Prentice Hall, 2008
4. G. S. Sodhi, Fundamental concepts of environmental chemistry, I Ed, Alpha Science International Ltd, India, 2000.

T110 BASIC CIVIL AND MECHANICAL ENGINEERING

OBJECTIVES

To be able to differentiate the types of buildings according to national building code.

To understand building components and their functions as well as different types of roads, bridges and dams

To explain the concepts of thermal systems used in power plants and narrate the methods of harnessing renewable energies

To explain the role of basic manufacturing processes

To develop an intuitive understanding of underlying working principles of mechanical machines and systems.

PART-A CIVIL ENGINEERING

UNIT I - BUILDINGS, BUILDING MATERIALS

Buildings-Definition-Classification according to NBC-plinth area, Floor area, carpet area, floor space index-construction materials-stone, brick, cement, cement-mortar, concrete, steel- their properties and uses.

UNIT II - BUILDINGS AND THEIR COMPONENTS

Buildings: Various Components and their functions. Soils and their classification. Foundation: function and types. Masonry- function and types. Floors: definition and types of floors. Roofs: definition f and types.

UNIT III - BASIC INFRASTRUCTURE

Surveying: classification, general principles, types, Uses, instruments used. Roads-types: components, types and their advantage and disadvantages. Bridges: components and types of bridges. Dams: Purpose, types of dams. Water supply-sources and quality requirements, need and principles of rainwater harvesting.

PART - B MECHANICAL ENGINEERING

UNIT - IV INTERNAL AND EXTERNAL COMBUSTION SYSTEMS

IC engines – Classification – Working principles - Diesel and petrol engines: two stroke and four stroke engines – Merits and demerits.

Steam generators (Boilers) – Classification – Constructional features (of only low pressure boilers) – Boiler mountings and accessories – Merits and demerits - Applications.

UNIT - V POWER GENERATION SYSTEMS

Conventional and Non-Conventional: Hydraulic – Thermal – Nuclear power plants – Schemes and layouts (Description Only)
Solar – wind –Geothermal - Wave – Tidal and Ocean Thermal Energy Conversion systems – Basic power plant schemes and layouts (Description only).

UNIT - VI MANUFACTURING PROCESSES

Machines – Lathe – Drilling – Bending – Grinding – Shearing (Description only)
Machining Processes – Turning – Planning – Facing – Blanking – Drilling – Punching – Shearing – Bending – Drawing – Filing – Sawing – Grinding.

Moulding and Metal Joining - Pattern making – Green and dry sand moulding – Arc and Gas welding – Brazing – Soldering (process description only).

Text Books

1. Natarajan, K V, Basic Civil Engineering, 11th Edition, Dhanalakshmi Publications Chennai, 2011. (For Units I to III)
2. Venugopal , K and Prabhu Raja, Basic Mechanical Engineering, Anuradha Publisher , 2012(For Units IV to VI)

Reference Books

1. Purushothama Raj.P., Basic civil engineering, 3rd Edn., Dhanam Publications, Chennai, 2001
2. Rajput, R K, Engineering Materials, S Chand & Co. Ltd., New Delhi, 2012.
3. Punmia, B.C., et. al., Surveying , Vol-I, Laxmi Publishers, New Delhi, 2012.
4. Punmia, B.C., et.al Building Construction, Laxmi Publishers, New Delhi ,2012.
5. El.Wakil, M.M., Power Plant Technology, Mc Graw Hill Book Co.,1985.
6. Hajra Choudhry, et. al., Workshop Technology Vol I and II, Media Promoters Publishers Pvt. Ltd., Bombay, 2004.
7. Lindberg, R.A.Process and Materials of Manufacture, PHI, 1999.
8. H.N.Gupta, R.C.Gupta and Arun Mittal, Manufacturing Processes, New Age Publications, 2001
9. Nagpal, Power Plant Engineering, Khanna Publishers, Delhi, 1998.

T111 ENGINEERING MECHANICS

OBJECTIVES

To understand the vector and scalar representation of forces and moments, static equilibrium of particles and rigid bodies in two dimensions

To comprehend the effect of friction on equilibrium

To understand the laws of motion, the kinematics of motion and the interrelationship and to learn to write the dynamic equilibrium equation

To emphasis the concepts through solved examples

UNIT I - FUNDAMENTAL OF MECHANICS

Basic Concepts Force System and Equilibrium, Definition of Force, Moment and Couple, Principle of Transmissibility, Varignon's theorem, Resultant of force system – Concurrent and non concurrent coplanar forces, Condition of static equilibrium for coplanar force system, stability of equilibrium, , applications in solving the problems on static equilibrium of bodies.

UNIT II – PRACTICAL APPLICATION OF FORCE SYSTEM

Structural member: definition, Degree of freedom, concept of free body diagrams, types of supports and reactions, types of loads, Analysis of Trusses-method of joints, method of sections.

Friction: Introduction, Static dry friction, simple contact friction problems, ladders, wedges.

UNIT III - PROPERTIES OF SURFACES

Properties of sections – area, centroids of lines, areas and volumes, moment of inertia first moment of inertia, second moment of inertia and product moment of inertia, polar moment of inertia, radius of gyration, mass moment of inertia.

UNIT IV - KINEMATICS AND KINETICS OF PARTICLES

Equations of motion - Rectilinear motion, curvelinear motion, Relative motion, D'Alembert's principle, work- Energy equation – Conservative forces and principle of conservation of energy, Impulse – momentum, Impact – Direct central impact and oblique central impact.

UNIT V - KINEMATICS AND KINETICS OF RIGID BODIES

Plane motion, Absolute motion, Relative motion, translating axes and rotating axes, work and energy, impulse and momentum

Text Books

1. Rajesekaran, S and Sankara Subramanian., G., Engineering Mechanics, Vikas Publishing House Private Ltd., 2012.

Reference Books

1. Palanichamy, M.S. Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw-Hill,2011.

2. Beer, F.P and Johnson Jr. E.R, Vector Mechanics for Engineers, Vol. 1 Statics and Vol.2 Dynamics, McGraw – Hill International Edition, 1997.

3. Bhavikatti,S.S and K.G.Rajashekarappa, Engineering Mechanics, New Age International (P) Ltd, New Delhi,2010

T112 COMMUNICATIVE ENGLISH

OBJECTIVES

To improve the LSWR skills of I B.Tech students

To instill confidence and enable the students to communicate with ease

To equip the students with the necessary skills and develop their language prowess

UNIT I – BASIC COMMUNICATION THEORY

Importance of Communication – stages of communication, modes of communication – barriers to communication – strategies for effective communication – Listening: Importance, types, barriers – Developing effective listening skills.

UNIT II – COMPREHENSION AND ANALYSIS

Comprehension of technical and non-technical material – Skimming, scanning, inferring-Note making and extension of vocabulary, predicting and responding to context-Intensive Reading and Reviewing

UNIT III – WRITING

Effective sentences, cohesive writing, clarity and conciseness in writing – Introduction to Technical Writing – Better paragraphs, Definitions, Practice in Summary Writing – Four modes of writing – Use of dictionaries, indices, library references – making bibliographical entries with regard to sources from books, journals, internet etc.

UNIT IV – BUSINESS WRITING / CORRESPONDENCE

Report writing – Memoranda – Notice – Instruction – Letters – Resumes – Job applications

UNIT V – ORAL COMMUNICATION

Basics of phonetics – Presentation skills – Group Discussions – Dialogue writing – Short Extempore – Debates-Role Plays-Conversation Practice

Text Book

1. Robert J.Dixson. ,Complete Course in English, Prentice-Hall of India Pvt. Ltd., New Delhi,2006.

Reference Books

1. Ashraf M.Rizvi., Effective Technical Communication. Tata-McGraw, 2005.
2. Boove, Courtland R et al., Business Communication Today. Delhi. Pearson Education,2002.
3. Meenakshi Raman and Sangeeta Sharma., Technical Communication Principles And Practice,OUP, 2007.
4. Robert J.Dixson., Everyday Dialogues in English, Prentice-Hall of India Pvt. Ltd., New Delhi,2007.
5. Sethi,J and Kamalesh Sadanand., A Practical Course in English Pronunciation, Prentice-Hall of India Pvt. Ltd, New Delhi,2007.

P104 PHYSICS LABORATORY

OBJECTIVES

To provide a practical understanding of some of the concepts learnt in the theory course on Physics.

LIST OF EXPERIMENTS (ANY 10 EXPERIMENTS)

1. Thermal conductivity – Lee's DISC
2. Thermal conductivity - Radial flow
3. Spectrometer – Prism or Hollow prism
4. Spectrometer – Transmission grating
5. Spectrometer - Ordinary & Extraordinary rays
6. Newton's rings
7. Air – wedge
8. Half shade polarimeter – Determination of specific rotatory power
9. Jolly's experiment – determination of α
10. Magnetism: i – h curve
11. Field along the axis of coil carrying current
12. Vibration magnetometer – calculation of magnetic moment & pole strength
13. Laser experiment: wavelength determination using transmission grating, reflection grating (vernier calipers) & particle size determination
14. Determination of optical absorption coefficient of materials using laser
15. Determination of numerical aperture of an optical fiber
16. Electrical conductivity of semiconductor – two probe / four probe method
17. Hall effect in semiconductor

P105 CHEMISTRY LABORATORY

OBJECTIVES

To gain a practical knowledge of Engineering Chemistry in relevance to Industrial applications

LIST OF EXPERIMENTS (ANY 10 EXPERIMENTS)

1. Determination of dissolved oxygen in water.
2. Determination of total hardness of water by EDTA method.
3. Determination of carbonate and bicarbonate in water.
4. Estimation of chloride content in water.
5. Estimation of magnesium by EDTA.

6. Estimation of acetic acid in vinegar.
7. Estimation of ferrous by permanganometry.
8. Estimation of ferrous and ferric iron in a solution mixture by dichrometry.
9. Estimation of available chlorine in bleaching powder.
10. Estimation of copper in copper sulphate solution.
11. Estimation of calcium by permanganometry.
12. Estimation of iron by colorimetry.

DEMONSTRATION EXPERIMENTS (ANY TWO OF THE FOLLOWING)

1. Determination of COD of water sample.
2. Determination of lead by conductometry.
3. Percentage composition of sugar solution by viscometry.

P106 WORKSHOP PRACTICE

OBJECTIVES

To convey the basics of mechanical tools used in engineering
To establish hands on experience on the working tools
To develop basic joints and fittings using the hand tools
To establish the importance of joints and fitting in engineering applications
To explain the role of basic workshop in engineering
To develop an intuitive understanding of underlying physical mechanism used in mechanical machines.

Sl. No.	Trade	List of Exercises
1.	Fitting	Study of tools and Machineries. Exercises on symmetric joints and joints with acute angle.
2.	Welding	Study of arc and gas welding equipment and tools – Edge preparation – Exercises on lap joint and V Butt joints – Demonstration of gas welding
3	Sheet metal work	Study of tools and Machineries – exercises on simple products like Office tray and waste collection tray.
4.	Carpentry	Study of tools and Machineries – Exercises on Lap joints and Mortise joints

LIST OF EXERCISES

I Fitting

1. Study of tools and Machineries
2. Symmetric fitting
3. Acute angle fitting

II Welding

1. Study of arc and gas welding equipment and tools
2. Simple lap welding (Arc)
3. Single V butt welding (Arc)

III Sheet metal work

1. Study of tools and machineries
2. Frustum
3. Waste collection tray

IV Carpentry

1. Study of tools and machineries
2. Half lap joint
3. Corner mortise joint.

P107 NCC / NSS

NCC/NSS training is compulsory for all the Undergraduate students

1. The above activities will include Practical/field activities/Extension lectures.
2. The above activities shall be carried out outside class hours.
3. In the above activities, the student participation shall be for a minimum period of 45 hours.
4. The above activities will be monitored by the respective faculty incharge and the First Year Coordinator.
5. Pass /Fail will be determined on the basis of participation, attendance, performance and behavior. If a candidate Fails, he/she has to repeat the course in the subsequent years
6. Pass in this course is mandatory for the award of degree.

Subject Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
MA T31	**MATHEMATICS III (Common to all branches of B.Tech.)**	3	1	-

Course Objectives:

1. To provide the concepts of functions of a complex variable, conformal mapping, complex integration, series expansion of complex functions, Harmonic analysis and Fourier series.
2. To make the students understand and work out problems of constructing analytic functions, conformal mapping, bilinear transformation, contour integration and expanding functions into Fourier series including Harmonic analysis.

Course Outcomes:

On successful completion of the module students will be able to:

- Understand the concepts of function of a complex variable and complex integration and apply these ideas to solve problems occurring in the area of engineering and technology.
- Expand functions into Fourier series which are very much essential for application in engineering and technology.

UNIT I

Function of a complex variable: Continuity, derivative and analytic functions – Necessary conditions– Cauchy-Riemann equations (Cartesian and polar form) and sufficient conditions (excluding proof) – Harmonic and orthogonal properties of analytic function– Construction of analytic functions.

UNIT II

Conformal mapping – Simple and standard transformations like $w= z+c$, cz, z^2, e^z, $\sin z$,$\cosh z$ and $z+1/z$ –Bilinear transformation and cross ratio property (excluding Schwarz-Christoffel transformation).Taylor's and Laurent's theorem (without proof) –Series expansion of complex valued functions –classification of singularities.

UNIT III

Complex Integration: Cauchy's integral theorem and its application, Cauchy's integral formula and problems. Residues and evaluation of residues – Cauchy's residue theorem – Contour integration: Cauchy's and Jordan's Lemma (statement only)– Application of residue theorem to evaluate real integrals – unit circle and semicircular contour (excluding poles on boundaries).

UNIT IV

Fourier Series: Dirichlet's conditions – General Fourier series – Expansion of periodic function into Fourier series – Fourier series for odd and even functions – Half-range Fourier cosine and sine series – Change of interval – Related problems.

UNIT V

Root Mean Square Value – Parseval's theorem on Fourier Coefficients. Complex form of Fourier series – Harmonic Analysis.

Text Books:

1. Veerarajan T., Engineering Mathematics for first year, Tata-McGraw Hill, 2010.
2.Venkataraman M.K., Engineering Mathematics, Vol. II & III, National Publishing Company, Chennai, 2012.

Reference Books:

1. Kandasamy P. et al, Engineering Mathematics, Vol. II & III, S. Chand & Co., New Delhi, 2012.
2. Bali N.P., Manish Goyal, "Engineering Mathematics, 7th Edition, Laxmi Publications, 2007.
3. Grewal B.S., Higher Engineering Mathematics, 40th Edition, Khanna Publishers, Delhi 2007.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 7Th Edition, Wiley India, 2007.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T32	ELECTRIC CIRCUIT ANALYSIS (COMMON TO ICE & EIE)	**3**	**1**	**0**

Course Objectives:

- To analyze electrical circuits using KCL and KVL
- To learn network theorems and apply them for circuit analysis
- To study resonance and coupled circuits
- To study two port parameters
- To study transient analysis of RC,RL,RLC circuits

Course Outcomes: .

- Analyse DC And AC circuits
- Design resonant and tuned circuits
- Find the transient response of RC, RL and RLC circuits
- Find the two port parameters of the circuits

Syllabus:

UNIT 1

BASICS OF CIRCUIT ANALYSIS: Voltage– Current relationship for passive elements- Review of Kirchhoff's laws- Network reduction techniques, Steady state analysis of R, L and C (in series, parallel and series parallel combinations) with sinusoidal excitation- power factor, Real and Reactive powers, Complex and Polar forms of representation, Complex power.

UNIT II

NETWORK THEOREMS FOR DC AND AC CIRCUITS: Review of loop and nodal methods of analysis, star-to-delta or delta-to-star transformation, Source transformation, Superposition theorem, Thevenin's theorem, Norton's theorem, reciprocity theorem, compensation theorem, Maximum power transfer theorem, Millman's theorem and Tellegen's theorem applied to dc and ac circuits.

UNIT – III

RESONANCE, COUPLED CIRCUITS, AND THREE PHASE CIRCUITS*:*

Resonance **–** Series and parallel resonance circuits- Concept of band width and Q factor.

Coupled Circuits: Faraday's laws of electromagnetic induction – Concept of self and mutual inductance – dot convention – coefficient of coupling**.**

Three phase circuits: Phase sequence – Star and delta connection – Relation between line and phase voltages and currents in balanced systems – Analysis of balanced and Unbalanced 3 phase circuits – two watt meter method to measure power and power factor.

UNIT – IV

TRANSIENT ANALYSIS: Initial conditions in elements, Transient response of R-L, R-C, R-L-C circuits (Series combinations only) step and sinusoidal excitations -Solution using differential equation approach and Laplace transform methods of solutions.

UNIT – V

NETWORK FUNCTIONS AND PARAMETERS: Network functions: The concept of complex frequency- concept of transformed network- driving point impedance and admittance-transfer function-poles and zeros. RC filters-lowpass, highpass , band pass and band reject filters-frequency response- Z, Y, ABCD, hybrid parameters and their relations– 2-port network parameters using transformed variables.

Text Books:

1. P. Ramesh Babu, "Circuit theory" Second Edition, Scitech Publications Pvt. Ltd, 2014
2. M.E.Van Valkenburg "Network Analysis", Third Edition, Prentice-Hall, 1980

Reference Books:

1. William Hayt and Jack E. Kimmerly, "Engineering circuit analysis" McGraw Hill Company, 8th edition. 2013
2. N.C. Jagan & C.Lakshminarayana, 'Network Theory' B.S Publications, 2006.
3. Kuriakose, "Circuit Theory", PHI Learning, 2005

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T33	ELECTRONIC DEVICES AND CIRCUITS	4	0	0

Course Objectives:

- Be familiar with the structure of basic electronic devices.
- Be exposed to the operation and applications of electronic devices

Course Outcomes

On successful completion of the module students will be able to:

- Analyse the function of various semiconductor devices.
- analyze and design amplifier circuits, oscillators and filter circuits employing BJT, FET devices.

UNIT I PN JUNCTION DEVICES

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

UNIT II TRANSISTORS

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

UNIT III 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 IV 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)., Power MOSFET

UNIT V 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.

TEXT BOOK

1. David A. Bell ,"Electronic devices and circuits", Prentice Hall of India, fifth edition, 2008.
2. Sedra and smith, "Microelectronic circuits " Oxford University Press, sixth Edition, 2013.

REFERENCE BOOKS

1. Rashid, “Micro electronic circuits” Thomson publications, 1999.
2. Floyd, “Electron devices” Pearson Asia 5th Edition, 2001.
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.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T34	**HUMAN ANATOMY & PHYSIOLOGY**	**4**	**0**	**0**

Course Objective :

Upon completion of this course, students should be able to:

- Qualitatively and quantitatively describe each system of the human body covered in this course: integumentary, skeletal, muscular, nervous, sensory, and endocrine.
- Qualitatively and quantitatively describe the normal function of the components of these systems on the organ and cellular level.
- Integrate a basic knowledge of chemistry and biochemistry with human physiology.
- Describe and explain the correlation of the systems covered with each other and their contributions to homeostasis.

Course Outcomes:

On successful completion of this module the learner will be able to

- Identify the different types of tissues found within the body and the describe the function of each.
- Describe the structure and components of the different body systems
- Outline the physiological processes that occur within each of the different body systems and the effects of disease upon them.
- Explain how each organ system contributes to the functioning of the body
- Perform practicals and write reports illustrating physiological processes

Syllabus

UNIT I:

Structure and function of Cell & cellular components – Membrane Potential – Action Potential – Generation and Conduction. Blood Cell – Composition – Fluid and electrolytic balance - Blood Groups – Estimation of RBC, WBC and platelet.

Overview of Immune system – Immune response – models of immune response – Autoimmune diseases.

UNIT II

Cardiovascular system – Heart and vascular system – ECG – Blood Pressure – Homeostasis –Cardiac output – Coronary and Peripheral Circulation – Heart Sounds

Nervous System – Structure and functions of Neurons, Synapse, Reflex action and Receptors – Velocity of Conduction of Nerve Impulses – Nervous control of Heart.

UNIT III

Musculo Skeletal System – Muscle Tissue, Structure of Skeletal Muscle, Types of Muscle, Types of Joints, Major Muscles of Limbs and their actions.

Respiratory system - Physiological aspects of respiration - Exchange of gases – Regulation of Respiration. Disturbance of respiration function. Pulmonary function test – Artificial respiration – Cardio-pulmonary

Resuscitation.

UNIT IV

Gastro Urinal system, Digestion and absorption – Movement of GI tract – Structure and function of kidneys and Nephron – Mechanism of Urine formation – Urine Reflex – Skin and Sweat Gland – Temperature regulation.

UNIT V

Optics of Eye – Retina - Photochemistry of Vision – Accommodation Neurophysiology of Vision – EOG. Structure and functions Internal Ear - Mechanism of Hearing – Auditory pathway, Hearing Tests.

TEXT BOOKS:

1. Sujit K.Chaudhuri – Concise Medical Physiology – New Central Book agency, 1997
2. Arthur.C.Guyton – Textbook of Medical Physiology – Prism Book (p) Ltd. 1996.
3. CL.Ghai – A textbook of Practical physiology – 5th Ed Jaypee Medical Publishers, 2003
4. Sarada Subramanyam, K.Madhavan Kutty and H.D.Singh – Text book of 'Human Physiology – S.Chand & Company, 1996

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T35	**DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING** (Common to ICE and EIE branches)	**4**	**0**	**0**

Course Objectives

1. To acquaint students with data structures used when programming for the storage and manipulation of data.
2. The concept of data abstraction and the problem of building implementations of abstract data types are emphasized.
1. To understand the concepts of object oriented programming
2. To expertise the programming skills through C++ language

Course Outcomes:

On successful completion of the module students will be able to:

1. Select of relevant data structures and combinations of relevant data structures for the given problems in terms of memory and run time efficiency.
2. Apply data abstraction in solving programming problems.
3. An ability to conceptualize the problem in terms of object oriented features
4. An ability to use the OO programming techniques(C++) in developing applications.
5. An ability to design and develop a complete object oriented applications

UNIT-I : SEARCHING AND SORTING

Introduction to Algorithm – Programming principles – Creating programs- Analyzing programs. Arrays: One dimensional array, multidimensional array. Pointers - Searching: Linear search, Binary Search. Sorting techniques: Internal sorting - Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Merge Sort and Radix Sort.

UNIT II - STACK, QUEUE and LINKED LIST

Stacks: Definition – operations - applications of stack. Queues: Definition - operations - Priority queues - De queues – Applications of queue. Linked List: Singly Linked List, Doubly Linked List, Circular Linked List, linked stacks, Linked queues, Applications of Linked List.

UNIT III : DYNAMIC STORAGE MANAGEMENT

- Trees: Binary tree, Terminology, Representation, Traversals, Applications
Graph: Terminology, Representation, Traversals – Applications - spanning trees, shortest path Introduction to Hash tables.

UNIT IV: PRINCIPLES OF OBJECT ORIENTED PROGRAMMING

Principles of Object Oriented Programming - Beginning With C++ - Tokens-Expressions-control Structures – Functions in C++, classes and objects, constructors and destructors ,operators overloading and type conversions .

UNIT V: ADVANCED OBJECT ORIENTED PROGRAMMING

Inheritance: Extending classes, Pointers, Virtual functions and polymorphism, File Handling Operations

TEXT BOOKS

1. Ellis Horowitz and SartajSahni, “Fundamentals of Data Structures”, Galgotia Book Source, Pvt. Ltd., 2004
2. D. Samanta, “Classic Data Structures”, Second Edition, Prentice-Hall of India, Pvt. Ltd., India 2012.
3. E. Balagurusamy, “ Object Oriented Programming with C++”, McGraw Hill Education (India)Private Limited, 6th Edition 2013

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REFERENCES

1. 1. Robert Kruse, C.L. Tondo and Bruce Leung, “Data Structures and Program Design in C”, Prentice-Hall of India, Pvt. Ltd., Second edition, 2007.
2. Seymour, “Data Structures”, The McGraw-Hill, 2007.
3. Jean – Paul Tremblay & Paul G.Sorenson, An Introduction to data structures with applications, Tata McGraw Hill edition, II Edition, 2002.
4. Bjarne Stroustrup, The C++ Programming Language, Addison Wesley, 2000
5. Robert Lafore, Object oriented programming in C++, Galgotia Publication

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T36	BIOCHEMISTRY	**4**	**0**	**0**

Course Objectives:

- To describe the molecular & functional organisation of a cell & list its sub-cellular & components.
- Delineate structure, function & interrelationship of various biomolecules & consequences of deviation from normal.
- Summarise the fundamental aspects of enzymology & clinical applications wherein regulation of enzymatic activity is altered.

Course Outcomes:

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

- Show core knowledge of the molecular and genetic basis of cancer.
- Demonstrate an in-depth knowledge of the molecular and cell biology of cancer cells.
- Use research skills including the ability to design experiments, use appropriate statistical methods, analyse and interpret data and critically review the scientific literature.
- Demonstrate effective use of transferable skills in oral presentation, report writing and the use of information technology.

Syllabus

UNIT I

Biochemistry of living cell, Sub cellular fractionation using the differential centrifugation method. Function of each organelle Redox Potential, Oxidative Phosphorylation, Transport of substances across biological membrane. NUCLEIC ACID: Composition and Function, Genes, Outline of DNA Structure, Re-Combinant DNA and its applications.

UNIT II

Enzymes: Chemical Nature, General Properties, Spectrophotometric measurement of enzymes, Isolation techniques, Diagnostic enzymes. Enzyme biotechnology. Hormones: Chemical Nature, Properties of hormones, Hormonal Assay and their Significance.

UNIT III

Carbohydrate – Classification, Metabolism of carbohydrate and its dysfunction. Uses of Carbohydrates. Lipids: Classification, Metabolism of lipids, Cholesterol, bile acids, Transport of lipids, Lipid metabolism dysfunction. Protein: Classification, Amino acids, Chromatography, electrophoresis and architecture of protein molecules.

UNIT IV

Liver Function tests, Renal Function Tests, Blood gas Analysis, Measurement of Electrolytes. Their abnormal and Normal Values and Conditions. Biochemistry of Urine and Stools testing.

UNIT V

Principles and Application of Photometry, Spectrophotometry, Flurometry, Flame Photometry,

Densitometry, Calorimetry, Automation in Clinical Laboratory. Use of Isotopes in Biochemistry.

TEXT BOOK

1. Harper's review of biochemistry By David. W. Martin, Peter. A. Mayes , Victor. W. Rodwell LANGE medical publications, 2003.
2. Practical Biochemistry – Principles & Techniques, Keith Wilson & John Walker. Oxford university press.

REFERENCE BOOKS

1. Understanding Enzymes By Trevor palmer. Published by Ellis Horwood LTD.
2. Biochemistry Lippincott's Illustrated Reviews By Pamela.C.Champe & Richard.A.Harvey. Lippincott-Raven publishers, 3rd edition, 2006.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P31	**ELECTRONIC DEVICES AND CIRCUITS LAB**	**0**	**0**	**3**

Syllabus:

Any ten experiments (including PSPICE simulation)

1. PN Junction diode and Zener diode characteristics
2. FET characteristics
3. SCR, DIAC and TRIAC characteristics
4. Measurement of h parameters of transistor in CB, CE, CC configurations
5. Rectifier with and without filters (Full wave & Half wave)
6. CE Amplifier and CC amplifiers
7. Single stage R-C coupled Amplifier.
8. FET amplifier (Common Source)
9. Wien Bridge and RC Phase Shift Oscillators
10. Hartley and Colpitts Oscillators.
11. Clippers and Clampers
12. RC wave shaping circuits

LAB REQUIREMENT FOR A BATCH OF 20 STUDENTS:

1.Semiconducter devices like Diode, Zener Diode, NPN Transistors, JFET, SCR, DIAC and TRIAC
2. Resistors, Capacitors and inductors
3. Function Generators 10
5. Regulated 3 output Power Supply 5, ± 15V 10V
6. CRO 10
7. Storage Oscilloscope 1
8. Bread boards 10
9. Component data sheets to be provided
10. Digital Multimeters 10
11. Digital IC Tester (Analog) 2
12. Computers (PSPICE installed) 10

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P32	**BIOCHEMISTRY AND HUMAN PHYSIOLOGY LAB**	**0**	**0**	**3**

List of Experiments:

1. General tests for carbohydrates, proteins and lipids.
2. Preparation of serum and plasma from blood.
3. Estimation of blood glucose.
4. Estimation of creatinine
5. Estimation of urea
6. Estimation of cholesterol
7. Assay of SGOT/SGPT
8. Separation of proteins by SDS electrophoresis
9. Separation of amino acids by thin layer chromatography
10. Separation of DNA by agarose gel electrophoresis
11. ESR , PCV, MCH , MCV ,MCHC , total count of RBCs and hemoglobin estimation.

Biochemistry and Human physiology Lab:

LAB REQUIREMENT FOR A BATCH OF 20 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
Tuning fork (256Hz to 512Hz)	5 Nos.
Blood grouping kit	1 No

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P33	**DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING LAB** (Common to ICE and EIE branches)	**0**	**0**	**3**

(The following experiments (1-8) are to be implemented only in C Language)

1. Searching Techniques
2. Sorting Techniques
3. Imp Linked List and doubly linked and its applications
4. Stack and its applications
5. Binary tree traversal
6. Graph traversal
7. Spanning Tree
8. Shortest path algorithms

(The following experiments (9-12) are to be implemented only in C++)

9. Programs to implement classes and objects with constructors and destructors
10. Programs to implement different types of inheritances like multiple, Multilevel and hybrid.
11. Programs to implement virtual functions to demonstrate the use of run time polymorphism
12. Programs to implement Queue and its applications

.**List of equipments required for a batch of 20 students**

1. Personal computer with C and C++ compiler- 20 Nos

Subject Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
MA T41	**MATHEMATICS IV (Common to all branches of B.Tech.)**	3	1	-

Course Objectives:

1. Importance of problems in Partial Differential Equations
2. Problem solving techniques of PDE
3. To make the students knowledgeable in the areas of Boundary Value Problems like vibrating string (wave equation), heat equation in one and two dimensions.
4. To acquaint the students with the concepts of Theory of sampling.

Course Outcomes:

On successful completion of the module students will be able to:

- Understand the different types of PDE and will be able to solve problems occurring in the area of engineering and technology.
- Know sampling theory and apply to solve practical problems in engineering and technology.

UNIT I – PARTIAL DIFFERENTIAL EQUATIONS:

Formation by elimination of arbitrary constants and arbitrary functions – General, singular, particular and integrals – Lagrange's linear first order equation – Higher order differential equations with constant coefficients

UNIT II: Solution of partial differential equation by the method of separation of variables – Boundary value problems – Fourier series solution – Transverse vibration of an elastic string.

UNIT III: Fourier series solution for one dimensional heat flow equation – Fourier series solutions for two dimensional heat flow equations under steady state condition – (Cartesian and Polar forms).

UNIT IV – APPLIED STATISTICS

Curve fitting by the method of least squares – fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large samples test for single proportions, differences of proportions, single mean, difference of means and standard deviations.

UNIT V: Small samples – Test for single mean, difference of means and correlations of coefficients, test for ratio of variances – Chi-square test for goodness of fit and independence of attributes.

Text Books:

1. Venkataraman M. K, "Engineering Mathematics, Third year Part A& B", 12th Edition, The National Publishing Company, Madras 1996.
2. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and sons, 1975.

Reference Books:

1. Kandasamy P. et al, Engineering Mathematics, Vol. II & III, S. Chand & Co., New Delhi,2012.
2. GrewalB.S., Higher Engineering Mathematics, 40th Edition, Khanna Publishers, Delhi 2007.
3. Bali N.P., Manish Goyal, " Engineering Mathematics, 7^{th} Edition, Laxmi Publications, 2007.
4. Erwin Kreyszig,Advanced Engineering Mathematics, 7^{th}Edition, Wiley India, 2007.
5. Ray Wylie C. , Advanced Engineering Mathematics, 6^{th} Edition, Tata McGraw Hill, 2003

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T42	MEDICAL PHYSICS	**4**	**0**	**0**

Course Objectives:

- To develop basic understanding of medical physics concepts,
- Develop problem-solving and critical-thinking skills,
- Learn to integrate and apply various physics concepts to a single problem,
- Develop scientific communication skills.

Course Outcomes:

By the end of the course, students will be expected to be able to:

- Describe an imaging system and break it down into its components and physical principles, for each of the imaging modalities covered (x-ray, CT, NM, US, MRI),
- Identify the key factors that affect image quality and address these factors for the different imaging modalities,
- Learn to communicate the physical principles behind medical technology, radiation safety, and relevant applications.

Syllabus

UNIT I ELECTROMAGNETIC SPECTRUM AND ITS MEDICAL APPLICATION

Light- Physics of light, Intensity of light color vision and limits of vision sound - Normal sound levels – Ultrasound fundamentals- Generation of ultrasound (Ultrasound Transducer) Interaction of Ultrasound with Materials-Reflection and Refraction – Absorption and Scattering Non ionizing Electromagnetic Radiation Tissue as a leaky dielectric – Relaxation process- overview of non-ionizing radiation effects- low frequency effect- high frequency effect

UNIT II RADIOACTIVE DECAY

Spontaneous Emission – Isometric Transition - Gamma ray emission, alpha, beta, positron decay, electron capture Principles of Nuclear Physics – Natural radioactivity, Decay series, Half life period, type of radiation and their applications. Production of radionucleides – Cyclotron produced Radionuclide - Reactor produced Radionuclide – fission and electron Capture reaction, Radionuclide Generator – Milking Process - Linear accelerator, Radionuclide used in Medicine and technology.

UNIT III INTERACTION OF RADIATION WITH MATTER

Interaction of charged particles with matter – Specific ionization , linear energy Transfer Range, Bremsstrahlung , Annihilation Interaction of Gamma radiations with matter – Photoelectric effect, Compton Scattering , pair Production, Attenuation of Gamma Radiation, Interaction of neuron with matter

UNIT IV PHYSICS OF CARDIOPULMONARY SYSTEM

The Airways, - blood and lung interaction – measurement of lung volume – pressure air flow volume relationships of lungs – physics of alveoli – the breathing mechanism – Major components of cardiovascular system – O2 and CO2 exchange in the capillary system – Physical activity of heart –

transmural pressure – Bernoulli's principles applied to cardiovascular system - Blood flow – laminar and turbulent

UNIT V RADIATION EFFECTS

Acute Radiation Effects - The concept of LD 50 – Radiation syndromes- Central nervous system syndrome - Gastro-intestinal syndrome –Bone Marrow syndrome Delayed Effects of Radiation - Stochastic and Deterministic effects – Late Deterministic effect in different organs and tissues.

TEXT BOOKS

1. B.H Brown , PV Law ford, R H Small wood , D R Hose , D C Barber , "Medical Physics and Biomedical Engineering", CRC Press, 1999.
2. Gopal B.Saha "Physics and Radiobiology of Nuclear Medicine" Springer, 3rd ed, 2006.

REFERENCES

1. John R. Cameron and James G. Skofronick, "Medical Physics", John–Wiley & Sons, 978.
2. RF Farr and PJ Allisy-Roberts, "Physics for Medical Imaging" Saunders, 1997.
3. P.Uma Devi, A. Nagarathnam, B S Satish Rao, "Introduction to Radiation Biology" B.I
4. Churchill Livingstone pvt ltd, 2000.
5. S.Webb, "The Physics of Medical Imaging", Taylor and Francis, 1988.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T43	**DIGITAL LOGIC THEORY AND DESIGN** (Common to ICE and EIE branches)	**3**	**1**	**0**

Course Objectives:

To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions

- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits
- and sequential circuits
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concept of synchronous and asynchronous sequential circuits

Course Outcomes: .

- The students will be able to understand and design of digital circuit and its principle
- The students will be able to explain the working of various sequential circuits
- Understand the digital Logic families and relevant ICs and its usages
- The student will understand algorithmic state machines and threshold logic and its usages

UNIT I

MINIMIZATION TECHNIQUES AND LOGIC GATES

Number System and Boolean algebra: Review of Number systems and codes – Error detecting codes –Hamming Code- Boolean postulates and laws – De-Morgan's Theorem - Principle of Duality -Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) –Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions - Quine-McCluskey method ofminimization.

Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR-Implementations of Logic Functions using gates, NAND–NOR implementations– Multi level gateimplementations-
Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates

UNIT II COMBINATIONAL CIRCUITS

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor - Parallel binary adder,parallel binary Subtractor – Fast Adder - Carry Look Ahead adder – Serial Adder/Subtractor - BCD adder –Binary Multiplier – Binary Divider - Multiplexer/ Demultiplexer – decoder - encoder – parity checker – parity generators - code converters - Magnitude Comparator.

UNIT III SEQUENTIAL CIRCUITS

Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation

–Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – serial adder/subtractor- Asynchronous Ripple or serial counter – AsynchronousUp/Down counter - Synchronous counters – Synchronous Up/Down counters – Programmable counters –Design of Synchronous counters: state diagram- State table – State minimization –State assignment -Excitation table and maps-Circuit implementation - Modulo–n counter, Registers – shift registers -Universal shift registers – Shift register counters – Ring counter – Shift counters - Sequence generators.

UNIT IV SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS

Synchronous Sequential Circuits: General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits Asynchronous Sequential Circuits**:** Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines– Problems in Asynchronous Circuits – Design of Hazard Free Switching circuits.

UNIT V MEMORY DEVICES

Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM – EAPROM, RAM –RAM organization – Write operation – Read operation – Memory cycle - Timing wave forms – Memorydecoding – memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) Field Programmable Gate Arrays (FPGA) Implementation of combinational logic circuits using ROM, PLA, PAL.

Text Books:

M. Morris Mano, M.Michael Ciletti, Digital Design, 5th Edition, Pearson Education(Singapore) Pvt. Ltd., New Delhi, 2013.

Reference Books:

1. John F.Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006
2. John.M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2002.
3. Charles H.Roth. Fundamentals of Logic Design, Thomson Learning, 2003.
4. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 6th Edition, TMH, 2003.
5. William H. Gothmann, Digital Electronics, 2nd Edition, PHI, 1982.
6. Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2003
7. Donald D.Givone, Digital Principles and Design, TMH, 2003.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T44	**ELECTRICAL AND ELECTRONIC INSTRUMENTS** (COMMON TO ICE AND EIE BRANCHES)	**4**	**0**	**0**

Course Outcomes:

make the students to gain a clear knowledge of the basic laws governing the operation of electrical instruments and the measurement techniques.

- To have an adequate knowledge in the measurement techniques for current, voltage, power and energy.
- Elaborate discussion about potentiometer & instrument transformers.
- Detailed study of resistance and impedance measuring methods.
- An exposure is given to the student about signal generation and analysis.
- In-depth knowledge is given to the student about cathode ray oscilloscope.
- Emphasis is laid on display and recording devices

Course Outcomes: .

- The students will be able to understand and design of digital circuit and its principle
- The students will be able to explain the working of various sequential circuits
- Understand the digital Logic families and relevant ICs and its usages
- The student will understand algorithmic state machines and threshold logic and its usages

Syllabus:

UNIT I
MEASUREMENT OF VOLTAGE, CURRENT, POWER AND ENERGY
Galvanometers – Ballistic, D'Arsonval galvanometer – Theory, calibration, application – Principle, construction, operation and comparison of moving coil, moving iron meters, dynamometer, induction type & thermal type meter, rectifier type – Extension of range and calibration of voltmeter and ammeter– Errors and compensation Electrodynamometer type wattmeter – Theory & its errors – Methods of correction – LPF wattmeter – Phantom loading – Induction type KWH meter – Calibration of wattmeter, energy meter.

UNIT II
POTENTIOMETERS & INSTRUMENT TRANSFORMERS

DC potentiometer – Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer – Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications – Magnetic measurements – Ballistic Galvanometer, Grassot flux meter – testing of ring specimen – method of reversal and step by step method – testing of bar specimen – Hopkinson's permeameter – Iron loss measurement by Lloyd Fisher square. AC test on magnetic materials. Current Transformer and Potential Transformer construction, theory, operation, phasor diagram, characteristics, testing, error elimination – Applications.

UNIT III

RESISTANCE AND IMPEDANCE MEASUREMENT

Measurement of low, medium & high resistance – Ammeter, voltmeter method – Wheatstone bridge – Kelvin double bridge – Series and shunt type ohmmeter –High resistance measurement – Megger – Direct deflection methods – Price's guard-wire method – Loss of charge method – Earth resistance measurement. A.C bridges– Measurement of inductance, capacitance – Q of coil – Maxwell Bridge – Wein's bridge – Hey's bridge – Schering bridge – Anderson bridge – Campbell bridge to measure mutual inductance –Introduction to cable fault and eddy current measurement.

UNIT IV

SIGNAL GENERATORS AND ANALYZERS

Sine wave generator – Frequency synthesized sine wave generator. – Sweep frequency generator, pulse and square wave generator – Function generator – Wave analyzer – Applications. Simple function generator using LM566, Monolithic function generator using XR2206 – Harmonic distortion analyzer – Spectrum analyzer – Applications – Audio Frequency generator – Noise generator.

UNIT V

CATHODE RAY OSCILLOSCOPE, RECORDERS AND DISPLAYS

General purpose oscilloscope CRT -Dual beam & dual trace – Probes – Oscilloscope techniques – Special oscilloscopes – Storage oscilloscopes – Sampling oscilloscope. X-Y Plotters, magnetic tape recording, direct, digital recording, – Data loggers. Display devices : $3\frac{1}{2}$ digit 7 segment LED Display driver and decoder, Analog and digital millimeters, Principles of LED and LCD monitors – Annunciators, Numerics, Alphanumeric

TEXT BOOKS

1. David. A. Bell, Electronic Instrumentation and Measurement, Oxford University Press, Second Edition, 2009.

2. E.W.Golding & F.C.Widdis, 'Electrical Measurements & Measuring Instruments', Reem Publications Pvt. Ltd, 2011.

REFERENCE BOOKS

1.Patranabis, "Principles of Electronic Instrumentation" - PHI, 2007

2.Albert D. Helfrick & William D. Cooper, 'Modern Electronic Instrumentation & Measurement Techniques', Prentice Hall of India, 2002

3. B.M.Oliver and J.M.Cage, 'Electronic Measurements & Instrumentation', McGraw Hill International Edition, 1975.

5. Joseph. J. Carr, 'Elements of Electronic Instrumentation & Measurements', III edition, Pearson Education, 2003.

6. A.K. Sawhney, 'Electrical & Electronic Measurements and Instrumentation', Dhanpath Rai & Co (P) Ltd, 2004

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T45	LINEAR INTEGRATED CIRCUITS (Common to ICE and EIE branches)	**3**	**1**	**0**

Course Objectives:

- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To teach the theory of ADC and DAC
- To introduce the concepts of waveform generation and introduce some special function ICs.

Course Outcomes: . On successful completion of the module students will be able to:

- Design simple circuits like amplifiers using Opamps.
- Design waveform generating circuits
- Design simple filters circuits for particular application.
- Gain knowledge in designing stable voltage regulators.

Syllabus:

UNIT I

INTEGRATED CIRCUITS : Classification, chip size and circuit complexity, Fundamentals of Monolithic IC technology, basic planar processes, Fabrication of a typical circuit, Active and passive components of ICs, fabrication of FET, Thin and thick film technology.

OPERATION AMPLIFIER: basic information of Op-amp, ideal and practical Op-amp, Op-amp characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential mode.

UNIT II

OP-AMP APPLICATIONS : Basic application of Op-amp, instrumentation amplifier, ac amplifier, V to I and I to V converters, Precision rectifiers, log and antilog amplifiers, sample & hold circuits, multipliers and dividers, Differentiators and Integrators, Comparators, Schmitt trigger, Multivibrator, Triangular wave generator.

UNIT III

ACTIVE FILTERS, OSCILLATORS AND REGULATORS: Introduction-Low pass and High pass filters- Design of first and second order Butterworth lowpass and high pass filters Band pass, Band reject and all pass filters- Oscillator types and principle of operation – RC, Wien bridge oscillators triangular, saw-tooth, square wave and VCO- Introduction to voltage

regulators, features of 723, Three Terminal IC regulators- DC to DC Converter- Switching Regulators-UPS-SMPS.

UNIT IV

TIMERS & PHASE LOCKED LOOPS : Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger. PLL - introduction, block schematic, principles and description of individual blocks of 565-PLL applications, Analog and digital phase detectors.

UNIT V

D-A AND A- D CONVERTERS : Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC, dual slope ADC and Sigma delta ADC. DAC and ADC specifications. DAC 0800 and ADC 0804 pin diagram and applications

Text Books:

1 D. Roy Chowdhury, "Linear Integrated Circuits" New Age International (p) Ltd, 2011.

Reference Books:

REFERENCES :

1. R.F. Coughlin & Fredrick F. Driscoll. Operational Amplifiers & Linear Integrated Circuits, PHI, 6th Edition, 2003
2. Ramakanth A. Gayakwad, Op-Amps & Linear ICs –PHI, 4th Edition 2004.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T46	**BIOMEDICAL SENSORS AND TRANSDUCERS**	**4**	**0**	**0**

Course Objectives:

The overall objective of this course is to introduce students

- To the basic principles and design issues of biomedical sensors and instrumentation, including: the physical principles of biomedical sensors, analysis of biomedical instrumentation systems, and the application-specific biomedical sensor and instrumentation design.

Course Outcomes:

By the end of the course the students will be able to:

- Classify systems modeling biomedical sensors and instrumentation
- Calculate the static and dynamic characteristics of bio instrumentation systems
- Analyze fluid mechanics models currently used for clinical research problems

Syllabus

UNIT I SCIENCE OF MEASUREMENT: Measurement System – Instrumentation – Classification and Characteristics of Transducers – Static and Dynamic – Errors in Measurements – Calibration – Primary and secondary standards.

UNIT II DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS: Strain Gauge: Gauge factor, sensing elements, configuration, unbounded strain gage, biomedical applications; strain gauge as displacement & pressure transducers: force summing devices, capacitive transducer, inductive transducer, LVDT, Passive types: RTD materials & range, relative resistance vs. temperature characteristics, thermistor characteristics, biomedical applications of Temperature sensors. Active type: Thermocouple – characteristics,

UNIT III PHOTOELECTRIC AND PIEZO ELECTRIC SENSORS: Phototube, Photo Multiplier Tube (PMT), photovoltaic, photoconductive cells, photo diodes, phototransistor, comparison of photoelectric transducers, spectro-photometric applications of photo electric transducers. Piezoelectric active transducer and biomedical applications as pressure & Ultrasound transducer.

UNIT IV ELECTRODES: Recording Electrodes – Electrode-tissue interface, polarization, skin contact impedance, motion artifacts, Silver-Silver Chloride electrodes, Surface Electrodes – Needle electrodes – Micro electrodes - Electrodes for ECG, Electrodes for EEG, Electrodes of EMG, Electrical conductivity of electrode jellies and creams.

UNIT V BIOCHEMICAL TRANSDUCERS: Biosensors - Chemoreceptors, hot and cold receptors, Baro receptors, sensors for smell, sound, vision, osmolality and taste. Transducers for the measurement of ions and dissolved gases. Ion exchange membrane electrodes - Measurement of pH - Glass pH electrodes. Measurement of pO_2, Measurement of pCO_2. ISFET for glucose, urea.

TEXT BOOKS

1. Principles of Applied Biomedical Instrumentation L.A Geddas and L.E.Baker – John Wiley and sons.
2. Albert D.Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.

REFERENCE BOOKS

1. Ernest O Doebelin and dhanesh N manik, Measuremet systems, Application and design ,5th edition ,McGraw-Hill, 2007.
2. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 2007.
3. Leslie Cromwell, “Biomedical Instrumentation and measurement”, Prentice hall of India,New Delhi, 2007.
4. John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, New York, 2004

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P41	**LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB (Common to ICE and EIE)**	**0**	**0**	**3**

Minimum ten Experiments to be conducted : (five from each part A & B)

Part A (IC Application Lab):

1. OP AMP Applications – Adder, Subtractor, Integrator and Differentiator Circuits using IC 741.
2. Active Filter Applications – LPF, HPF (first order)
3. IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.
4. Function Generator using OP AMPs.
5. IC 555 Timer – Monostable and Astable Operation Circuit.
6. IC 565 – PLL Applications, IC 566 – VCO Applications.
7. Voltage Regulator using IC 723.
8. Three Terminal Voltage Regulators – 7805, 7809, 7912.
9. 4 bit DAC using OP AMP.

Part B

1. D Flip-Flop 7474
2. Decade counter-7490
3. shift registers-7495 7
4. 3-8 Decoder -74138
5. 4 bit Comparator-7485
6. 8 x 1 Multiplexer -74151 and 2x4 Demultiplexer-74155
7. RAM (16x4)-74189 (Read and Write operations)
8. Decoder drives for LED

Equipments and Components Required for a batch of 30 students

Equipments for Analog Lab CRO (30MHz) – 10 Nos.
Signal Generator /Function Generators (3 MHz) – 10 Nos.
Dual Regulated Power Supplies (0 – 30V) – 10 Nos..
Transistor/FET (BJT-NPN-PNP and NMOS/PMOS) – 50 Nos.
Dual power supply/ single mode power supply - 10 Nos
Digital IC Trainer Kit - 10 Nos
Bread Boards -10 Nos.
Multimeter -15 Nos.
ICs each 40 Nos 741/555/565/566/7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 / 74151 / 74147 / 7445 / 7476/7491/ 7494 / 7447 / 74189 / 7485 / 7473 / 74138 / 7411 / 7474,
IC tester - 5 Nos

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P42	**BIOMEDICAL SENSORS AND TRANSDUCERS LAB**	**0**	**0**	**3**

1. Characteristic of Temperature transducers (LDR, thermistor and thermocouple).
2. Measurement of Displacement using capacitive transducer, LVDT, inductive transducer and potentiometric transducer.
3. Characteristics of Optical Transducers (LDR, Phototransistor, Photovoltaic and photoconductive cells)
4. Modeling of RTD and thermocouple.
5. Measurement of Pressure and Temperature using ICs (LM 335, and AD 590)
6. Measurement of strain using strain gauge for (i) Quarter bridge (ii) Half bridge (iii) Full bridge
7. Plotting characteristics of Photoelectric Transducer, Piezo-electric Transducer, and Thermoelectric Transducer.
8. Determination of characteristics of (i) DC Amplifier (ii) Chopper Amplifier and (iii) Instrumentation Amplifier.
9. Characteristics of Ultrasound Transducer and Phono Transducer.
10. Measurement of Skin Resistance.
11. Determination of characteristics of Polarized Electrodes, Non-polarized Electrodes, Multi Point Electrodes.

Equipments and Components Required for a batch of 30 students

RTD-PT100 - 5 no.s, Thermistor- 5 no.s, Thermocouple- K and J type -5no.s each,
Hot water bath-2 no.s
Muffle furnace -2 no.s,
Regulated Power supply-10 No.s,
Digital Multimeter -10 No.s,
Oscilloscope-10 No.s,
LVDT kit- 1No.
Inductive Transducers Kit-1No.
Potentiometer-1No.
Strain gauge trainer-1No.
Photoelectric Transducer Kit-1No.,
Piezo-electric Transducer Kit-1No.,
Thermoelectric Transducer. Kit-1No.
Ultrasound Transducer and Photo Transducer Kits- each 1No.
Polarized Electrodes, Non-polarized Electrodes, Multi Point Electrodes. Each 1 set with instrument

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P43	**SIMULATION LAB**	**0**	**0**	**3**

CYCLE I

1. Series And Shunt Feed Back Amplifiers
2. Design Of Wein Bridge Oscillator
3. Design Of Transistor RC Phase Shift Oscillator
4. Design Of LC – Hartley And Colpitts Oscillator
5. Class C Tuned Amplifier
6. Integrators And Differentiators
7. Clippers And Clampers
8. Design Of Monostable Multivibrator
9. Design Of Astable Multivibrator
10. Design Of Bistable Multivibrator

CYCLE II

1. Verification Of Superposition And Reciprocity Theorems
2. Verification Of Thevenin's Norton's &Maximum Power Transfer Theorems
3. Determination Of Two Port Network Parameters
4. Determination Of Self, Mutual Inductances And Coefficient Coupling
5. Differentiate Amplifier
6. Active Filter: Butterworth II Order LPF
7. D / A And A/D Converter (Successive Approximation)
8. Analog Multiplier
9. CMOS Inverter, NAND And NOR

List of equipments required for a batch of 30 students

1. Personal computer with PSPICE / Equivalent Circuit Simulation Software- 20 No.s

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P44	**Physical Education**	**0**	**0**	**0**

Physical Education is compulsory for all the Undergraduate students

1. The activities will include games and sports / extension lectures.
2. Two Hrs. / Week will be allocated for physical education in the third and fourth semesters. The student participation shall be for a minimum period of 45 hours in both the semesters put together.
3. These activities will be monitored by the Director of Physical Education.
4. Pass /Fail will be determined on the basis of participation, attendance, and performance. If a candidate Fails, he/she has to repeat the course in the subsequent years
5. Pass in this course is mandatory for the award of degree.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T51	**PROBABILITY AND RANDOM PROCESSES**	**4**	**0**	**0**

Course Objectives:

This course aims at providing the necessary basic concepts in random processes. Knowledge of fundamentals and applications of random phenomena will greatly help in the understanding of topics such as signals & systems, pattern recognition, voice and image processing and filtering theory.

Course Outcomes:

- At the end of the course, the students would
- Have a fundamental knowledge of the basic probability concepts.
- Have a well-founded knowledge of standard distributions which can describe real life phenomena.
- Acquire skills in handling situations involving more than one random variable and functions of random variables.
- Understand and characterize phenomena which evolve with respect to time in probabilistic manner.
- Be able to analyze the response of random inputs to linear time invariant systems.

Syllabus

U UNIT I RANDOM VARIABLES

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables.

UNIT III RANDOM PROCESSES

Classification – Stationary process – Markov process - Poisson process – Random telegraph process.

UNIT IV CORRELATION AND SPECTRAL DENSITIES

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS

Linear time invariant system – System transfer function – Linear systems with random inputs – Autocorrelation and Cross correlation functions of input and output.

TEXT BOOK

1. Ibe.O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier,1st Indian Reprint, 2007.

2.P. Ramesh babu, "Probability Theory and Random Processes", McGraw Hill Education, First Edition, New Delhi, 2015.

REFERENCE BOOKS

1. Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes", Wiley India Pvt. Ltd.,Bangalore, 2nd Edition, 2012.

2. Stark. H., and Woods. J.W., "Probability and Random Processes with Applications to Signal Processing", Pearson Education, Asia, 3rd Edition, 2002.

3. Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to Signal Processing and Communications", Academic Press, 2004.

4. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.

5. Cooper. G.R., McGillem. C.D., "Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3rd Indian Edition, 2012.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T52	**BIO CONTROL SYSTEMS**	**3**	**1**	**0**

Course Objectives:

- To familiarize the student with the analysis and design of industrial Process Control, Object-Oriented analysis and design for real-time systems.

Course Outcomes:

- Development of advanced process control systems.
- Development of advanced object-oriented software solutions for real-time systems.
- Training, mentoring, and consulting of the highest professional caliber in process control, object-oriented design, and real-time software architecture.

Syllabus

UNIT-I

INTRODUCTION: Concepts of control systems- Open loop and closed loop control systems and their differences- Different examples of control systems- classification of control systems.

MATHEMATICAL MODELS OF PHYSICAL SYSTEMS: Differential equations- transfer function and block diagram representation of physical systems- translational and rotational mechanical systems, electrical systems-analogous systems- Block diagram reduction using algebra- Representation by signal flow graph- reduction using Mason's gain formula.

UNIT-II

TIME RESPONSE ANALYSIS: Standard test signals- impulse, step and ramp response analysis of first order and second order systems- Characteristics Equation of Feedback control systems, Transient Response of second order systems- Time domain specifications- Steady state response- Steady state errors and error constants- Effects of proportional derivative, proportional integral systems, performance indices.

UNIT-III

CONCEPTS OF STABILITY: The concept of stability, Routh stability criterion- qualitative stability and conditional stability. The root locus concept- construction of root loci- effects of adding poles and zeros to G(s)H(s) on the root loci-root contour.

UNIT-IV

FREQUENCY RESPONSE ANALYSIS: Frequency response specifications- Bode diagrams- Determination of Frequency domain specifications and transfer function from the Bode diagram- Phase margin and Gain margin- Stability Analysis from Bode plots. Polar plots, Nyquist plots and applications of Nyquist criterion to find the stability- Effects of adding poles and zeros to G(s)H(s) on the shape of the Nyquist diagrams, Constant M and N circles- Nichols Chart- Frequency Domain specifications from Nichols Chart.

UNIT-V

PHYSIOLOGICAL CONTROL SYSTEMS: Differences between the technological and Physiological control system, Regulation of electrolyte concentrations, Regulation of Electrolyte concentrations, Regulation of Acid-Base Balance, Regulation of Red blood cell Production, Regulation of Arterial Pressure, Regulation of blood volume, regulation of Respiration, reflex

functions of the nervous system, regulation of body temperature, regulation of blood glucose.

TEXT BOOK:

1. R.Anandanatarajan, P.Ramesh Babu, "Control Systems Engineering", Fifth Edition, Scitech Publications, India, 2014. (UNITS I,II, III,IV)
2. Michael C K Khoo, "Physiological control systems", IEEE press, Prentice –Hall of India, 2001 (UNIT V)

REFERENCES:

1. J.Nagrath & M.Gopal, "Control System Engineering" New-age International(P), 4th Edition Ltd., New Delhi, 2009.
2. Katsuhiko Ogata, "Modern Control Engineering", PHI Learning, Fifth Edition, 2010.

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Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T53	**PATHOLOGY AND MICROBIOLOGY**	**3**	**1**	**0**

Course Objectives:

- To study Cell-structure and function (ultrastructural and molecular aspects), intercellular junctions, cell cycle and division, cell cycle regulators, cell - cell and cell - extra cellular matrix interactions.
- Detailed molecular aspects of DNA, RNA, and intracellular organelles, transcription and translation and molecular biology techniques.

Course Outcomes:

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

- Understand and explain factors, about the causation of disease.
- Understand processes involved in the gross and microscopic changes of organs and tissues and explain these changes.
- Understand and explain the basis of evolution of clinical signs and symptoms.

UNIT I

Cell Degeneration, repair and neoplasia-Cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification, cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours.

UNIT II:

Fluid and hemodynamic derangements, - edema, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock. Hematological disorders-Bleeding disorders, Leukaemias, Lymphomas.

UNIT III

General Structural Organisation of bacterial and viral cell- growth and identification of bacteria, observation of culture.

Microscopy: Light microscopy, dark field microscopy, phase contrast microscopy, fluorescence and electron microscopy.

UNIT IV

Genetic disorders, Infection and Immunity-Mutations, Autosomal and X linked disorders, Mendelian disorders, types of immune response, hypersensitivity disorders, Immune deficiency syndrome, Viral disease, Chlamydial ,Bacterial, Mycoplasma, Rickettsial, Fungal, protozoal and helminthic disease.

UNIT V

Identification of disease producing organisms, simple stain, Gram stain, AFB stain, Fluorescent techniques, antigen-antibody techniques.

TEXT BOOKS

1. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins: Pathologic Basis of diseases. WB Saunders Co. 7th edn-2005.
2. Harsh Mohan: Text book of Pathology. Jaypee publishers. 4th edn. 2000.
3. Ananthanarayanan R& Panicker CKJ:Textbook of Microbiology. Orient Longmans.7th ed.2006.
4. Dubey RC and Maheswari DK.A textbook of Microbiology. S Chand,2007.

REFERENCE:

1. Underwood JCE: General and Systematic Pathology Churchill Livingstone 3edn.2000.4
2. Prescott, Harley, Klein. Microbiology. Mc Graw Hill 5th ed. 2002.
3. Manual of Microbiology tools and techniques. Kanika Sharma. Ane's student edition.2007.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T54	**MICROPROCESSORS & ITS APPLICATIONS** (Common to ICE and EIE branches)	**4**	**0**	**0**

Course Objectives:

1. To study 8085 programming
2. To study interfacing devices like 8255, 8253, 8259 and 8251
3. To study 8086 and programming
4. To study the applications of 8085

Course Outcomes: .

1. Write simple assembly language program in 8085
2. Interface any i/o device and communicate using 8085
3. Write simple assembly language programs in 8086
4. Design a microprocessor based system for any application

Syllabus:

UNIT-I

INTRODUCTION TO 8085: Generic-8-bit microprocessor and its architecture-8085 functional block diagram-Architecture-functions of different sections-Memory mapping-Memory interfacing-Instruction format-addressing modes-instruction set of 8085 CPU-instruction cycle-timing diagram-different machine cycles-fetch and execute operations-estimation of execution time.

UNIT-II

PROGRAMMING 8085: data transfer instructions-arithmetic operations-logic and branch operations-writing assembly language programmes-looping, count indexing-16 bit arithmetic instructions-arithmetic operations related to memory-logical operations, rotate compare, counter and time delays-debugging techniques. Stack- subroutine- call and return instructions-parameter passing techniques-nested subroutine. Parallel input-output and interfacing applications-peripheral and memory mapped I/O. 8085 interrupts-Restart as software instructions

UNIT-III

INTERFACING DEVICES: 8255 programmable peripheral interface-8253 programmable interval timer-8259 programmable interrupt controller-direct memory access(DMA) and 8257 DMA controller-8155 multipurpose programmable devices-8279 programmable keyboard display interface-serial I/O and data communication-8251 USART-Interfacing data converters ADC and DAC.

UNIT-IV

INTRODUCTION TO 8086: Architecture of 8086 Microprocessor- Special functions of General purpose registers- 8086 flag register and function of 8086 flags- Addressing modes of 8086- Instruction set of 8086-, Assembly language programs involving logical, Branch & Call instructions, sorting, evaluation of arithmetic expressions, string manipulation- Pin diagram of 8086-Minimum mode and maximum mode of operation- Timing diagram- Memory interfacing to 8086 (Static RAM & EPROM).

UNIT-V

APPLICATIONS OF MICROPROCESSORS: Typical application of microprocessors: Seven segment display interface, LCD interface, stepper motor control, temperature control, frequency measurement., phase angle and power factor measurement, Measurement of strain, deflection and water level measurement, Microprocessor based traffic control .

Text Books:

1. Ramesh S Gaonkar, "Microprocessor Architecture, Programming and application with 8085", 6th Edition, Penram International Publishing, New Delhi, 2013. (Unit I, II, III and V).

2. A.K. Ray and K.M.Burchandi, and A.K.Ray," AdvancedMicrprocessor and Peripherals, McGraw Hill International Edition, 3rd Edition, 2012 (Unit-IV)
3. B. Ram, "Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai Publications, 2001 (Unit V)

Reference Books:

1. N. Senthil Kumar, M.Saravanan and S.Jeevananthan, ―Microprocessor and Microcontrollers, OXFORD UNIVERSITY PRESS, November, 2010.

2. John Uffenbeck, "The 80x86 Family, Design, Programming and Interfacing", Third Edition, Pearson Education, 2002.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T55	**MEDICAL INSTRUMENTATION**	**3**	**1**	**0**

Course Objectives:

- To learn the physiology of the human body and the Instrumentation related to Biomedical Systems.

Course Outcomes:

Students can able to:

- Introduce the concepts of physiology and the Electrical Components of a Biomedical System.
- Discuss and analyse the measurement of physiological parameters.
- Understand the concepts of Imaging System and Telemetry ad the various Therapeutic Equipments used in Medicine.

UNIT – I BASIC COMPONENTS OF BIOMEDICAL SYSTEM

Bio potential electrodes, Electrode-electrolyte interface, Half-cell Potential, Electrodes-Micro, needle and surface electrodes. Various biomedical transducers. Bio-signal Amplifiers - Differential amplifiers, Chopper amplifiers, Notch Filters

UNIT – II MEASUREMENT OF PHYSIOLOGICAL PARAMETERS

ECG– ECG Lead systems and recording methods - EEG- EMG – Measurement of blood pressure-Cardiac output - Heart sounds - Respiratory rate - Lung Volumes and Capacities – Pneumotachography, Flow rate of CO_2, O_2 in exhaust air - pH of blood, GSR measurements- Plethysmography.

UNIT – III IMAGING SYSTEM AND TELEMETRY

Ultrasound scanner – X-Ray Imaging - CAT / CT scan –MRI Imaging – PET scan. Basic elements of a Biotelemetry system - Single / Multi channel Telemetry Systems – Implanted transmitters – Telemedicine

UNIT – IV ASSISTING AND THERAPEUTIC EQUIPMENTS

Electrotherapy – Diathermy – Pacemakers - Defibrillators – Heart Lung Machine - Audiometry - Hearing aid – Dialysis machine – Ventilators - Endoscopes.

UNIT V ELECTRICAL SAFETY

Physiological effects of electrical currents, macro shock and micro shock, preventive measures to reduce shock hazards, Leakage current, isolation of patient circuits, safety of electrically susceptible patients, radiation hazards and safety, shielding, open ground problem and earthing methods.

Text Books:

1. John Webster, "Medical Instrumentation: Application and Design", 3rd Edition, Wiley Publishing, 2009.

Reference Books:

1. R. Anandanatarajan, "Biomedical Instrumentation and Measurements", PHI Learning, 2011.
2. Leslie Cromwell, Fred. J. Weibell, "Biomedical Instrumentation and Measurements", 2nd Edition, PHI, 2003.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P51	**MEDICAL INSTRUMENTATION LAB**	**0**	**0**	**3**

LIST OF EXPERIMENTS

1. Design and analysis of biological pre amplifiers
2. Recording of ECG signal and analysis
3. Recording of EMG-Signal
4. Recording of EEG-Signal
5. Recording of various physiological parameters using patient monitoring system and telemetry units.
6. Measurement of pH and conductivity.
7. Measurement and recording of peripheral blood flow
8. Measurement of visually evoked potential.
9. Study of characteristics of optical Isolation amplifier
10. Galvanic skin resistance (GSR) measurement

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS:

1. Multiparameter patient monitoring system : 1 No.
2. EEG recorder with accessories for evoked studies : 1 No.
3. ECG recorder : 1 No.
4. EMG recorder : 1 No.
5. pH meter, conductivity meter : 1 No.
6. Blood flow measurement system using ultrasound transducer: 1 No.
7. GSR measurement setup. : 1 No.
8. Function Generators
9. DSOs
10. Regulated Power supplies
11. Bread boards
12. IC 741

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P52	PATHOLOGY AND MICROBIOLOGY LAB	0	0	3

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. Gram stain.
10. AFB stain.
11. Slides of malarial parasites, micro filaria and leishmania donovani.
12. Haematology slides of anemia and leukemia. Study of bone marrow charts.
13. Bleeding time and clotting time.

LAB EQUIPMENTS FOR 30 STUDENTS:

Wax dispenser	1 No
Slide warming	1 No
Microtome	1 No
Microscope	
Microphotographic unit	1 No
Slides	1 box
Coverslip	1 box
Distillation Unit	1 No
Water bath normal	1 No
Incubator	1 No
Autoclave	1 No
Oven	1 No

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P53	**MICROPROCESSORS AND ITS APPLICATIONS LAB**	**0**	**0**	**3**

Syllabus:

1. Programming 8085 microprocessor kit
2. Programming 8086 microprocessor kit
3. Interfacing programmable interrupt controller
4. Interfacing of display devices
5. Interfacing of D/A and A/D converters
6. Interface of key board and display using programmable controllers
7. Interface of programmable timer
8. Stepper motor control using microprocessor
9. Interfacing of 8251 and 8257
10. Traffic light Controller Interface

LIST OF EQUIPMENT FOR A BATCH OF 20 STUDENTS:

1. 8085 Microprocessor Trainer with Power Supply- 10 No.s
2. 8086 Microprocessor Trainer Kit with power supply-10 No.s
3. 8255 Interface board -3
4. 8251 Interface board -3
5. 8259 Interface board -3
6. 8279 Keyboard / Display Interface board -3
7. 8254 timer counter -3
8. ADC and DAC card -3
9. Stepper motor Controller- 3
10. Traffic Light Control System- 3
11. Seven segment display interface- 3 No.s

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P54	**GENERAL PROFICIENCY-I**	**0**	**0**	**3**

Syllabus

UNIT -I ART OF COMMUNICATION

Verbal and Non-verbal Communication – Barriers to Communication – Importance of Body Language – Effective Listening – Feedback

UNIT - II INTRODUCATION TO SOFT SKILLS

Attitude – Self-Confidence – Leadership Qualities – Emotional Quotient – Effective Time Management Skills – Surviving Stress – Overcoming Failure – Professional Ethics – Interpersonal Skills

UNIT – III WRITING

Importance of Writing – Written Vs Spoken Language – Formal and Informal Styles of writing – Resources for improving writing – Grammar and Usage – Vocabulary Building – SWOT analysis

UNIT – IV SPEAKING PRACTICE

Dialogue – Telephone Etiquette – Public Speaking – Debate – Informal Discussions – Presentations

UNIT – V APTITUDE

Verbal and Numerical aptitude

REFERENCES :

1. Nicholls, Anne. Mastering Public Speaking. Jaico Publishing House,2003.
2. Aggarwal, R.S. Quantitative Aptitude. S.Chand &Co.,2004.
3. Leigh, Andrew and Michael Maynard. The Perfect Leader. Random House Business Books,1999.
4. Whetton .A.David and Kim S. Cameron. Developing Management Skills. Pearson Education, 2007.
5. K.R. Lakshminarayan. Developing Soft Skills. Scitech, 2009.
6. Sherfield M Robert. Developing Soft Skills Pearson Education, 2005.
7. Hair O' Dan, Friedrich W. Gustav and Lynda Dee Dixon. Strategic Communication in Business and the Professions. Pearson Education,2008.
8. Chaney Lilian and Jeanette Martin. Intercultural Business Communication, Fourth Edition. Pearson Education, 2008.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T61	**DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS**	**4**	**0**	**0**

Course Objectives:

- 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

Course Outcomes:

Students can able to:

- Use different medical devices applied in measurement of parameters related to cardiology, neurology
- Explain about cardiac assist devices, its continuous monitoring and transmission
- Measure signals generated by muscles

Syllabus

UNIT I 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 II NEUROLOGICAL EQUIPMENT

Clinical significance of EEG, Multi channel EEG recording system, Epilepsy, Evoked Potential– Visual Auditory and Somatosensory, EEG Bio Feedback Instrumentation.

UNIT III 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 IV 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 V PATIENT MONITORING AND EXTRA CORPOREAL DEVICES

Patient monitoring systems, ICU/CCU Equipments, Infusion pumps, bed side monitors, Central consoling controls. 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.

TEXT BOOKS

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

REFERENCE BOOKS

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. Antony Y.K.Chan, "Biomedical Device Technology, Principles and design", Charles Thomas Publisher Ltd, Illinois, USA, 2008.
5. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson education, 2004.
6. John G.Webster, "Medical Instrumentation Application and Design", third edition, John Wiley and Sons, New York, 2006.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T62	**TELEMEDICINE**	**4**	**0**	**0**

Course Objectives:

- To Understand the basic requirement for the delivery of telemedicine services,
- To differentiate and apply telemedicine technology and practices in a variety of health care environments.

Course Outcomes:

- Students will be able to have a clear understanding of the concepts of telemedicine, including basic terminologies, and technologies, services, impact and challenges of telemedicine.

Syllabus

UNIT I

History of Telemedicine, Block diagram of telemedicine system, Definition of telemedicine, Tele health, Tele care, origins and Development of Telemedicine, Scope, Benefits and limitations of Telemedicine.

UNIT II

Types of information: Audio, Video, still Images, text and data, Fax. Types of Communication and Network: PSTN, POTS, ATN, ISDN, Internet, Wireless Communications: GSM, satellite and Micro Wave. Different modulation techniques, Types of antennas depending on requirements, Integration and Operational issues: system integration, Store-and-forward operation, real-time Telemedicine.

UNIT III

Data Exchanges: Network Configuration, Circuit and packet switching, H.320 series (Video phone based ISBN) T.120, h.324 (Video phone based PSTN), Video Conferencing.

UNIT IV

Data Security and Standards: Encryption, Cryptography, Mechanisms of encryption, Phases of Encryption. Protocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7.
Ethical and legal aspects of Telemedicine: Confidentiality and Law, patient rights and consent, access to medical Records, Consent treatment, jurisdictional Issues, Intellectual property rights.

UNIT V

Tele radiology: Basic parts of Teleradiology system: Image Acquisition system, Display system, Communication network, Interpretation. Tele Pathology: Multimedia databases, color images of sufficient resolution: Dynamic range, spatial resolution, compression methods, Interactive control of colour, Controlled sampling, security and confidentiality tools. Tele cardiology, Teleoncology, Telesurgery.

TEXT BOOKS:

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

Course Objectives:

- To Understand the basic requirement for the delivery of telemedicine services,
- To differentiate and apply telemedicine technology and practices in a variety of health care environments.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T63	BIOMEDICAL SIGNAL PROCESSING	3	1	0

Course Objectives:

- It provides a solid foundation in advanced biomedical signaling and imaging systems including up-to-date coverage of commercially relevant topics.
- It focuses on biomedical signals, processing the signals, and validate the methods and results for optimization of clinical applications

Course Outcomes:

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

- Choosing a class of signal model,
- Process the biomedical signal

Syllabus

UNIT – I Discrete-Time Signals and Linear Systems

Classification of signals: continuous and discrete, energy and power -representation of discrete-time signals, elementary discrete-time signals, classification of discrete-time signals, Classification of systems, Representation of a system with difference equation, impulse response and step response, FIR and IIR systems, Convolution sum and correlation, sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect, reconstruction of analog signal from its samples.

UNIT- II - DTFT and Z-transform

Discrete-time Fourier series, Frequency range, Discrete-time Fourier transform-properties, Frequency response , ideal filters, Z-transform and its properties- inverse z-transforms- system function- stability criterion- Solving difference equations using Z-transform.

Realization of IIR systems- direct form-I, direct form –II, cascade form and parallel forms. Realization of FIR systems-direct form, linear phase realization, cascade and parallel forms

UNIT- III - DFT and FFT

Discrete Fourier Transform, Relationship of the DFT to other transforms, Properties of DFT, circular convolution, filtering long duration sequences, parameter selection to calculate DFT.

Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – Butterfly structure-FFT applications.

UNIT IV - Design of Digital Filters

FIR filter design: Linear phase characteristics- Windowing technique of designing FIR filter– Need and choice of windows, frequency sampling method.

IIR filter design: Analog filter design - Butterworth and Chebyshev filters, digital design using impulse invariant and bilinear transformation – Warping effect, prewarping

UNIT V - Biomedical Applications

ECG averaging – Reduction of 50 Hz noise – Maternal ECG cancellation in fetal electrocardiography – High frequency noise cancellation in Electro surgery. ECG QRS detection Techniques – Estimation of R-R interval –Arrhythmia analysis monitoring – Basics of ECG data reduction techniques. EEG analysis - time and frequency domain methods

TEXT BOOKS:

1. P.Ramesh Babu, “Digital Signal Processing”, Sixth Edition, Scitech publications, Chennai, 2014 (UNITS I, II, III & IV)
2. DC Reddy, Biomedical Signal Processing – Principles and Techniques, Tata McGraw Hill Publishing company Ltd., 2005 (UNIT V)

REFERENCE

1. Willis J.Tompkins, Biomedical Digital signal processing, Prentice Hall of India Pvt. Ltd., 2000

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T64	**EMBEDDED SYSTEM DESIGN** (Common to ICE and EIE branches)	**3**	**1**	**0**

Course Objectives:

1. To introduce system design concepts to students using microcontrollers with foundational concepts of microcontroller architecture and programming .
2. To introduce hardware and software integration for real time systems using microcontrollers and thereby imparting real time system design knowledge to students.

Course Outcomes:

1. Foundational knowledge in activating and using a generic microcontroller. Preliminary design considerations for system level implementation.
2. Knowledge of 8051 Microcontroller hardware features and internal peripherals. Programming knowledge of 8051 microcontrollers.
3. Knowledge of ARM Processor hardware features and internal peripherals. Programming knowledge of ARM Processors.
4. Software design techniques to be followed for embedded system designing.
5. Using real time operating systems for embedded systems.

EMBEDDED SYSTEM DESIGN

UNIT I

REVIEW OF EMBEDDED SYSTEMS: Introduction to Embedded Systems – Components of an Embedded System – Processor Specifications – Role of Microcontrollers in Embedded System design – Features of Microcontrollers – on Board peripherals – Processor Selection criteria – Microcontroller Design Specifications – Word length – Performance Issues - Power consumption – Package Types – Electrical requirements – Reset Hardware – oscillator Design – power Consideration -Development Tools –Firmware Development options – Assembly Language Vs High level Language Programming- Intel Hex File Format.

UNIT II

INTRODUCTION TO MCS51 MICROCONTROLLER: Intel MCS51 Architecture – Derivatives - Special Function Registers (SFR), I/O pins, ports and circuits, Instruction set, Addressing Modes, Assembly Language Programming, Timer and Counter Programming, Serial Communication, RS-232 implementation, Interrupts Programming, External Memory interfacing.

UNIT III

INTRODUCTION TO LPC2148 MICROCONTROLLER: ARM 7 Architecture – LPC2148 microcontroller introduction – Internal memory map - Peripheral details – Implementation of GPIO, Timer/Counter, UART, Interrupt architecture – ADC and DAC. SPI, I2C and USB features of LPC2148. Firmware development using Embedded C – introduction to data types – conditional statements – loops – simple programs using embedded 'C'

UNIT IV

DESIGN OF SIMPLE EMBEDDED SYSTEMS:

Design of Simple I/O systems using Switches, LEDs, Buzzers - Current source and sink

concepts - Interfacing Character and Graphical LCD Displays – RTC interfacing - Interfacing External ADC and DAC - DC Motor Speed Control System – Speed Measurement – Design of Digital Frequency meter - Stepper Motor Interfacing – Relays – Keypads - Interfacing SD cards and touch screens– Signal processing applications – PC based Control systems.

UNIT V

REAL TIME OPERATING SYSTEMS: Concept of Scheduling – Round Robin and Preemptive scheduling – Implementing a simple scheduler in 'C' - Task and Task States, tasks and data, semaphores and shared Data Operating system Services-Message queues- Events-Memory Management, Interrupt Routines in an RTOS environment, Implementing SD card – Graphical LCD system using RTOS.

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TEXT BOOK:

1. David E Simon, " An embedded software primer ", Pearson education Asia, 2001 (UNIT V)
2. Mohammed Ali Mazidi and Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded System", Pearson Education Asia, New Delhi, 2006.(UNIT II)
3. Trevor Martin,"The Insider's Guide to the Philips ARM7-Based Microcontrollers",Hitex Pubications(UK),2005.(UNIT III)
4. Michael J Pont,"Patterns for Time-Triggered Embedded Systems",Addison-Wesley Professional,2001.(UNIT I, IV)),

REFERENCES:

1. Burns, Alan and Wellings, Andy, " Real-Time Systems and Programming Languages ", Second Edition. Harlow: Addison-Wesley-Longman, 1997.
2. Raymond J.A. Bhur and Donald L.Bialey, " An Introduction to real time systems: Design to networking with C/C++ ", Prentice Hall Inc. New Jersey, 1999.
3. Grehan Moore, and Cyliax, " Real time Programming: A guide to 32 Bit Embedded Development. Reading " Addison-Wesley-Longman, 1998.
4. Heath, Steve, " Embedded Systems Design ", Newnes 1997.
5. John B Peat man " Design with Microcontroller ", Pearson education Asia, 1998.
6. Jonartthan W. Valvano Brooks/cole " Embedded Micro computer Systems. Real time Interfacing ", Thomson learning 2001.
7. Grehan Moore, and Cyliax, " Real time Programming: A guide to 32 Bit Embedded Development. Reading " Addison-Wesley-Longman, 1998.
8. John B Peatman " Design with Microcontroller ", Pearson education Asia, 1998.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T65	MEDICAL INFORMATICS & EXPERT SYSTEMS	4	0	0

Syllabus

Course Objectives:

- Medical informatics is the intersection of information science, computer science, and health care.
- It deals with the resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine. Health informatics tools include not only computers but also clinical guidelines, formal medical terminologies, and information and communication systems.

Course Outcomes:

Students will be able to:

- Create medical documentation,
- Utilize computer skills to develop expert systems

Syllabus

UNIT I MEDICAL INFORMATICS

Introduction - Structure of Medical Informatics –Internet and Medicine -Security issues , Computer based medical information retrieval, Hospital management and information system, Functional capabilities of a computerized HIS, e-health services, Health Informatics – Medical Informatics, Bioinformatics

UNIT II COMPUTERISED PATIENT RECORD

Introduction - History taking by computer, Dialogue with the computer, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology- Application server provider, Clinical information system, Computerized prescriptions for patients.

UNIT III COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING

Automated clinical laboratories - Automated methods in hematology, cytology and histology, Intelligent Laboratory Information System - Computerized ECG, EEG and EMG, Computer assisted medical imaging- nuclear medicine, Radiation therapy and planning, Nuclear Magnetic Resonance

UNIT IV COMPUTER ASSISTED MEDICAL DECISION-MAKING

Neuro computers and Artificial Neural Networks application, Expert system - General model of CMD, Computer – assisted decision support system-production rule system cognitive model, semester networks, decisions analysis in clinical medicine-computers in the care of critically patients-computer assisted surgery – designing

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS

Virtual reality applications in medicine, Computer assisted surgery, Surgical simulation,

Telemedicine - Tele surgery computer aids for the handicapped, computer assisted instrumentation in Medical Informatics - Computer assisted patient education and health Medical education and health care information.

TEXT BOOKS:

1. R.D.Lele Computers in medicine progress in medical informatics, Tata Mcgraw Hill Publishing omputers Ltd,2005, New Delhi
2. Mohan Bansal, Medical informatics Tata Mc Graw Hill Publishing computers Ltd, 2003 New Delhi

REFRENCE BOOKS:

1. M F Collen, " Hospital Computer Systems"-
2. Lee, " Computers in Medicine", Mc Graw Hill
3. H Dominic Covvey et al , "Computer in the practice of, medicine", Addison Wesley

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P61	**DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS LAB**	**0**	**0**	**3**

LIST OF EXPERIMENTS:

1. ECG heart rate monitoring with alarm system
2. Peripheral pulse rate monitoring with alarm system
3. Apnea monitoring
4. Short wave / ultrasound diathermy unit – study & demo
5. EMG biofeedback system – study & demo
6. ECG simulator and servicing of ECG machine
7. ECG Telemetry system
8. Computerized Pulmonary Function Tests including Spirometry.
9. Pacemaker & Defibrillator – study & demo
10. Arrhythmia monitoring
11. Computerized ECG / EMG / EEG systems – study & demo
12. Audiometry – study & demo

LAB REQUIREMENTS FOR 30 STUDENTS

Multioutput power supply (+15v, -15v, +30V variable, +5V , 2A) 2 Nos.
Single parameter biotelemetry system 1 No.
Electrical Safety Analyser 1 No.
Spirometry with associated analysis system 1 No.
ECG Simulator 1 No.
Medical stimulator 1 No
Surgical diathermy with analyzer 1 No
Audiometer 1No
ECG heart rate monitor with alarm system- 2 Units
Peripheral pulse rate monitor with alarm system – 2 units
Apnea monitor - 2 Units
EMG biofeedback system- 1 unit
External Pacemaker & DC Defibrillator – 1 Unit (with patient simulator)
Short-wave Diathermy ,Ultrasonic Diathermy & Surgical Diathermy Unit – each 1 Unit
Special storage oscilloscope with facility for automatic - 10 No’s

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P62	**BIOMEDICAL SIGNAL PROCESSING LAB**	**0**	**0**	**3**

MATLAB / SCILAB / EQUIVALENT SOFTWARE PACKAGE

CYCLE 1

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

CYCLE 2

6. ECG & Arrhythmia signal generation
7. Spectrum analysis & Noise removal of biomedical signals
8. Detection of QRS component from ECG signals using analog circuits
9. Isolation of bio-signal (EMG / ECG) using analog circuits.
10. Measurement of Hearing Threshold using Audiometer and plotting its characteristics.
11. PCG Classification
12. ECG Compression

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

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

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P63	**SYSTEM DESIGN USING MICROCONTROLLERS LAB**	**0**	**0**	**3**

I. PROGRAMMING

1. Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).
3. Counters.
4. Boolean & Logical Instructions (Bit manipulations).
5. Conditional CALL & RETURN.
6. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX .
7. Programs to generate delay, Programs using serial port and on-Chip timer / counter.

II. INTERFACING

1. Write C programs to interface 8051 chip to Interfacing modules to develop single chip solutions.
2. Simple Calculator using 6 digit seven segment display and Hex Keyboard interface to 8051.
3. Alphanumeric LCD panel and Hex keypad input interface to 8051.
4. External ADC and Temperature control interface to 8051.
5. Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to 8051; change the frequency and amplitude.
6. Stepper and DC motor control interface to 8051.

List of Equipments for a batch of 20 students

Sl Nr	Name of the Equipment	Quantity
1	MCS51-P89V51RD2 Microcontroller Development Board	10
2	LCD Interface Board(16x2)	4
3	Real time Clock Interface Board	4
4	LED and Switch Interface Board	4
5	ADC and DAC Interface Board	4
6	DC and Stepper Motor Interface Board	4
7	KeyPad and Relay Interface Board	4
8	Video and Memory Interface Board	4
9	SD card and TFT Interface Board	4
10	DSO - Quad Channel 100 MHz	4
11	DMM - HH Meter	4

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P64	**GENERAL PROFICIENCY – II**	**0**	**0**	**3**

Syllabus

UNIT – I :
COMPOSITION ANALYSIS: Technical and Non-Technical Passages (GRE Based) – Differences in American and British English – Analyzing Contemporary issues – Expanding Terminology

UNIT – II :
WRITING: Job Application Letter Writing – Resume Writing

UNIT – III :
ORAL SKILLS: Group Discussion – Introduction and Practice – Team Work – Negotiation Skills – Organizing and Attending Meetings – Facing Interviews

UNIT – IV :
ADAPTING TO CORPORATE LIFE: Corporate Etiquette – Grooming and Dressing

UNIT – V :
APTITUDE: Verbal and numerical aptitude

REFERENCES

1. Pushplata and Sanjay Kumar. Communicate or Collapse : A Handbook of Effective Public Speaking, Group Discussions and Interviews. Prentice-Hall, Delhi,2007.
2. Thorpe, Edgar. Course in Mental Ability and Quantitative Aptitude. Tata McGraw-Hill, 2003.
3. Thorpe, Edgar. Test Of Reasoning. Tata McGraw-Hill,2003.
4. Prasad,H.M. How to prepare for Group Discussion and Interview. Tata McGraw-Hill,2001.
5. Career Press Editors.101 Great Resumes. Jaico Publishing House,2003.
6. Aggarwal, R.S. A Modern Approach to Verbal & Non-Verbal Reasoning. S. Chand & Co.,2004.
7. Mishra Sunita and Muralikrishna, Communication Skills for Engineers, First Edition. Pearson Education, 2004.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T71	**BIOMATERIALS AND ARTIFICIAL ORGANS**	**4**	**0**	**0**

Course Objectives:

- To study the characteristics and classification of Biomaterials
- To study about the different metals and ceramics used as biomaterials
- To learn about polymeric materials and combinations that could be used as a tissue replacement implants
- To study the artificial organ developed using these materials

Course Outcomes:

Students can able to:

- Understand the properties of the Bio-compatible materials
- Gain knowledge about the different types of Biomaterials
- Design artificial organs

Syllabus

UNIT I STRUCTURE OF BIO-MATERIALS AND BIO-COMPATIBILITY

Definition and classification of bio-materials, mechanical properties, visco elasticity, wound-healing process, body response to implants, blood compatibility.

UNIT II IMPLANT MATERIALS

Metallic implant materials, stainless steels, co-based alloys, Ti-based alloys, ceramic implant materials, aluminum oxides, hydroxyapatite glass ceramics carbons, medical applications.

UNIT III POLYMERIC IMPLANT MATERIALS

Polymerisation, polyolefin, polyamicles, Acrylic, polymers, rubbers, high strength thermoplastics, medical applications.

UNIT IV TISSUE REPLACEMENT IMPLANTS

Soft-tissue replacements, sutures, surgical tapes, adhesive, percutaneous and skin implants, maxillofacial augmentation, blood interfacing implants, hard tissue replacement implants, internal fracture fixation devices, joint replacements.

UNIT V ARTIFICIAL ORGANS

Artificial Heart, Prosthetic Cardiac Valves, Limb prosthesis, Externally Powered limb Prosthesis, Dental Implants

TEXT BOOKS

1. Park, J. B. and Lakes, R. S., Biomaterials, Third edition, Springer (2007)

REFERENCE BOOKS

1. J B Park, Biomaterials - Science and Engineering, Plenum Press , 1984.
2. Sujata V. Bhat, Biomaterials, Narosa Publishing House, 2002.
3. C.P.Sharma & M.Szycher, Blood compatible materials and devices, Technomic Publishing Co. Ltd., 1991.
4. Piskin and A S Hoffmann, Polymeric Biomaterials (Eds), Martinus Nijhoff Publishers. (Dordrecht. 1986)

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T72	**DIGITAL IMAGE PROCESSING**	**4**	**0**	**0**

Course Objectives:

- This course gives the knowledge of effectively storing images, extracting interesting patterns from an image, discriminate between different classes of images, and mathematical fundamentals for image processing. This may lead to the confidence in developing image-processing applications.

Course Outcomes:

Students can able to:

- Develop simple algorithms for image processing.
- Use the various techniques involved in Medical applications, etc

Syllabus

UNIT I

Digital image fundamentals - Digital Image through scanner, digital camera. Concept of gray levels. Gray level to binary image conversion. Sampling and quantization. Relation ship between pixels. Imaging Geometry.

UNIT II

Image Transforms 2-D FFT , Properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform, Hotelling transform. Image enhancement Point processing. Histogram processing. Spatial filtering.

UNIT III

Enhancement in frequency domain, Image smoothing, Image sharpening. Colour image processing : Psedo colour image processing, full colour image processing. Image Restoration Degradation model, Algebraic approach to restoration, Inverse filtering, Least mean square filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT IV

Image segmentation Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region oriented segmentation.

UNIT V

Image compression Redundancies and their removal methods, Fidelity criteria, Image compression models, Source encoder and decoder, Error free compression, Lossy compression.

TEXT BOOK :

1. Digital Image processing – R.C. Gonzalez & R.E. Woods, Addison Wesley/ Pearson education, 2nd Education, 2002.

REFERENCES :

1. Fundamentals of Digital Image processing – A.K.Jain , PHI.
2. Digital Image processing using MAT LAB – Rafael C. Gonzalez, Richard E Woods and Steven
3. L. Edition, PEA, 2004.
1. Digital Image Processing – William K. Pratt, John Wilely, 3rd Edition, 2004.
2. Fundamentals of Electronic Image Processing – Weeks Jr., SPIC/IEEE Series, PHI.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P71	**DIGITAL IMAGE PROCESSING LAB**	**0**	**0**	**3**

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

Equipments for a batch of 20 students (2 students per experiment):

PCs with related accessories- 15
MATLAB (licensed) or any equivalent software with Image processing tool box

Image processing software tools

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P72	**SEMINAR**	**3**	**0**	**0**

1. Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for a total of 100 marks.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P73	**INDUSTRIAL VISIT TRAINING**	**0**	**0**	**0**

- During the course of study from 3rd to 7th semester each student is expected to undertake a minimum of four industrial visits or undertake a minimum of two weeks of industry/field training. The students are expected to submit a report, which shall be evaluated by an internal assessment committee at the end of seventh semester for 100 marks.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM PW7	**PROJECT WORK (PHASE-I)**	**0**	**0**	**3**

- The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental , design or combination of these in the area of Electronics and Instrumentation Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. The evaluation is based on continuous internal assessment by an internal assessment committee for 100 marks.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T81	**PROFESSIONAL EHICS PRACTICE**	**3**	**0**	**0**

The course should cover the following topics by way of Seminars, Expert Lectures and Assignments:

1. Engineering Ethics – Moral issues, Ethical theories and their uses
2. Engineering as Experimentation – Code of Ethics
3. Engineer's responsibility for safety
4. Responsibilities and rights
5. Global issues of engineering ethics

REFERENCE BOOK

1. Charles D.Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T82	**HOSPITAL SAFETY AND MANAGEMENT**	**4**	**0**	**0**

Course Objectives

- This course is designed to provide health policy, health organization, health financing system, Safety and Security, Hazardous materials, Emergency management, Fire safety Medical equipment, Utility systems.

Course Outcomes:

Students will be able to know:

- reduce and control hazards and risks
- prevent accidents and injuries
- maintain safe conditions.

Syllabus

UNIT I

Clinical engineering program, educational responsibilities, role to be performed by them in hospital, staff structure in hospital – HIS. Need for evolving health policy, health organization in state, health financing system, health education, health insurance, health legislation

UNIT II

Difference between hospital and industrial organization, levels of training, steps of training, developing training program, evaluation of training, wages and salary, employee appraisal method.

UNIT III

Necessity for standardization, FDA, AERB, Joint Commission of Accreditation of hospitals, ICRP and other standard organization, methods to monitor the standards.

UNIT IV

Nature and value of strategic management in hospitals - Awareness on the application of IT in Various functions of Hospital. Application of statistical tools in the areas of Health services. Introduction to support services - Disaster management, Ambulance services, Laundry services, Civil Assets etc.

UNIT V

Elements of Safety - Safety Publications and Standards Organizations - Orientation to Laboratory Safety - Types of risks in the hospitals - factors of environment - Safety showers and Eye Washes – Radiation hazards – radiation detection – safety measures – standards. Ergonomics - Flammables and Explosives – Formaldehydes - PEL Standards and Calculations - Material Safety - Organization of Safety in the hospitals.

TEXT BOOKS

1. P.E.Stanley, Handbook of hospital safety, CRC Press (UNIT V)
2. Arun Kumar, Hospital Management, Anmol Publications Pvt. Ltd., Jan 2000 , 1st.ed (UNITS I, II, III & IV)

REFERENCE BOOKS

1. William Charney, Handbook of Modern Hospital Safety, CRC press
2. Webster J.C. and Albert M.Cook, "Clinical Engineering Principle and Practice", Prentice Hall Inc., Englewood Cliffs, New Jersey, 1979
3. Goyal R.C., "Handbook of hospital personal management", Prentice Hall of India, 1996

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM T83	**BIOMECHANICS**	**4**	**0**	**0**

Course Objectives:

- Course provides the mechanical properties and structural behavior of biological tissues, and biodynamics.
- Specific course topics will include structure and function relationships in tissues and organs; application of stress and strain analysis to biological tissues;

Course Outcomes:

Students will be able to:

- Identify a given bone, ligament or muscle by name, anatomic location, or function.
- Recall the general characteristics, material properties, appropriate constitutive model, and adaptation potential for tissue and organs studied.
- Identify relationships between structure and function in tissues and the implications/importance of these relationships.
- Analyze the forces at a skeletal joint for various static and dynamic human activities.

Syllabus

UNIT I INTRODUCTION

Scope of mechanics in medicine, mechanics of bone structure, determination of in-vivo elastic modulus. Biofluid mechanics, flow properties of blood.

UNIT II MECHANICS OF PHYSIOLOGICAL SYSTEMS

Heart valves, power developed by the heart, prosthetic valves. Constitutive equations for soft tissues, dynamics of fluid flow in cardiovascular system and effect of vibration - shear stresses in extra-corporal circuits.

UNIT III ORTHOPAEDIC MECHANICS

Mechanical properties of cartilage, diffusion properties of articular cartilage, mechanical properties of bone, kinetics and kinematics of joints, Lubrication of joints.

UNIT IV MATHEMATICAL MODELS

Introduction to Finite Element Analysis, Mathematical models - pulse wave velocities in arteries, determination of in-vivo elasticity of blood vessel, dynamics of fluid filled catheters.

UNIT V ORTHOPAEDIC APPLICATIONS

Dynamics and analysis of human locomotion - Gait analysis (determination of instantaneous joint reaction analysis), occupant response to vehicular vibration. Mechanics of knee joint during standing and walking.

TEXT BOOKS

1. Dhanjoo N. Ghista, “Bio-mechanics of Medical Devices”, Marcel Dekker, 1980.
2. Haufred Clynes, “Bio-medical Engineering Systems”, McGraw Hill, 1998.

REFERENCES

1. Y.C. Fung, “Bio-Mechanics- Mechanical Properties of Tissues”, Springer-Verlag,1998.
2. Dhanjoo N. Ghista, “Orthopaedic Mechanics”, Academic Press, 1990.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM P81	**COMPREHENSIVE VIVA-VOCE**	**0**	**0**	**3**

The student will be tested for his understanding of the basic principles of the core engineering subjects. The internal assessment for a total of 50 marks will be made by a committee comprising of the faculty members of the department. The committee will conduct a written examination (objective type and short questions from all the core subjects) followed by a viva voce examination. The external university examination, which carries a total of 50 marks, will be a viva voce examination conducted by a committee of one external examiner and one internal examiner appointed by the university.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM PW8	**PROJECT WORK (PHASE II)**	**0**	**0**	**3**

Extension and completion of project work started in the previous semester. On completion of the project work, each student has to prepare a project report and submit the same to the department.
In the Phase II, the project work and the report will be evaluated by the internal assessment committee for a total of 50 marks. The external university examination, which carries a total of 100 marks, will have report evaluation and viva voce examination conducted by a committee of one external examiner and one internal examiner appointed by the University.

V SEMESTER ELECTIVES

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E51	COMPUTER ARCHITECTURE AND ORGANIZATION	4	0	0

Course Objectives:

- To have a thorough understanding of the basic structure and operation of a digital computer.
- To discuss in detail the operation of the arithmetic unit including the algorithms & implementation of fixed-point and floating-point addition, subtraction, multiplication & division.
- To study the different ways of communicating with I/O devices and standard I/O interfaces.
- To study the hierarchical memory system including cache memories and virtual memory

Course Outcomes:

Students will have thorough knowledge about

- Basic structure of a digital computer
- Arithmetic operations of binary number system
- The organization of the Control unit, Arithmetic and Logical unit, Memory unit and the I/O unit.

Syllabus

UNIT I INTRODUCTION

Computing and Computers, Evolution of Computers, VLSI Era, System Design- Register Level, Processor Level, CPU Organization, Data Representation, Fixed – Point Numbers, Floating Point Numbers, Instruction Formats, Instruction Types. Addressing modes.

UNIT II DATA PATH DESIGN

Fixed Point Arithmetic, Addition, Subtraction, Multiplication and Division, Combinational and Sequential ALUs, Carry look ahead adder, Robertson algorithm, booth's algorithm, nonrestoring division algorithm, Floating Point Arithmetic, Coprocessor, Pipeline Processing, Pipeline Design, Modified booth's Algorithm

UNIT III CONTROL DESIGN

Hardwired Control, Microprogramme Control, Multiplier Control Unit, CPU Control Unit, Pipeline Control, Instruction Pipelines, Pipeline Performance, Superscalar Processing, Nano Programming.

UNIT IV MEMORY ORGANIZATION

Random Access Memories, Serial - Access Memories, RAM Interfaces, Magnetic Surface Recording, Optical Memories, multilevel memories, Cache & Virtual Memory, Memory Allocation, Associative Memory.

UNIT V SYSTEM ORGANIZATION

Communication methods, Buses, Bus Control, Bus Interfacing, Bus arbitration, IO and system control, IO interface circuits, Handshaking, DMA and interrupts, vectored interrupts, PCI interrupts, pipeline interrupts, IOP organization, operation systems, multiprocessors, fault tolerance, RISC and CISC processors, Superscalar and vector processor.

TEXT BOOK:

1. John P.Hayes, 'Computer architecture and Organisation', Tata McGraw-Hill, Third edition, 1998.
2. V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, " Computer Organisation", V edition, McGraw-Hill Inc, 1996..

REFERENCES:

1. Morris Mano, "Computer System Architecture", Prentice-Hall of India, 2000.
2. Paraami, "Computer Architecture", BEH R002, Oxford Press.
3. P.Pal Chaudhuri, , "Computer organization and design", 2nd Ed., Prentice Hall of India, 2007.
4. G.Kane & J.Heinrich, ' MIPS RISC Architecture ', Englewood cliffs, New Jersey, Prentice Hall, 1992.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E52	**ELEMENTS OF BIOTECHNOLOGY**	**4**	**0**	**0**

Course Objectives:

- To develop skills of the students in the field of environmental biotechnology and its applications.

Course Outcomes:

At the end of the course, the students would have learnt about the

- social issues of pollution, waste water management, biodiversity and conservation etc.
- bioremediation and biodegradation of wastes.

Syllabus

UNIT-I

What is Biotechnology, Biotechnology –an interdisciplinary pursuit, public perception of Biotechnology, Biotechnology and the developing world? Classification of micro-organisms, The cell, its organelles and their respective functions, Basic metabolism of cells, DNA – Structure and function, RNA-Structure and function.

UNIT-II

Enzyme Technology: Proteins, Protein Structure & Function, Protein –Protein interactions, The nature of enzymes, application of enzymes, Technology of enzyme production, immobilized enzymes.

UNIT-III

Biotechnology and Medicine: Introduction, Pharmaceuticals and bio-pharmaceuticals, Antibiotics, vaccines and monoclonal antibodies, gene therapy. Biotechnology and Environment: Introduction, Microbial ecology / environmental biotechnology, waste water and sewage treatment, landfill technologies, composting, bioremediation, microbes and the geological environment, sustainability.

UNIT – IV

Genetics and Biotechnology: Introduction, industrial genetics, protoplast and cell fusion technologies, genetic engineering, Introduction to Bio-informatics, potential lab biohazards of genetic engineering, Bioethics.

UNIT V

Biotechnology in Agricultural, food and Beverage industries: Introduction, plant biotechnology, diagnostics in agriculture, food and beverage fermentation, specialty fermentation products e.g.: biopolymers, bio-pesticides, miscellaneous microbial derived food products.

TEXT BOOKS

1. Bailey, J.E. and D.F. Ollis. 1986. Biochemical Engineering Fundamentals, 2nd Ed. McGraw-Hill, New York.

REFERENCE BOOKS:

1. Shuler, M.L. and F. Kargi. 1992. Bioprocess Engineering, Prentice-Hall, Englewood Cliffs, NJ. Biotechnology by Smith, Cambridge Press.
2. Modern Concepts of Biotechnology by H.D. Kumar, Vikas Publishing House Pvt. Ltd.
3. Elements of Biotechnology by P.K. Gupta, Rastogi Publications.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E53	BASICS OF ELECTRICAL ENGINEERING	4	0	0

Course Objectives:

- To develop skills of the students in the field of electrical engineering and its applications.

Course Outcomes:

At the end of the course, the students would have learnt about the

• Magnetic circuits, principle and application of transformers
• Principle of operation of DC motors and AC Machines
• Principle of fractional-kW motors and their applications.

Syllabus

UNIT I INDUCTION THEORY
Magnetic effects of electric current- Magnetic circuits- Magnetic materials and B-H relationship – Electromagnetic induction and force – Hysteresis and eddy current losses

UNIT II TRANSFORMER
Introduction – Single phase transformer construction and principle of operation – EMF equation of transformer-Transformer no–load phasor diagram — Transformer on–load phasor diagram – Equivalent circuit of transformer – Regulation of transformer –Transformer losses and efficiency-All day efficiency –auto transformers.

UNIT III DC MACHINES
Construction of DC machines – theory of operation of DC generators – characteristics of DC generators-Applications. Operating principle of DC motors – types of DC motors and their characteristics – speed control of DC motors-Applications, Stepper motor and Applications.

UNIT IV INDUCTION MACHINES AND SYNCHRONOUS MACHINES
Principle of operation of three-phase induction motors – Construction –Types – Equivalent circuit – Construction of single-phase induction motors – Types of single phase induction motors – Double revolving field theory – starting methods Principles of alternator – Construction details – Types – Equation of induced EMF – Voltage regulation. Methods of starting of synchronous motors – Torque equation – V curves – Synchronous motors.

UNIT V FRACTIONAL KILOWATT MOTORS
Single phase induction motor, principle of operation, torque-speed characteristics – Types of single phase motors- Split phase motors; Split Phase Resistance Start Induction motor, Split phase capacitor start induction motor, Permanent –split capacitor induction motor-Single phase Commutator Motors- Repulsion motor, Repulsion start Induction run motor - AC Series Motor.

TEXT BOOKS

1. D P Kothari and I J Nagrath, “Basic Electrical Engineering”, 2nd Edition, TMH, 2002
2. P. C Sen, “Principles of Electric Machines and Power Electronics”, 2nd Edition, John - Wiley & Sons, 2001

REFERENCE BOOKS:

R.K. Rajput, “Basic Electrical &Electronics Engineering”, Lakshmi Publishers, Reprint 2008

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E54	**COMMUNICATION ENGINEERING**	**4**	**0**	**0**

Course Objectives:

- To equip students with various issues related to analog and digital communication such as modulation, Demodulation, Noise handling, Data conversion and Multiplexing

Course Outcomes:

- Students will be familiar with the techniques involved in the transfer of information in the field of Radio communication
- Students will be able to detect and correct the errors that occur due to noise during transmission
- Students will be able to understand the concepts of Facsimile, Television, Cellular and Satellite Communication

Syllabus

UNIT-I ANALOG MODULATION SYSTEMS

Need for modulation - Amplitude modulation – Frequency spectrum of AM wave – Representation of AM – Power relation –Frequency modulation – Frequency spectrum of FM wave –AM transmitter – FM transmitter – Super heterodyne AM receiver –FM receivers.

UNIT-II PULSE AND DIGITAL MODULATION SYSTEMS

Principles of pulse modulation – sampling theorem, PAM – PWM – PPM– Conversion of PWM wave to PPM wave – Generation of PAM, PPM and PWM waves – Demodulation of PAM, PWM, PPM – An introduction to digital modulation systems – PCM, ASK, FSK and PSK.

UNIT- III MICROWAVE AND SATELLITE COMMUNICATION SYSTEMS

Microwave communication systems: advantage, block diagram of a microwave radio system, microwave radio stations- Terminal station and repeater station.
Satellite Communication system: Satellite Orbits, launch vehicles, look angles, satellite parameters, satellite link model, personal communication systems- GPS services.

UNIT- IV FIBER OPTICAL COMMUNICATION SYSTEMS

Need for fiber optics, introduction to optical fiber, principle of light transmission through a fiber, fiber characteristics and classification, various fiber losses- Light sources and photo detectors- Block diagram of a fiber optic system- Power budget analysis for a optical link-Recent applications of fiber optics.

UNIT –V CELLULAR MOBILE COMMUNICATION

Cellular concept, basic cellular concept and its operation, uniqueness of mobile radio environment- Performance metrics in cellular system-Elements of cellular mobile radio-Handoff- Frequency management and channel assignment- Introduction to various cellular standards like AMPS, GSM, GPRS,

IS-95A, IS-95B, CDMA-2000 and WCDMA.

TEXT BOOKS

1. Kennedy Davis, “Electronic Communication Systems”, Tata McGraw Hill Publishing Company Limited, New Delhi, 1999.
2. Wayne Tomasi, “Electronic Communication Systems”, Pearson education Private Limited, Delhi, 2004.

REFERENCE BOOKS:

1. Roddy D and Coolen J, “Electronic Communications”, Prentice Hall of India Private Limited, fourth edition, 2007.
2. William C.Y. Lee, “Mobile Cellular Telecommunication Systems”, McGraw Hill International Edition, Second edition, 2006.
3. Gerd Keiser, “Optical fiber Communications”, McGraw Hill International Edition, Fourth edition, 2006.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E55	**SOFT COMPUTING**	**4**	**0**	**0**

Course Objectives:

- To learn Artificial neural networks, Fuzzy systems, Neuro Fuzzy modeling and Genetic Algorithm.

Course Outcomes:

- To understand the concepts of soft computational techniques.
- The course would help to arouse student's interest in the application of soft computational techniques to solve various problems.

UNIT I

Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

UNIT II

Optimization - Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method – Step Size Determination – Derivative-free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

UNIT III

Introduction to Neural Networks - Supervised Learning Neural Networks – Perceptrons - Adaline – Back propagation Mutilayer Perceptrons – Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization – Hebbian Learning.

UNIT IV

Adaptive networks based Fuzzy interface systems - Classification and Regression Trees - Data clustering algorithms - Rule based structure identification - Neuro-Fuzzy controls - Simulated annealing – Evolutionary computation.

UNIT V

Applications: Pattern Recognitions, Image Processing, Biological Sequence Alignment and Drug Design, Robotics and Sensors, Information Retrieval Systems, Natural Language Processing

TEXT BOOKS

1. S.Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003. (UNIT I. III, IV, V)
2. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, N.Y., 1989.(UNIT II)

REFERENCE BOOKS

1. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill, 1997.
2. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI, 2004, Pearson Education 2004.
3. R.Eberhart, P.Simpson and R.Dobbins, “Computational Intelligence - PC Tools”, AP Professional, Boston, 1996.

VI SEMESTER ELECTIVES

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E61	**ANAESTHESIA**	**4**	**0**	**0**

Course Objectives:

- To understand the airway evaluation including predictors of difficult intubations
- Understand airway evaluation including predictors of difficult mask ventilation
- Understand difficult airway algorithm and its application to difficult airway cases
- Understand how different surgical pathology relates to anesthetic management and planning

Course Outcomes:

On the successful completion of the course, students will be able to know:

- Local anesthetic armamentarium components, and their characteristics, proper handling, and use.
- Topical anesthetics and their appropriate use.
- Causes, prevention, and management of needle breakage.
- Local complications associated with use of local anesthetics, and their clinical signs and management.
- Systemic complications associated with use of local anesthetics, and their clinical signs and emergency management.

Syllabus

UNIT I

Introduction & Gas Laws, Differential Pressure Flowmeters, Variable-Area Flowmeters, Anemometry, Spirometers.

UNIT II

Introduction, Vaporizing Systems (Draw-Over Systems), Other Factors Affecting Vapour Concentration, Summary of Vaporizer Performance, Calibration of Vaporizers, Examples of Vaporizers: Boyle's Vapourisers & its use. Definitions of Humidifiers, Importance of Humidification, Examples of Humidification Equipment.

UNIT III

The Continuous Flow Anesthetic Machine - Introduction, Machine Framework, Pin Index System for Gas Cylinders, Other Types of Gas-Tight Connections Within the Machine, Pressure Gauges, Pressure Regulators, (Reducing Valves), The Back Bar, Safety Features, The Common Gas Outlet, Auxiliary Gas Sockets. Maintenance of Anesthetic Machines.
Electronics in the Anesthetic Machine - Introduction, Ergonomics, Control Engineering, New Components, An Electronically Controlled Anesthetic Machine, Servo-controlled Anesthesia.

UNIT IV

Breathing Systems & Nonbreathing Systems - Definitions, Classification of Breathing Systems, Classification of Systems with Potential for Rebreathing- Mapleson A breathing system, Mapleson A & controlled ventilation. Mapleson D system with spontaneous respiration, Mapleson D system with controlled ventilation, Non Rebreathing Systems- Anesthetic non Rebreathing system which include CO2 absorption.

UNIT V

Introduction to Monitoring of Gases, Inspired Oxygen Concentration (working principle of Galvanic Oxygen fuel cell, Servomex paramagnetic oxygen analyzer, Nitrous Oxide and the Volatile Agents: The Riken gas indicator, Bruel & Kjaer Anesthetic gas monitor, Raman anesthetic gas monitor, Hewlett-Packard main stream carbon dioxide gas analyzer. Anesthetic Room: Introduction, Layout of the Anesthetic Room, Contents of the Anesthetic Room.

TEXT BOOKS

1. Jerry A Dorsch (Author), Susan E Dorsch (Author), Understanding Anesthesia Equipment (Hardcover), Lippincott Williams & Wilkins publishers; Fifth Edition, October 2007

REFERENCE BOOKS:

1. R Chandrasekaran, R Lakshmi, Essentials of Anaesthesia For Undergraduates, Jaypee Medical Publishers, 2006
2. Vasumathi M Divekar, Anaesthesia And Resuscation For Medical Students And Practitioners, Jaypee Medical Publishers, 2000
3. Rajeshwari Subramaniam, A Primer Of Anesthesia, Jaypee Medical Publishers, 2008
4. Ward's Anaesthetic Equipment" by Andrew Davey, John T. B. Moyle & Crispian S. Ward, 3rd edition.
5. A Text book of Anaesthesia by R. D. Miller.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E62	BIOMETRIC SYSTEMS	4	0	0

Course Objectives:

- To understand the latest Biometric technology including the definition, terminologies used, parameters and basic features.
- To learn the principle, process, hardware used and issues for the different biometric methods like finger, facial, iris, voice, hand and retina.

Course Outcomes:

On completion of this course, students will be able to

- Examine and comparatively evaluate biometric systems
- Evaluate the performance of biometric systems, including the application of ROC curves
- Identify fingerprint recognition methods and compare the performance of fingerprint recognition systems
- Compare face recognition methods and apply face detection and recognition methods
- Explain the benefits and challenges of iris recognition systems

Syllabus

UNIT I BIOMETRIC FUNDAMENTALS

Key Biometric terms and Processes – Definitions-verification and identification – matching, Accuracy in Biometric Systems – False match rate - False nonmatch rate - Failure to enroll rate – Derived metrics - An Introduction to Biometric Authentication Systems- a taxonomy of application environment, a system model, biometrics and privacy.

UNIT II FINGERPRINT IDENTIFICATION TECHNOLOGY

History, Components, Application of Fingerprints, The Technology- Finger Scan Strengths and Weaknesses, Criminal Applications, Civil Applications, Commercial Applications, Technology Evaluation of Fingerprint Verification Algorithms.

UNIT III IRIS RECOGNITION

Introduction, Anatomical and Physiological underpinnings, Components, Sensing, Iris Scan Representation and Matching, Iris Scan Strengths and Weaknesses, System Performance, Future Directions.

UNIT IV FACE RECOGNITION

Introduction, components, Facial Scan Technologies, Face Detection, Face Recognition- Representation and Classification, Kernel- based Methods and 3D Models, Learning the Face Spare, Facial Scan Strengths and Weaknesses, Methods for assessing progress in Face Recognition.

UNIT V VOICE SCAN

Introduction, Components, Features and Models, Addition Method for managing Variability, Measuring Performance, Alternative Approaches, Voice Scan Strengths and Weaknesses, NIST Speaker Recognition Evaluation Program, Biometric System Integration.

TEXT BOOKS:

1. James Wayman & Anil Jain, Biometric Systems – Technology, Design and Performance Evaluation, Springer-verlag London Ltd, USA, 2005.
2. Sanir Nanavati, Michael Theme, Biometrics Identity Verification in a Networked world, Wiley Computer Publishing Ltd, New Delhi,2003.

REFERENCE:

1. John D. Woodword Jr., Biometrics, Dreamtech Press, New Delhi, 2003.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E63	**MEDICAL IMAGING TECHNIQUES**	**4**	**0**	**0**

Course Objectives:

- To study the quality assurance test for radiography, method of recording sectional images
- To study the functioning of radioisotopic imaging equipments
- To study the MRI, image acquisition and reconstruction
- To study the 3-D image display techniques

Syllabus

UNIT I INTRODUCTION

Basic imaging principle image modalities, Image properties Projection radiography, interaction between X – Rays and matter, Intensity of an X – Ray, Attenuation, X – Ray Generation and Generators, Beam Restrictors and Grids, Intensifying screens, fluorescent screens and image intensifiers, X – Ray, detectors, Conventional X – Ray radiography, Fluoroscopy, Angiography, Digital radiography.

UNIT II COMPUTED TOMOGRAPHY

Basic Principle, Generation of CT machines, Detectors & Detector arrays, Details of Acquisition, Digital image display Radiation Dose, Image quality.

UNIT III ULTRASOUND

Acoustic propagation, Attenuation, Absorption and Scattering, Ultrasonic transducers, Transducer Arrays, A mode, B mode, M mode scanners, Tissue characterization, Color Doppler flow imaging, Echocardiography.

UNIT IV RADIO NUCLIDE IMAGING

Interaction of nuclear particles and matter, nuclear sources, Radionuclide generators, nuclear radiation detectors, rectilinear scanner, scintillation camera, SPECT, PET, Gamma ray camera, LINAC, molecular imaging.

UNIT V MAGNETIC RESONANCE IMAGING

Angular momentum, Magnetic dipole moment, Magnetization, Larmor frequency Rotating frame of reference, free induction decay, Relaxation times, Pulse sequences, Generation and Detection of NMR Imager, Slice selection, Frequency encoding, Phase encoding, Spin – Echo imaging, Gradient – Echo imaging, Imaging safety, Biological effects of magnetic field, Introduction to FMRI,EMRI.

TEXT BOOKS:

1. Mathematics and Physics of Emerging Biomedical Imaging , National Academies Press, 1996

REFERENCE:

1. K Kirk Shung, Michael B smith & Benjamim M W Tsui, “Principles of Medical Imaging”, Academic press inc, 1992.
2. Jerry L Prince & Jonathan M Links, “Medical Imaging Signals and Systems”, Pearson Prentice Hall, 2006.
3. Jerrold T. Bushberg “The essential Physics of Medical Imaging”, Lippincott Williams and Wilkins, 2002.
4. R S Khandpur, “Hand Book of Biomedical Instrumentation”, Tata McGraw Hill Publication, Second Edition. 2003.
5. Ray H. Hashemi , William G. Bradley, Christopher, J. Lisanti, MRI: The Basics, 2004.
6. Frederick W Kremkau “Diagnostic Ultrasound Principles & Instruments”, Saunders Elsevier, 2005.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E64	**VLSI DESIGN**	**4**	**0**	**0**

Course Objectives:

- To study the basic concepts of MOS transistor, circuit design processes, Combinational Logic Circuits, Sequential Logic Circuits, Arithmetic Building Blocks, Memory and Array Structures and BiCMOS Logic Circuits

Course Outcomes:

- Students are expected to design circuits using different CMOS styles and also to do analysis on CMOS structures.

Syllabus

UNIT - I

Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS technologies- Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design-Gate realization using CMOS- Introduction to Reconfigurable Hardware – HDL basics.

UNIT – II

VHDL basics - VHDL levels of abstraction - Abstraction and timing - The VHDL design flow - VHDL design entities - Entity declarations - Architectures - Using libraries and packages - Concurrent signal assignments - Signal assignments with delays.

UNIT – III

Component declarations - Component instantiation - Named port mapping - Positional port mapping - Direct instantiation - Configuration specifications - Entity binding
Port modes - VHDL processes - Processes sensitivity lists - Objects in VHDL - Constants, variables and signals - VHDL types - Scalar types - Arrays – Records - Custom types and subtypes

UNIT – IV

Concurrent statements - Sequential statements - Conditional & selective signal assignments - The generate statement - Signal and variable assignments -
For loops - Subprograms – Functions – Procedures - Differences between functions and procedures - Subprogram declarations – Packages - Package declaration - Package body.

UNIT – V

VHDL synthesis - Modeling hardware in VHDL - VHDL models for multiplexers, Encoders, Decoders, Parity Generators – combinational circuit implementation - compilation and simulation of VHDL code, modeling a sequential machine, Test bench development.

TEXT BOOKS

1. J. Bhasker, VHDL Primer, Prentice Hall, 3rd edition, 1998.

REFERENCE BOOKS:

1. Chip Design for Submicron VLSI: CMOS Layout & Simulation, - John P. Uyemura, Thomson Learning.
2. Introduction to VLSI Circuits and Systems - John .P. Uyemura, JohnWiley, 2003.
3. Digital Integrated Circuits - John M. Rabaey, PHI, EEE, 1997.
4. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E65	VIRTUAL INSTRUMENTATION	4	0	0

Course Objectives:

i. To review background information required for studying virtual instrumentation.
ii. To study the basic building blocks of virtual instrumentation.
iii. To study the various techniques of interfacing of external instruments of PC.
iv. To study the various graphical programming environment in virtual instrumentation.
v. To study a few applications in virtual instrumentation.

Syllabus

UNIT 1. REVIEW OF DIGITAL INSTRUMENTATION

Representation of analog signals in the digital domain – Review of quantization in amplitude and time axes, sample and hold, sampling theorem, ADC and DAC.

UNIT 2. FUNDAMENTALS OF VIRTUAL INSTRUMENTATION

Concept of virtual instrumentation – PC based data acquisition – Typical on board DAQ card – Resolution and sampling frequency - Multiplexing of analog inputs – Single-ended and differential inputs – Different strategies for sampling of multi-channel analog inputs. Concept of universal DAQ card - Use of timer-counter and analog outputs on the universal DAQ card.

UNIT 3. CLUSTER OF INSTRUMENTS IN VI SYSTEM

Interfacing of external instruments to a PC – RS232, RS 422, RS 485 and USB standards - IEEE 488 standard – ISO-OSI model for serial bus – Introduction to bus protocols of MOD bus and CAN bus.

UNIT 4. GRAPHICAL PROGRAMMING ENVIRONMENT IN VI

Concepts of graphical programming – Lab-view software – Concept of VIs and sub VI - Display types – Digital – Analog – Chart – Oscilloscopic types – Loops – Case and sequence structures - Types of data – Arrays – Formulae nodes –Local and global variables – String and file I/O.

UNIT 5. ANALYSIS TOOLS AND SIMPLE APPLICATIONS IN VI 9

Fourier transform - Power spectrum - Correlation – Windowing and filtering tools – Simple temperature indicator – ON/OFF controller – P-I-D controller - CRO emulation - Simulation of a simple second order system – Generation of HTML page

TOTAL PERIODS:60

TEXT BOOKS

1. S. Gupta and J.P Gupta, ‘PC Interfacing for Data Acquisition and Process Control’, Instrument society of America, 1994.
2. Peter W. Gofton, ‘Understanding Serial Communications’, Sybex International.
3. Robert H. Bishop, ‘Learning with Lab-view’, Prentice Hall, 2003.

REFERENCE BOOKS

1. Kevin James, 'PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control', Newness, 2000.
2. Gary W. Johnson, Richard Jennings, 'Lab-view Graphical Programming', McGraw Hill Professional Publishing, 2001.

VII SEMESTER ELECTIVES

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E71	**NANO ELECTRONICS**	**4**	**0**	**0**

Course Objectives:

- To learn and understand basic and advance concepts of nanoelectronics.

Course Outcomes:

- The students will be able to understand basic and advanced concepts of nanoelectronic devices, sensors and transducers and their applications in nanotechnology.

Syllabus

UNIT I INTRODUCTION TO NANOTECHNOLOGY

Background to nanotechnology: Types of nanotechnology and nanomachines – periodic table atomic structure – molecules and phases – energy – molecular and atomic size – surface and dimensional space – top down and bottom up; Molecular Nanotechnology: Electron microscope – scanning electron microscope – atomic force microscope – scanning tunnelling microscope – nanomanipulator – nanotweezers – atom manipulation – nanodots – self assembly – dip pen nanolithography. Nanomaterials: preparation – plasma arcing – chemical vapor deposition – sol-gels – electrodeposition – ball milling – applications of nanomaterials;

UNIT II FUNDAMENTALS OF NANOELECTRONICS

Fundamentals of logic devices:- Requirements – dynamic properties – threshold gates; physical limits to computations; concepts of logic devices:- classifications – two terminal devices – field effect devices – coulomb blockade devices – spintronics – quantum cellular automata – quantum computing – DNA computer; performance of information processing systems;- basic binary operations, measure of performance processing capability of biological neurons – performance estimation for the human brain. Ultimate computation:- power dissipation limit – dissipation in reversible computation – the ultimate computer.

UNIT III SILICON MOSFETs & QUANTUM TRANSPORT DEVICES

Silicon MOSFETS - Novel materials and alternate concepts:- fundamentals of MOSFET Devices-scaling rules – silicon-dioxide based gate dielectrics – metal gates – junctions & contacts – advanced MOSFET concepts. Quantum transport devices based on resonant tunneling:- Electron tunneling – resonant tunneling diodes – resonant tunneling devices; Single electron devices for logic applications:- Single electron devices – applications of single electron devices to logic circuits.

UNIT IV CARBON NANOTUBES

Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic propertics – synthesis of carbon nanotubes – carbon nanotube interconnects – carbon nanotube FETs – Nanotube for memory applications prospects of an all carbon

nanotube nanoelectronics.

UNIT V MOLECULAR ELECTRONICS

Electrodes & contacts – functions – molecular electronic devices – first test systems – simulation and circuit design – fabrication; Future applications: MEMS – robots – random access memory – mass storage devices.

TEXTBOOKS:

1. Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, Nanotechnology: Basic Science and Emerging Technologies, Chapman & Hall / CRC, 2002
2. T. Pradeep, NANO: The Essentials – Understanding Nanoscience and Nanotechnology, TMH, 2007
3. Rainer Waser (Ed.), Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley-VCH, 2003

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E72	**WEARABLE SYSTEMS**	**4**	**0**	**0**

Course Objectives:

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

Syllabus

UNIT I 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 II 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 III 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 IV 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 V 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

TOTAL PERIODS:60

TEXTBOOKS:

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, 2012
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

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E73	**TISSUE ENGINEERING**	**4**	**0**	**0**

Course Objectives:

- The objective of this course is to gain an appreciation for the concepts and applications of molecular, cellular, and tissue engineering. Basic techniques in biotechnology, cell and tissue dynamics, stem cell technology, and cell transplantation are overviewed. Physiology of cell growth and culturing along with adhesion dynamics.

Course Outcomes:

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

- Learn how to derive weak formulations for mechanics problems.
- Understand theory of finite element modeling .
- Learn how to use software for finite element modeling of biologic tissues
- Learn how to formulate multiscale approaches for tissue mechanics problems and solve these problems numerically

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

Case study and regulatory issues: Case study of multiple approaches: cell transplantation for liver, musculoskeletal, cardiovascular, neural, visceral tissue engineering. Ethical, FDA and regulatory issues of

tissue engineering.

TEXT BOOKS

1. Clemens van Blitterswijk, Tissue Engineering, Academic Press, 2008

REFERENCE BOOKS:

1. Principles of tissue engineering, Robert. P.Lanza, Robert Langer & William L. Chick, Academic press.
2. The Biomedical Engineering –Handbook, Joseph D. Bronzino, CRC press.
3. Introduction to Biomedical Engg. , Endarle, Blanchard & Bronzino, Academic press.
4. Tissue Engineering, B. Palsson, J.A. Hubbell, R.Plonsey & J.D. Bronzino, CRC- Taylor & Francis

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E74	BIOINFORMATICS	4	0	0

Course Objectives:

- To impart knowledge on basic techniques of Bioinformatics

Course Outcomes:

At the end of the course, the students would have learnt about

- Sequencing Alignment and Dynamic Programming
- Sequence Databases
- Evolutionary Trees and Phylogeny

Syllabus

UNIT I

Introduction to genomics: Information flow in biology, DNA sequence data, experimental approach to genome sequence data, genome information resources.

UNIT II

Functional proteomics: Protein sequence and structural data, protein information resources and secondary data bases.

UNIT III

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 IV

Sequence alignment and data base search: Protein primary sequence analysis, DNA sequence analysis, pair wise sequence alignment, FASTA algorithm, BLAST, multiple sequence alignment, DATA base searching using BLAST and FASTA.

UNIT V

Structural data bases: Small molecules data bases, protein information resources, protein data bank, genebank, swissport, enterz.

TEXT BOOKS

1. Andrzej Polanski, Marek Kimmel, Bioinformatics, Springer publications, 2007

REFERENCE BOOKS

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.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E75	**RADIOLOGICAL EQUIPMENT**	**4**	**0**	**0**

Course Objectives:

- To study the anatomy and Physiology, Radiologic physics and safety, Electricity and electronics, Radiologic equipment applications, Technical problem solving.

Course Outcomes:

On completion of the course, the students will be able

- to demonstrate an understanding of diagnostic radiologic image devices and the appropriate performance evaluations.

Syllabus

UNIT I 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 II COMPUTER TOMOGRAPHY

Principles of Tomography - First to Fourth generation scanners – Image reconstruction technique- Back projection and Iterative method. Spiral CT Scanning - Ultra fast CT Scanners- X-Ray Sources – Collimation – X-Ray Detectors – Viewing System.

UNIT III MAGNETIC RESONANCE IMAGING

Fundamentals of Magnetic Resonance- Interaction of nuclei with static Magnetic Field and Radio frequency wave – Rotation and Precession –induction of a magnetic resonance signal – bulk Magnetization – Relaxation Processes T1 and T2. Block diagram approach of MRI system- System Magnet (Permanent, Electromagnet and super conductors) , generation of Gradient magnetic Fields , Radio Frequency coils (sending and receiving) Shim coils, Electronic components.

UNIT IV NUCLEAR MEDICINE SYSTEMS

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 V RADIATION THERAPY AND RADIATION SAFETY

Radiation therapy-Linear accelerator, betatron, cesium and cobalt .Radiation Protection in Medicine –

Radiation Protection principles, Radiation measuring instruments-Dosimeter, film Badges, Thermo luminescent dosimeters – Electronic dosimeter- ICRP regulation Practical reduction of dose to staff and visitors.

TEXT BOOKS

1. Steve webb, Physics of Medical Imaging, , Taylor and Francis, 1988.
2. R. Hendee and Russell Ritenour "Medical Imaging Physics"–William,Wiley, Fourth Edition 2002

. **REFERENCE BOOKS**

1. Physics and Radiobiology of Nuclear Medicine –Third edition – Gopal B.Saha – Publisher – Springer, 2006.
2. Medical Physics and Biomedical Engineering –B.H Brown , PV Lawford, R H Small wood , D R Hose , D C Barber , CRC Press, 1999.
3. Standard handbook of Biomedical Engineering and Design – Myer Kutz Publisher – McGraw – Hill, 2003.
4. P.Raghunathan, "Magnetic Resonance Imaging and Spectroscopy in Medicine" Concepts and Techniques, Orient Longman, 2007.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E76	MEDICAL OPTICS	4	0	0

Course Objectives:

- To provide a sound basic knowledge and understanding of the optical properties of tissues
- To impart knowledge on applications of microscopy techniques including optical coherence tomography and fluorescence microscopy.
- To impart knowledge in laser physics and the principles of the thermal, photochemical and photomechanical effects that light can have on biological tissue.

Course Outcomes:

The students will be able to:

- Demonstrate knowledge of the fundamentals of optics and how basic principles are used to design and optimize optical instruments used in medical diagnostics
- Describe geometrical optics and its role in the design of microscopy instruments
- Describe wave optics and its role in the design of instrumentation for optical coherence tomography

Syllabus

UNIT I OPTICAL PROPERTIES OF THE TISSUES

Refraction, Scattering, absorption, light transport inside the tissue, tissue properties, Light interaction with tissues, optothermal interaction, fluorescence, speckles.

UNIT II INSTRUMENTATION IN PHOTONICS

Instrumentation for absorption, scattering and emission measurements, excitation light sources – high pressure arc lamp, solid state LEDs, Lasers, optical filters, polarizer, solid state detectors, time resolved and phase resolved detectors.

UNIT III APPLICATIONS OF LASERS

Laser in tissue welding, lasers in dermatology, lasers in ophthalmology, otolaryngology, urology.

UNIT IV OPTICAL TOMOGRAPHY

Optical coherence tomography, Elastrography, Doppler optical coherence tomography, Application towards clinical imaging.

UNIT V SPECIAL OPTICAL TECHNIQUES

Near field imaging of biological structures, in vitro clinical diagnostic, fluorescent spectroscopy, photodynamic therapy.

TEXT BOOKS:

1. Tuan Vo Dirh, “Biomedical photonics – Handbook”, CRC Press, Bocaraton, 2003.
2. Mark E. Brezinski., Optical Coherence Tomography: Principles and Applications,Academic Press, 2006.

REFERENCES:

1. Leon Goldman, M.D., & R. James Rockwell, Jr., “Lasers in Medicine”, Gordon and Breach, Science Publishers Inc., New York, 1971.
2. R. Splinter and B.A Hooper, An Introduction to BioMedical Optics,Taylor and Francis,2007.

VIII SEMESTER ELECTIVES

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E81	BIO MEMS	4	0	0

Course Objectives:

- To gain knowledge about different materials used for BioMEMs fabrication, different steps of micro fabrication and manufacturing technology.
- To gain good knowledge about Biosensors for different applications

Course Outcomes:

- critical thinking in microengineering process, materials and design issues,
- understanding of microscale physics for use in designing MEMS applications,
- review current MEMS, RFMEMS and BioMEMS applications,
- knowledge to design and fab novel MEMS/BioMEMS/RF MEMS applications as part of a group project.

Syllabus

UNIT I MEMS AND MICROSYSTEMS

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

UNIT II MICROSENSORS AND ACUATORS

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, gyroscope, piezoactuator.Thermal sensors and actuators-micromachined thermocouple probe, Peltier effect hat pumps, thermal flow sensors

UNIT III MICRO OPTO ELECTRO MECHANICAL SYSTEMS

Fundamental principle of MOEMS technology, light modulators, beam splitter, microlens, digital micromirror devices, light detectors, grating light valve, optical switch

UNIT IV 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, dielectriophoresis, microfluid dispenser, microneedle, micropumps-continuous flow system

UNIT V 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 hybridization.

TEXT BOOKS:

1. Nitaigour Premchand Mahalik, " MEMS", Tata McGraw Hill Publishing Company, New Delhi, 2007
2. Tai Ran Hsu , "MEMS and Microsystems design and manufacture", Tata McGraw Hill Publishing Company, New Delhi, 2002

REFERENCE:

1. Wanjun Wang, Stephen A.Soper,"BioMEMs: Technologies and applications", CRC Press, New York, 2007

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E82	**ASSIST DEVICES**	**4**	**0**	**0**

Course Objectives:

- To understand chronic heart failure and cardiogenic shock. Focusing on cardiomyopathies, cardiogenic shock, destination therapy, LVADs, and patient care. Didactic sessions, case presentations, audience polling, and interactive discussions will engender learning and improvement in the management of patients with the full spectrum of heart failure.

Course Outcomes:

- Recognize cardiogenic shock that will be refractory to standard therapies
- Identify the types of percutaneous and surgical devices available to treat cardiogenic shock
- Recognize the limitations of LVAD therapy and understand how to manage them appropriately
- Discuss the future of device therapy in advanced and less advanced stages of heart failure
- Recognize the benefits of cardiac transplantation
- Select patients for cardiac transplantation and/or device therapy
- Identify available technology and the indications for ECMO
- Understand LVAD outpatient management and the concept of "Shared Care"

UNIT I CARDIAC ASSIST DEVICES

Principle of External counter pulsation techniques, intra aortic balloon pump, Auxillary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves.

UNIT II HEMODIALYSERS

Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters.

UNIT III HEARING AIDS

Common tests – audiograms, airconduction, bone conduction, masking techniques, SISI,Hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.

UNIT IV PROSTHETIC AND ORTHODIC DEVICES

Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthodic system, functional electrical stimulation, sensory assist devices.

UNIT V RECENT TRENDS

Transcutaneous electrical nerve stimulator, bio-feedback.

TEXT BOOKS

1. Levine S.N. (ed), “Advances in Bio-medical engineering and Medical physics”, Vol. I, II, IV, inter university publications, New York, 1968 (Unit I, IV, V).
2. Kolff W.J, “Artificial Organs”, John Wiley and sons, New York, 1976. (Unit II).
3. Albert M.Cook and Webster J.G, “Therapeutic Medical Devices”, Prentice Hall Inc., New Jersey, 1982 (Unit III).

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E83	**ENTREPRENEURSHIP**	**3**	**1**	**0**

Course Objectives:

- This course will introduce the many aspects required to create a successful new venture. The idea of starting a business is appealing to many people. The life cycle of a start-up company from the points of view of inventors, engineers or investors includes issues of planning, dealing with legal and tax issues, financial opportunities at different stages, and sources of technical assistance. The course also examines creativity in start-ups and creative gap analysis.

Course Outcomes:

After completing this course, students will be able to

- Apply the entrepreneurial process
- Analyze the feasibility of a new venture business concept
- Evaluate his or her own entrepreneurial tendency and ability

Syllabus

UNIT I

Indian Industrial Environment – competence; Opportunities and Challenges, entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, linkages among small, medium and heavy industries and forms enterprises.

UNIT II

Identification and characteristics of Entrepreneurs, Emergence of First generation entrepreneurs, environmental influence and women entrepreneurs. Conception and evaluation of ideas, their sources and decision making, Choice of Technology – Collaborative interaction for Technology development.

UNIT III

Project formulation, Analysis of marked demand, Demand supply gap, Financial and Profitability analysis and Technical analysis. Project financing in India.

UNIT IV

Project Management during construction phase, project organization, project planning and control using CPM-PERT techniques. Human aspects of project management. Assessment of tax burden.

UNIT V

Behavioral aspects of entrepreneurs: Personality – determinants, attributes and models, leadership concepts and models. Values and attitudes. Motivation aspects, change behaviour.
Time Management: Various approaches of time management, their strengths and weaknesses. The urgency addiction and the time management matrix.

REFERENCES:

1. Vasant Desai, Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House, 1997.
2. Prasanna Chandra, Project – Planning, Analysis, Selection, Implementation and Review, Tata Mc Graw Hill Publishing Company Ltd., 1995.
3. B.Badhai, Entrepreneurship for Engineers, Dhanpath rai & Co., Delhi, 2001.
4. Stephen R. Covey and A.Roger Merril, First Things First, Simon and Schuster, 2002.
5. Robert D. Hisrich and Michael P.Peters, Entreneurship, Tata Mc Graw Hill ed., 2002.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E84	**SPEECH PROCESSING**	**4**	**0**	**0**

Course Objectives:

- To introduce speech production and related parameters of speech.
- To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech.
- To understand different speech modeling procedures such as Markov and their implementation issues.

Course Outcomes:

- Model speech production system and describe the fundamentals of speech.
- Extract and compare different speech parameters.
- Choose an appropriate statistical speech model for a given application.
- Design a speech recognition system.
- Use different speech synthesis techniques.

Syllabus

UNIT I BASIC CONCEPTS

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

UNIT II SPEECH ANALYSIS

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

UNIT III SPEECH MODELING

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

UNIT IV SPEECH RECOGNITION

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

UNIT V SPEECH SYNTHESIS

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

Text Books:

1. Lawrence Rabiner and Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003.
2. Daniel Jurafsky and James H Martin, “Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson

Education, 2002.
3. Frederick Jelinek, “Statistical Methods of Speech Recognition”, MIT Press, 1997.

Reference Books:

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.
4. Ben Gold and Nelson Morgan, “Speech and audio signal processing, Processing and Perception of Speech and Music”, Wiley- India Edition, 2006.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E85	**PHYSIOLOGICAL MODELLING**	**4**	**0**	**0**

Course Objectives:

- Understand the characteristics and dynamics of certain physiological models
- Analyze the dynamics of simple physiological models
- Describe bifurcations in dynamical systems
- Describe physiological systems with simple differential equations

Course Outcomes:

Student will be able to

- recognize the importance of modelling as a tool to study physiological systems and biomeasurement systems
- explain different modelling methods and procedures including various model classes and methods from physical and analog models to finite element applications as well as how different models can be constructed and used.
- Analyze forward and diverse problems.
- Practiced on modelling physiological systems with COMSOL multiphysics software.

Syllabus

UNIT I PROPERTIES OF SYSTEMS AND ELECTRICAL ANALOG

System concept, system properties – Resistance, storage, resistance – compliance, piece-wise linear approximation, electrical analog for compliance, thermal storage, step response of first order systems – resistance- compliance systems, and pulse response of first order systems

UNIT II TRANSFER FUNCTIONS

Transfer functions and its use, Study of transfer function of first order and second order systems, engineering concept in coupled system, example of Transformed signals.

UNIT III IMPEDANCE CONCEPT

Transfer functions with impedance concept, prediction of performance, identification of the system from impedance function, periodic signals, relationship between transfer function and sinusoidal response, evaluation of transfer function from frequency response.

UNIT IV FEEDBACK SYSTEMS

Characteristics of physiological feedback systems, stability analysis of systems.

UNIT V SIMULATION OF BIOLOGICAL SYSTEMS

Simulation of thermal regulation, pressure and flow control in circulation, occulomotor system, endocrinal system, functioning of receptors.

TEXT BOOKS:

1. William B.Blesser, " System approach to Bio-medicine", McGraw-Hill book co., New York, 1969.
2. Manfred Clynes and John H.Milsum, "Bio-medical engineering system", McGraw-Hill book co., NewYork, 1970.
3. Michael C.K. Khoo," Physiological Control Systems -Analysis, Simulation and Estimation" Prentice Hall of India Pvt. Ltd., New Delhi, 2001

REFERENCE:

1. Douglas S. Rigg, "Control theory and physiological feedback mechanism", The William & Williams co., Baltimore, 1970.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E86	**PROSTHETIC ENGINEERING**	**4**	**0**	**0**

Course Objectives:

To provide with the analytical tools to perform fundamental and applied research in biomedical engineering. Alternatively, you will gain the requisite technical knowledge to apply to management, marketing, sales and other entrepreneurial activities related to biomedical engineering.

Course Outcomes:

Students acquire the skills to engage in technological innovations that give people longer, healthier, and more productive lives.

Syllabus

UNIT – I

Engineering Concepts in Sensory Rehabilitation, Motor Rehabilitation, Communication Disorders, Computer-Aided Engineering in customized component design. Intelligent prosthetic knee, Hierarchically controlled prosthetic hand, Self-aligning orthotic knee joint. Externally powered and controlled orthotics and prosthetics: FES systems: Restoration of hand function, standing and walking. Hybrid Assistive Systems (HAS). Active Above Knee Prostheses. Myoelectric hand and arm prostheses.

UNIT – II

Wheeled Mobility: Categories of Wheelchairs. Wheelchair Structure and Component Design. Ergonomics of Wheel chair propulsion. Power Wheelchair Electrical Systems. Control. Personal Transportation. Auxiliary devices and systems.

UNIT – III

Sensory augmentation and substitution: Visual system: Visual augmentation. Tactual vision substitution, Auditory vision substitution; Auditory system: Auditory augmentation. Cochlear implantation, Visual auditory substitution, Tactual auditory substitution, Tactual system: Tactual augmentation. Tactual substitution, Augmentative communication, Control and Computer Access: User Interface, Cost-Effectiveness of High – Verses Low – technology Approaches, Intervention and other Issues.

UNIT – IV

Measurement tools and processes: Subjective and Objective measurement methods, Measurements and assessments; measurement Objectives and Approaches; Characterising the human system and subsystems. Characterising tasks. Characterising assistive devices. Characterizing overall systems in high-level-task situations. Decision-Making process: Current Limitations: Quality of measurements, Standards. Rehabilitation service delivery.

UNIT – V

Computer applications in Rehabilitation Engineering: Interfaces in Compensation for visual perception. Improvement of orientation and mobility. Computer-assisted lip reading. Brain-computer interfaces

TEXT BOOKS:

1. Robinson C.J., Rehabilitation Engineering, CRC Press, 1995.
2. Ballabio E., et al., Rehabilitation Technology, IOS Press, 1993.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
BM E87	REHABILITATION ENGINEERING	4	0	0

Course Objectives

The student should be made to:

- Study the principles of rehabilitation.
- Know new rehabilitation concepts for future development and applications.
- Learn therapeutic Exercise Techniques.
- Understand orthopedic prosthetics and orthotics in rehabilitation.

Syllabus

UNIT I INTRODUCTION TO REHABILITATION & REHABILITATION TEAM: **9**

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 II PRINCIPLES OF REHABILITATION: 9

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 III THERAPEUTIC EXERCISE TECHNIQUE: 9

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 IV PRINCIPLES IN MANAGEMENT OF COMMUNICATION: 9

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.

UNIT V ORTHOTIC & PROSTHETIC DEVICES: 9

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.

TEXT BOOKS

1. Dr. S. Sunder, Rehabilitation Medicine-, 3rd Edition, Jaypee Medical Publications, New Delhi. 2010 (Units I, III, IV & V)

2. Joseph D.Bronzino, The Biomedical Engineering Handbook, Third Edition: Three Volume Set, CRC Press, 2006 (Units II & V).

REFERENCE BOOKS

1. Rory A Cooper, An Introduction to Rehabilitation Engineering, Taylor & Francis, CRC press, 2006.
2. Susan B O'Sullivan, Thomas J Schmitz, Physical Rehabilitation. 5th Edition, Davis publications, 2007.