ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

M.E. REHABILITATIVE INSTRUMENTATION

(Choice Based Credit System)

(Two Year Full-Time & Three Year Part-Time)

REGULATIONS AND SYLLABUS

REGULATIONS - 2019

1. Conditions for Admission

Candidates for admission to the first year of the four-semester **M.E./M.Tech. Degree programme in Engineering** shall be required to have passed B.E./B.Tech. degree of Annamalai University or any other authority accepted by the syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time. The admission for M.E. Part-Time programme is restricted to those working or residing within a radius of **90 km** from Annamalainagar. The application should be sent through their employers.

2. Branches of Study in M.E./M.Tech.

Department	Programme (Full Time & Part time)	Eligible B.E./B.Tech Programme
Electronics & Instrumentation Engineering	Rehabilitative Instrumentation	B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and Electornics Engg, Electronics and Communication Engg, Control and Instrumentation Engg, Instrumentation Engg, Bio Medical Engg, Mechatronics.

3. Courses of study

The courses of study along with the respective syllabi and the scheme of Examinations for each of the M.E / M. Tech programmes offered by the different Departments of study in the Faculty of Engineering and Technology are given separately.

4. Choice Based Credit System (CBCS)

The curriculum includes three components namely Program Core, Program Electives and Open Electives, Mandatory Learning Courses and Audit Courses in addition to Thesis. Each semester curriculum shall normally have a blend of theory and practical courses.

5. Assignment of Credits for Courses

Each course is normally assigned one credit per hour of lecture / tutorial per week and 0.5 credit for one hour of laboratory or project or industrial training or seminar per week. The total credits for the programme will be **68**.

6. Duration of the programme

A student of M.E / M.Tech programme is normally expected to complete in four semesters for full-time / six semesters for part-time but in any case not more than four years for full-time / six years for part-time from the date of admission.

7. Registration for Courses

A newly admitted student will automatically be registered for all the courses prescribed for the first semester, without any option. Every other student shall submit a completed registration form indicating the list of courses intended to be credited during the next semester. This registration will be done a week before the last working day of the current semester. Late registration with the approval of the Dean on the recommendation of the Head of the Department along with a late fee will be done up to the last working day. Registration for the Thesis Phase - I and Phase-II shall be done at the appropriate semesters.

8. Electives

8.1 Program Electives

The student has to select two electives in first semester, another two electives in the second semester and one more in the third semester from the list of Program Electives.

8.2 Open Electives

The student has to select two electives in third semester from the list of Open Electives offered by the Department and / or other departments in the Faculty of Engineering and Technology.

8.3 MOOC (SWAYAM) Courses

Further, the student can be permitted to earn credits by studying the Massive Open Online Courses offered through the SWAYAM Portal of UGC with the approval of the Head of the Department concerned. These courses will be considered as equivalent to open elective courses. Thus the credit earned through MOOC courses can be transferred and considered for awarding Degree to the student concerned.

8.4 Value Added Courses (Inter Faculty Electives)

Of the two open elective courses, a student must study one value added course that is offered by other Faculties in our University either in second or third semester of the M.E programme.

9. Industrial Project

A student may be allowed to take up the one program elective and two open elective courses of third semester (Full Time program) in the first and second semester, to enable him/her to carry out Project Phase-I and Phase-II in an industry during the entire second year of study. The condition is that the student must register those courses in the first semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specific slots will be allotted in the time table for such courses.

10. Assessment

10.1 Theory Courses

The break-up of continuous assessment and examination marks for theory courses is as follows:

First assessment (Mid-Semester Test-I)	:	10 marks
Second assessment (Mid-Semester Test-II)	:	10 marks
Third Assessment	:	5 marks
End Semester Examination	:	75 marks

10.2 Practical Courses

The break-up of continuous assessment and examination marks for Practical courses is as follows:

First assessment (Test-I)	:	15 marks
Second assessment (Test-II)	:	15 marks
Maintenance of record book	:	10 marks
End Semester Examination	:	60 marks

10.3 Thesis work

The thesis Phase I will be assessed for 40 marks by a committee consisting of the Head of the Department, the guide and a minimum of two members nominated by the Head of the Department. The Head of the Department will be the chairman. The number of reviews must be a minimum of three per semester. 60 marks are allotted for the thesis work and viva voce examination at the end of the third semester. The same procedure will be adopted for thesis Phase II in the fourth semester.

10.4 Seminar / Industrial Training

The continuous assessment marks for the seminar / industrial training will be 40 and to be assessed by a seminar committee consisting of the Seminar Coordinator and a minimum of two members nominated by the Head of the Department. The continuous assessment marks will be awarded at the end of the seminar session. 60 marks are allotted for the seminar / industrial training and viva voce examination conducted based on the seminar / industrial training report at the end of the semester.

11. Student Counselors (Mentors)

To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counselor (mentor) for those students throughout their period of study. Such student counselors shall advise the students in selecting open elective courses from, give preliminary approval for the courses to be taken by the students during each semester, and obtain the final approval of the Head of the Department monitor their progress in SWAYAM courses / open elective courses.

12. Class Committee

For each of the semesters of M.E / M.Tech programmes, separate class committees will be constituted by the respective Head of the Departments. The composition of the class committees from first to fourth semesters for Full time and first to sixth semesters for Part-time will be as follows:

- Teachers of the individual courses.
- A Thesis coordinator (for Thesis Phase I and II) shall be appointed by the Head of the Department from among the Thesis supervisors.
- A thesis review committee chairman shall be appointed by the Head of the Department

- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.
- All counselors of the class and the Head of the Department (if not already a member) or any staff member nominated by the Head of the Department may opt to be special invitees.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory courses / 40 marks for practical courses, for Industrial Training and for Thesis work (Phase-I and Phase-II) will be finalized for every student and tabulated and submitted to the Head of the Department for approval and transmission to the Controller of Examinations.

13. Temporary Break Of Study

A student can take a one-time temporary break of study covering the current semester and / or the next semester with the approval of the Dean on the recommendation of the Head of the Department, not later than seven days after the completion of the mid-semester test. However, the student must complete the entire programme within the maximum period of **four years for Full time / six years for Part time.**

14. Substitute Assessments

A student who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the end of semester examination may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Head of the Department within a week from the date of the missed assessment.

15. Attendance Requirements

The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

A student who withdraws from or does not meet the minimum attendance requirement in a semester must re-register and repeat the same semester in the subsequent academic years.

16. Passing and declaration of Examination Results

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the grade point average (GPA) and cumulative grade point average (CGPA) and prepare the mark sheets.

90 to 100 marks	Grade 'S'
80 to 89 marks	Grade 'A'
70 to 79 marks	Grade 'B'
60 to 69 marks	Grade 'C'
55 to 59 marks	Grade 'D'
50 to 54 marks	Grade 'E'
Less than 50 marks	Grade 'RA'
Withdrawn from the Examination	Grade 'W'

A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S, A, B, C, D or E for a course is declared to have successfully completed that course and earned the credits for that course. Such a course cannot be repeated by the student.

A student who obtains letter grade RA / W in the mark sheet must reappear for the examination of the courses.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA - 0

Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-totaling of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

CGPA is similarly calculated considering all the courses taken from the time of admission.

17. Awarding Degree

After successful completion of the programme, the degree will be awarded with the following classifications based on CGPA.

For First Class with Distinction the student must earn a minimum of 68 credits within four semesters for full-time / six semesters for Part time from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above.

For First Class, the student must earn a minimum of 68 credits within two years and six months for full-time / three years and six months for Part time from the time of admission and obtain a CGPA of 6.75 or above.

For Second class, the student must earn a minimum of 68 credits within four years for full-time / six years for Part time from the time of admission.

18. Ranking of Candidates

The candidates who are eligible to get the M.E /M.Tech degree in First Class with Distinction will be ranked on the basis of CGPA for all the courses of study from I to IV semester for M.E / M.Tech full-time / I to VI semester for M.E / M.Tech part-time.

The candidates passing with First Class and without failing in any subject from the time of admission will be ranked next to those with distinction on the basis of CGPA for all the courses of study from I to IV semester for full-time / I to VI semester for M.E / M.Tech part-time.

19. Transitory Regulations

If a candidate studying under the old regulations M.E. / M.Tech could not attend any of the courses in his/her courses, shall be permitted to attend equal number of courses, under the new regulation and will be examined on those subjects. The choice of courses will be decided by the concerned Head of the department. However he/she will be permitted to submit the thesis as per the old regulations. The results of such candidates will be passed as per old regulations.

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

M.E. REHABILITATIVE INSTRUMENTATION

VISION

To nurture higher echelons of technology through participative education, innovative and collaborative research with a view to bring out employable graduates of International standard.

MISSION

To establish state of art facilities related to diverse dimension in the field of Instrumentation Engineering, Biomedical Engineering and Microelectronics and MEMS.

To foster higher quality of education with equivocal focus in theory and practical areas of Electronics, Control and Instrumentation Engineering, Biomedical Engineering and Microelectronics and MEMS.

To ensure that the dissemination of knowledge reaches the stakeholders and forge the opening of a fresh flair of human resources.

To create opportunities for advancements in different facets of this discipline and offer avenues to reach the citadels of one's career.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The major objectives of the M.E (Rehabilitative Instrumentation) programme are to implement Science and Engineering principles in the broad area of medical instrumentation to improve healthcare delivery to human in association with physicians and surgeons and prepare them for:

- Comprehend the fundamental concepts in Bio Medical Engineering.
- Apply knowledge of Engineering, biology, and Biomechanical principles to the design, development, and evaluation of various medical devices for cost effective diagnosis and treatment of various ailments.
- To help the society and specifically the physically challenged person for their comfortable life style.

PROGRAMME OUTCOMES (PO)

A student who has undergone the M.E (Rehabilitative Instrumentation) program would have acquired abilities to

1. Possess a good knowledge of basic science (including medicine), mathematics & Engineering required for specific topics in Rehabilitation Engineering.
2. Have skill to use of different types of sensors and measurement of various physiological parameters.
3. Possess ability to provide effective solutions through data interpretation, design & implementation (as applicable to a given topic/scenario).
4. Able to identify the latest tools (hardware &/or software/program &/or materials) available, towards an effective biomedical solution to a given problem.
5. Understand the current healthcare necessities & the associated multidisciplinary environment and sustainability, and an ability to provide appropriate engineering-solutions especially for Physically Challenged persons.
6. Able to take leadership in investigating complex healthcare problems by putting together, a cohesive multidisciplinary team.
7. Able to understand about various imaging modalities used in the Hospitals.
8. Learn some of the latest techniques that can be applied to research.
9. Focuss the experience through Hospital training and projects in one or more areas of advanced research.

MAPPING OF PEO WITH PO									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
PEO1	✓	✓		✓		✓		✓	
PEO2	✓	✓			✓		✓		✓
PEO3	✓	✓	✓		✓	✓	✓	✓	

M.E. REHABILITATIVE INSTRUMENTATION (FULL-TIME)

COURSES OF STUDY AND SCHEME OF EXAMINATIONS (REGULATION – 2019)

SEMESTER I

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
19EIRIPC11	PC	Medical Physiology	3	-	-	25	75	100	3
19EIRIPC12	PC	Impairment Engineering	3	-	-	25	75	100	3
19EIRIPE13	PE	Professional Elective-I	3	-	-	25	75	100	3
19EIRIPE14	PE	Professional Elective-II	3	-	-	25	75	100	3
19EIRIMC15	MC	Research Methodology and IPR	2	-	-	25	75	100	2
19EIRICP16	CP	Biosignal and Image Processing Lab	-	-	3	40	60	100	2
19EIRICP17	CP	Biosensors and Transducers Lab	-	-	3	40	60	100	2
19EIRIAC18	AC	Audit Course-I	2	-	-	-	-	-	0
					Total	205	495	700	18

SEMESTER II

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
19EIRIPC21	PC	Modelling and Control of Biological Systems	3	-	-	25	75	100	3
19EIRIPC22	PC	Artificial Organ Systems	3	-	-	25	75	100	3
19EIRIPE23	PE	Professional Elective-III	3	-	-	25	75	100	3
19EIRIPE24	PE	Professional Elective-IV	3	-	-	25	75	100	3
19EIRIOE25	OE	Open Elective -I	3	-	-	25	75	100	3
19EIRICP26	CP	Bio Instrumentation Lab	-	-	3	40	60	100	2
19EIRITS27	TS	Industrial Training / Seminar		Tr	S	40	60	100	2
				2	2				
19EIRIAC28	AC	Audit Course-II	2	-	-	-	-	-	0
					Total	205	495	700	19

SEMESTER III

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
19EIRIPE31	PE	Professional Elective-V	3	-	-	25	75	100	3
19EIRIOE32	OE	Open Elective -II	3	-	-	25	75	100	3
19EIRIPV33	PV-I	Project work & Viva-voce Phase-I	-	Pr	S	40	60	100	10
				16	4				
					Total	90	210	300	16

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
19EIRIPV41	PV-II	Project work & Viva-voce Phase-II	-	Pr	S	40	60	100	15
				24	6				
					Total	40	60	100	15

Note: * - Four weeks during the summer vacation at the end of IInd Semester.

L: Lecture , **P:** Practical, **T**: Tutorial**, CA:** Continuous Assessment, **FE:** Final Examination, **Tr**: Training, **S:** Seminar, **Pr**: Project work

PC	Programme Core	CP	Core Practical	AC	Audit Course
PE	Professional Elective	TS	Industrial Training and Seminar	PV	Project work & Viva-voce
OE	Open Elective	MC	Mandatory Learning Course	EI	Branch code
				RI	M.E Specialization Code

M.E. REHABILITATIVE INSTRUMENTATION (PART-TIME)

COURSES OF STUDY AND SCHEME OF EXAMINATIONS (REGULATION – 2019)

SEMESTER I										
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent course Code in M.E. Full-Time**
19PEIRIPC11	PC	Medical Physiology	3	-	-	25	75	100	3	19EIRIPC11
19PEIRIPC12	PC	Impairment Engineering	3	-	-	25	75	100	3	19EIRIPC12
19PEIRIMC13	MC	Research Methodology and IPR	2	-	-	25	75	100	2	19EIRIMC15
19PEIRICP14	CP	Biosignal and Image Processing Lab	-	-	3	40	60	100	2	19EIRICP16
		Total				**115**	**285**	**400**	**10**	

SEMESTER II										
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent course Code in M.E. Full-Time**
19PEIRIPC21	PC	Modelling and Control of Biological Systems	3	-	-	25	75	100	3	19EIRIPC21
19PEIRIPC22	PC	Artificial Organ Systems	3	-	-	25	75	100	3	19EIRIPC22
19PEIRIOE23	OE	Open Elective	3	-	-	25	75	100	3	19EIRIOE25
19PEIRICP24	CP	Bio Instrumentation Lab	-	-	3	40	60	100	2	19EIRICP26
		Total				**115**	**285**	**400**	**11**	

SEMESTER III										
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent course Code in M.E. Full-Time**
19PEIRIPE31	PE	Professional Elective-I	3	-	-	25	75	100	3	19EIRIPE13
19PEIRIPE32	PE	Professional Elective-II	3	-	-	25	75	100	3	19EIRIPE14
19PEIRICP33	CP	Biosensors and Transducers Lab	-	-	3	40	60	100	2	19EIRICP17
	Total					**90**	**210**	**300**	**8**	

SEMESTER IV										
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent course Code in M.E. Full-Time**
19PEIRIPE41	PE	Professional Elective-III	3	-	-	25	75	100	3	19EIRIPE23
19PEIRIPE42	PE	Professional Elective-IV	3	-	-	25	75	100	3	19EIRIPE24
19PEIRITS43	TS	Industrial Training / Seminar	-	Tr 2	S 2	40	60	100	2	19EIRITS27
	Total					**90**	**210**	**300**	**8**	

SEMESTER V										
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent course Code in M.E. Full-Time**
19PEIRIPE51	PE	Professional Elective-V	3	-	-	25	75	100	3	19EIRIPE31
19PEIRIOE52	OE	Open Elective – II	3	-	-	25	75	100	3	19EIRIOE32
19PEIRIPV53	PV-I	Project work & Viva-voce Phase-I	-	Pr 16	S 4	40	60	100	10	19EIRIPV33
	Total					**90**	**210**	**300**	**16**	

SEMESTER VI										
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent course Code in M.E. Full-Time**
19PEIRIPV61	PV-II	Project work & Viva-voce Phase-II	-	Pr 24	S 6	40	60	100	15	19EIRIPV41
		Total							**15**	

LIST OF ELECTIVES

S.No.	Professional Electives
1	Medical Image Processing
2	Medical Diagnostic Instrumentation
3	Computational Neuro Engineering
4	Computational Methods and Cancer Modelling
5	Biosignal Processing
6	Transportation in Living Systems
7	Cancer Biology
8	Computational Methods and Bone Modelling
9	Medical Imaging Systems and Radio Theraphy
10	Wavelet Transforms and its applications
11	Bioinformatics
12	Medical Ethics and Standards

S.No.	Open Electives
1	Computers in Medicine
2	Tissue and Stem Cell Engineering
3.	Radiological Equipments
4.	Sports medicine
5.	Computational Bioengineering
6.	Healthcare Systems
7.	Telemedicine
8.	Modeling of Physiological Systems
9.	Biomechanics
10.	Troubleshooting of Medical Equipments
11.	Design of Medical Equipments

LIST OF AUDIT COURSES FOR M.E. (FULL-TIME)

S.No.	Audit Courses
1	English for Research paper writing
2	Disaster Management
3	Sanskrit for Technical Knowledge
4	Value Education
5	Constitution of India
6	Pedagogy Studies
7	Stress Management by Yoga
8	Personality Development through life Enlightenment Skills

SYLLABUS

19EIRIPC11 / 19PEIRIPC11	MEDICAL PHYSIOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To understand basics of Human Anatomy and Physiology.

To understand different physiological processes taking place inside human body.

To impart knowledge on cell divisions, blood vascular system, ductless/endocrine glands, digestive system and nervous system and familiarize medical physiology to the students.

To apply this knowledge into biomedical engineering field.

Cell divisions and development of human body: Cell structure – functions. Tissues: Types of tissues, epithelial & connective, muscle and nervous. Classification of epithelial and connective tissues with their locations. Muscular architecture: Structure of skeletal, smooth and cardiac muscles – differences. Single unit and multi – unit smooth muscle – properties of muscle – muscle contraction sterling laws – mechanisms – E C coupling – muscle fatigue – rigor mortis – sliding filament theory – slow and fast muscle fibres – isotonic and isometric contraction.

Blood Vascular System: Composition and functions of blood, coagulation – actionof platelets, functions, mechanisms. Hemoglobin: functions – compounds and derivatives. Erythrocyte Sedimentation Rate (ESR) – significance. Blood coagulation – factors – process – anticoagulants – prothrombin time – clotting time – bleeding time – blood groups – ABO systems and Rh factors – Ultra structure and functions of blood vessels (artery and vein).

Ductless/endocrine glands: various ductless glands: pituitary glands – hypothalamus and adenohypohysis. Hormone secretion – actions of hormone and related applied physiology – thyroid gland – histology – blood and hormone secretion – action of hormone – Parathyroid gland and adrenal gland.

Digestive System: Anatomy – histology of gastro intestinal tract – oral cavity (mouth) – teeth – salivary glands – structure, composition and functions of saliva. Circulatory system: Anatomy – functions – heart valves – heart rhythm – conducting system of heart – blood supply – properties of cardiac muscles – action potential of single cardiac fiber – special junctionaltissue of heart – myogenic and neurogenic heart – conducting system of heart – E.C.G.

Nervous system: Anatomy – classification – structure of a typical neuron – synapse – synaptic transmission, neuro transmitter, Central Nervous System (CNS) – anatomy of brain and its sub divisions. Functions of brain – central canal of the spinal cord – thalamus and hypothalamus – spinal cord and transverse section effects. Peripheral nervous system – classifications of motor nerves – description – voluntary and involuntary action – Autonomic nervous system – classifications –

functions. Neural **Transmission:** Introduction – sympathetic and parasympathetic response.CNS synaptic, electrical and chemical transmissions. Neuro muscular Junction: Structure – events in transmission – end – plate potential – post tetanic potential.

REFERENCES

1. Arthur C. Guyton and John E. Hall, Text book of Medical Physiology, Saunders (Elsevier), NJ, 11th Edition, 2005.
2. B.G. King, W.J. Showers, Human Anatomy & Physiology, W.B.Saunders Co., NY, 6th edition, 1969.
3. Ross and Wilson, Anatomy and Physiology in health and illness, Churchill Living Stone, 11th edition, 2010.

COURSE OUTCOMES

By successfully completing this course, students will be able to:

1. Describe and explain specific parts and key terms applied in anatomy and physiology.
2. Describe important physiological mechanisms involved in cell, tissue, and organ.
3. Understand organisation and functions of each organs and systems in human body.
4. Correlate the knowledge of medicine and engineering for the development of various instruments.
5. Understand the diseases associated with various parts of the body.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓					✓	✓	
CO2	✓	✓				✓			
CO3	✓	✓	✓		✓				
CO4	✓	✓		✓		✓			✓
CO5					✓		✓		✓

19EIRIPC12 / 19PEIRIPC12	IMPAIRMENT ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To impart knowledge on impairment, sensory and auditory rehabilitation, orthopaedic prosthetics and orthotics in rehabilitation.
- To study basics of Rehabilitation Engineering.
- To study various orthotic & prosthetic devices.
- To understand various assistive technology for vision & hearing.

Impairment: Introduction – impairment types – handicaps – measurements – assessment and characterization concepts in sensory and motor rehabilitation.

Anthropometry: Static and dynamic Measurements – Area – movement, measurement of Muscular Strength and Capabilities.

Measurement tools and processes: Fundamental principles – structure – functioning – performance and behaviour – Subjective and objective. Ergonomic aspects in designating devices: Design of information devices – traditional Devices – V.D.Uâ€™ s, Using colour and Control designs.

Sensory and Auditory rehabilitation: Sensory augmentation and substitution. Visual system: Visual augmentation – tactual vision substitution, and Auditory vision substitution. Auditory system: Auditory augmentation – Audiometer – Hearing aids – cochlear implantation – visual auditory substitution – tactual auditory substitution. Tactual system: Tactual augmentation and substitution.

Orthopedic Prosthetics and Orthotics in rehabilitation: Motor rehabilitation: Introduction – concepts – applications. 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 Prostheses: Active above knee prostheses – myoelectric hand and arm prostheses – different types. The MARCUS intelligent Hand prostheses.

Computer applications in Rehabilitation and Robotic Manipulation Aids: Modes of operation and control – interfaces in compensation for visual perception – improvement of orientation and mobility. Computer assisted lipreading – Brain computer interface – concepts.

REFERENCES

1. Joseph D. Bronzino, Handbook of biomedical engineering, CRC Press, 3rd edition, 2006.
2. Robinson, C.J., Rehabilitation engineering. CRC press, 2003.
3. Horia – Nicolai L. Teodorescu, L.C. Jain, Intelligent systems and technologies in rehabilitation engineering; CRC Press; December 2000.
4. Etienne Grandjean, Harold Oldroyd, Fitting the task to the man, London: Taylor & Francis, 4th edition, 1988.

COURSE OUTCOMES

By the end of this course the student will be able

1. To design rehabilitation aid and apply them with confidence, to help the challenged people.
2. To build foundation for learners enabling the learners to pursue higher studies with specialization in Rehabilitation Engineering.
3. To design rehabilitation aids and its understanding.
4. To have a thorough understanding of aids which can be useful with the societal needs.
5. To apply and test the developed products and automate it.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓							
CO2	✓	✓							✓
CO3	✓	✓	✓		✓				
CO4	✓	✓		✓					
CO5					✓	✓		✓	

19EIRIMC15/ 19PEIRIMC 13	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To understand the research problem formulation and analyze research related information.

Research Problem: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Effective literature studies: Approaches, analysis Plagiarism, Research ethics.

Effective technical writing: How to write report, Paper. Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

References

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”, Ranjit Kumar, 2 nd Edition , “Research Methodology: A Step by Step Guide for beginners”
3. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
4. Mayall , “Industrial Design”, McGraw Hill, 1992.
5. Niebel , “Product Design”, McGraw Hill, 1974.
6. Asimov , “Introduction to Design”, Prentice Hall, 1962.

7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
8. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

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

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

MAPPING OF COs WITH POs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	✓	✓	✓					✓			✓
CO2	✓	✓	✓								✓
CO3			✓	✓	✓	✓					✓
CO4				✓	✓			✓			✓
CO5				✓	✓	✓		✓			

19EIRICP16 / 19PEIRICP14	BIOSIGNAL AND IMAGE PROCESSING LAB	L	T	P	C
		0	0	3	2

LIST OF EXPERIMENTS

1. Representation of basic signals.
2. Linear convolution.
3. Autocorrelation and cross correlation.
4. Development of FFT and IFFT Techniques.
5. Difference equation Representation of systems using Matlab.
6. Digital IIR Butterworth filter – LPF & HPF.
7. Digital IIR chebychev filter – LPF & HPF.
8. Design of FIR filter using windowing technique.
9. Upsampling and downsampling of Biosignals.
10. Analysis of ECG.
11. Analysis of EEG.

12. Analysis of PCG.

19EIRICP17 / 19PEIRICP33	BIOSENSORS AND TRANSDUCERS LAB	L	T	P	C
		0	0	3	2

LIST OF EXPERIMENTS

1. Temperature measurement using AD590 IC sensor
2. Displacement measurement by using a capacitive transducer
3. Study of the characteristics of a LDR
4. Pressure and displacement measurement by using LVDT
5. Study of a load cell with tensile and compressive load
6. Torque measurement Strain gauge transducer
7. Study & characterization of Biotransducers – Pressure, Temparature, Humidity
8. Study & characterization of Bioelectrodes – ECG, EMG, EEG
9. Study & characterization of Biotransducers – Tactile, Respiration, eyeball movement
10. Study of Giat Analysis

19EIRIPC21 / 19PEIRIPC21	MODELLING AND CONTROL OF BIOLOGICAL SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To gain basic knowledge about the concepts of control systems and study its application in physiological modeling.
- To understand the system concepts and different mathematical modelling techniques applied in analyzing any given system.
- To understand basic concepts of modeling for designing biological model.
- To train and motivate students for pursuing higher education and research for developing cutting edge technologies.

Feedback system: Basic feedback concepts – effect of feedback on noise – distortion analysis – open loop control system – control system with feed Back. Mathematical descriptions of systems: transfer function matriX–state space representation – state – variable description – mathematical description of composite systems. Solution of dynamical equation: state transition matriX– impulse response matriX–controllability and observability.

Biological control system: Introduction – dynamical systems – modelling – similarities between biological and engineering control system – biological receptors and receptor characteristics.The pupil control systems:General structure – dynamic response characteristics – open and closed loop instability – automatic aperture control.

Human thermal system: Basic concepts – modelling – thermo regulation – cold and warm bloodedness – lumped and partial differential equations. Case Study: Heat transfer example. Modeling the body as compartment: behavior in simple

compartmental system – pharmaco kinetic model – urea distribution model. Multi compartmental system: Dissolution of drugs in solid form – distribution and accessibility of body water and tissue compartments – basis for zero and first order chemical kinetic behavior in the biological system.

Modeling of human thermal regulatory system: Parameters involved – control system model – biochemistry of digestion – types of heat loss from body – heat transfer models – subsystems of human body like skin, core.

Case Study Applications: Cardiac rate – blood pressure – respiratory rate – mass balancing of lungs – oxygen uptake by RBC and pulmonary capillaries – oxygen and carbon dioxide transport in blood and tissues.

REFERENCES

1. Benjamin C. Kuo, FaridGolnaraghi, Automatic Control Systems, John Wiley & Sons, Inc., NY, 9th edition, 2009.
2. M.Gopal, Digital Control and State Variable Analysis, Tata McGraw Hill, 2008.
3. David O. Cooney, Biomedical Engineering Principles – An introduction to Fluid, Heat, and Mass transport processes, CRC Press, 1976.
4. John H Milsum, Biological Control Systems, McGraw Hill, 1966.
5. Howard T Milhorn, The application of control theory to physiological systems, Saunders, Philadelphia, 1966.
6. E. Carson, E. Salzsieder, Modelling and Control in Biomedical Systems 2000 (including Biological Systems) (IFAC Proceedings Volumes) (Paperback), Pergamon Publishing, January 2001.

COURSE OUTCOMES

Students will be able to

1. Understand the concepts of modeling.
2. Design control strategies for various organ functioning.
3. Analyse the causes for malfunctioning of organs.
4. Analyse and do research in the micro level for diagnosing the diseases.
5. Theoritically diagnose the kind of diseases for their understanding from the case studies.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓							
CO2	✓	✓							
CO3	✓	✓	✓		✓				
CO4	✓	✓		✓					
CO5					✓	✓		✓	✓

19EIRIPC22 / 19PEIRIPC22	ARTIFICIAL ORGAN SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To understand the principles and biology underlying the design of implants and artificial organs.

To understand the fundamentals of materials used for manufacturing implants, prosthesis and orthoses that has wide application in healthcare industry.

Bio materials: Definition of biomaterials – Requirements of biomaterials – classification of biomaterials – Comparison of properties of some common biomaterials – Effects of physiological fluid on the properties of biomaterials – Biological responses (extra and intra – vascular system). Surface properties of materials – physical properties of materials – mechanical properties – Biomaterial outlook for organ transplant, design considerations.

Introduction to artificial organs: Biomaterials used in artificial organs and prostheses – inflammation, rejection, correction. Rheological properties of blood – blood viscosity variation – effect of shear rate – hematocrit – temperature and protein contents – Casson equation – flow properties of blood through the blood vessels – problems associated with extracorporeal blood flow.

Artificial Heart and circulatory assist devices: Engineering design of artificial heart and circulatory assist devices. Artificial kidney: Structure – function – filtration – basic methods of artificial waste removal – hemo dialysis – equation for artificial kidney – middle molecule hypothesis. Hemo dialysers: flat plate type – coil type – hollow fiber – analysis of mass transfer in dialysers – regeneration of dialysate – membrane configuration – wearable artificial kidney machine – separation of antigens from blood in ESRD patients.

Artificial heart – lung machine: Introduction – gaseous exchange / transport – artificial heart – lung devices. Oxygenators: bubble, film oxygenators and membrane oxygenators – gas flow rate and area for membrane oxygenators. Liver support system – artificial pancreas – blood – skin.

Audiometry: air conduction – bone conduction – masking – diagram. Hearing aids: Types – receiver amplifiers – opthalmoscope – retinoscope – I.A.B.P principle and application. Rehabilitation Engineering: Rehabs for locomotion, visual, speech and hearing – artificial limb and hands – prosthetic heart valves – gait study – spinal rehabilitation.

REFERENCES

1. Joseph D. Bronzino, The Biomedical Engineering Handbook, CRC Press, 2000.
2. Khandpur. R. S., Hand Book of Biomedical Instrumentation, Tata McGraw Hill Pub Co. Ltd., New Delhi, 2nd ed., 2003.
3. Erie.D.Blom and Howard.B.Rothman, Artificial Organs, 1994.
4. David O. Cooney Biomedical Engineering Principles (Volume – II), Marcel Dekker Inc, New York, 1976.

5. Rory A. Cooper; HisaichiOnabe; Douglas A. Hobson, Introduction to Rehabiliation
6. Engineering, CRC press, 2006.
7. E.Ballabio, Rehabilitation Engineering, IOS press, 1993.

COURSE OUTCOMES

Student will be able to

1. Understand the concept of biocompatibility and the methods of biomaterial testing.
2. Awareness about the testing of the biomaterials done biologically before implantation in the human body.
3. Gain knowledge in the existing designs of artificial organs.
4. Understanding the applications of the organs implants.
5. Develop additional features in the exsisting instruments.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓				✓			
CO2	✓	✓							
CO3	✓	✓	✓		✓		✓		✓
CO4	✓	✓		✓					
CO5		✓		✓			✓	✓	✓

19EIRICP26 / 19PEIRICP24	BIO INSTRUMENTATION LAB	L	T	P	C
		0	0	3	2

LIST OF EXPERIMENTS

1. Respiratory system analysis using Spirometer.
2. ECG wave analysis using simulator.
3. Real time patient monitoring system.
4. 12 – lead ECG measurement System.
5. EMG Biofeedback with NCV.
6. EMG Measurement system.
7. Auditory system check up using Audiometer.
8. ECG heart rate system with HRV.
9. Heart sound measurement using PCG.
10. Measurement of BP, Pulse and SPO2.
11. Measurement of Giat Analysis.
12. Design of Medical Amplifier.

19EIRITS27 / 19PEIRITS43	INDUSTRIAL TRAINING / SEMINAR	L	T	P	C
		0	2	2	2

COURSE OBJECTIVES

- To train the students in the field work related to Rehabilitative Instrumentation and to have a practical knowledge in carrying out Rehabilitative Instrumentation field related works.

- To train and develop skills in solving problems during execution of certain works related to Rehabilitative Instrumentation.

The students individually undergo a training program in reputed concerns in the field of Rehabilitative Instrumentation during the summer vacation (at the end of second semester for full-time/fourth semester for part-time) for a minimum stipulated period of four weeks. At the end of the training, the student has to submit a detailed report on the training they had, within ten days from the commencement of the third semester for Full-time/fifth semester for part-time. The students will be evaluated by a team of staff members nominated by head of the department through a viva-voce examination.

COURSE OUTCOMES

1. The students can face the challenges in the practice with confidence.
2. The student will be benefited by the training with managing the situation arises during the execution of works related to Rehabilitative Instrumentation.

19EIRIPV33 / 19PEIRIPV53	PROJECT WORK AND VIVA-VOCE PHASE – I	L	T	P	C
		0	16	4	10

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

1. Take up any challenging practical problems and find solution.
2. Learn to adopt systematic and step-by-step problem solving methodology.

MAPPING OF COs WITH POs									
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓		✓					✓	✓
CO2	✓			✓	✓				

19EIRIPV41 / 19PEIRIPV61	PROJECT WORK AND VIVA-VOCE PHASE – II	L	T	P	C
		0	24	6	15

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

1. Take up any challenging practical problems and find solution.

2. Learn to adopt systematic and step-by-step problem solving methodology.

MAPPING OF COs WITH POs									
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓		✓					✓	✓
CO2	✓			✓	✓				

PE - PROFESSIONAL ELECTIVES

19EIRIPEXX / 19PEIRIPEXX	MEDICAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To study the production of X–rays and its application to different medical Imaging techniques.
- To study the different types of Radio diagnostic techniques.
- To study the special imaging techniques used for visualizing the cross sections of the body.
- To study the imaging of soft tissues using ultrasound technique

Introduction to Driving problems in biomedical imaging: Signal input – image matrix, digital image quality – digital image processing – picture archiving and communication system (PACS) – sources of imaging data acquisition and noise – elementary image processing – Grenander's Pattern Theory.

X–rays: Production X–rays – various components of radiographic systems – X–ray tube design – X–ray spectrum – rating charts of X–ray tubes. Electrical circuit for X–ray machine – filament circuits and mA control – HT circuits – KV control – control of exposure timers – collimators, scatter and grids – absorbed dose – basics of tables and arms – properties of X–ray films and screens – dark room accessories – types of X–ray tubes for various medical applications.

Fluoroscopy and angiography: Fluoroscopic imaging system – principle – specific system design. Digitalfluoroscopy – c – arm system – Digital Subtraction Angiography (DSA) – digital subtraction programming. Ultra Sound in Medicine: Introduction – generation – acoustic impedance – ultrasonic transducers and types – transmitter and detector principles – probe design – principles of image formation. Display system: Principles of A – mode, B – mode and M – mode display – scan conversion – image processing – Doppler Ultrasound and Colour flow mapping – application of diagnostic ultra sound.

Magnetic Resonance Imaging (MRI): Introduction – principles – instrumentation – magnets – gradient system – RF coils receiver system – pulse sequence – image acquisition and reconstruction techniques – functional MRI – application of MRI. Radio isotope imaging/Nuclear medicine: Radio nuclides for imaging – radionuclide production: cyclotron production, reactor production,

generator production. Rectilinear scanners – Linear scanners – SPECT – PET – Gamma Camera – Comparison of other tomographic techniques.

Infra red Imaging: Physics of thermography – imaging systems – clinical themography – liquid crystal thermography. Special imaging techniques: Cineradiography – cinefluorography – stereoscopic radiography – magnification radiography – microradiography – tomography – neutron radiography.

REFERENCES

1. David J. Dowsett, Patrick A. Kenny, R. Eugene Johnston, The Physics of Diagnostic Imaging, Chapman & Hall Medical, Madras/London.2nd edition, 2006.
2. S. Webb, The Physics of Medical Imaging, Adam Hilger, Bristol. Taylor and Francis group, New York, 1988.
3. Rangaraj M. Rangayyan, Biomedical Image Analysis, CRC press, 2005.

COURSE OUTCOMES

Student will

1. Get the clear domain knowledge about the various Medical Imaging techniques.
2. To understand the various diagnostic applications of the medical imaging techniques.
3. To apply the imaging modalities in the medical hospitals.
4. To use the advanced techniques to diagnose the health problems.
5. Use their knowledge to use advanced Instruments for imaging.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓				✓			✓
CO2	✓	✓					✓		
CO3	✓	✓	✓		✓				
CO4	✓	✓		✓					
CO5			✓				✓		✓

19EIRIPEXX / 19PEIRIPEXX	MEDICAL DIAGNOSTIC INSTRUMENTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the basic principle, working and design of various automated diagnostic equipments.
- To develop skills enabling Biomedical Engineers to serve Hospitals, National and International Industries and Government Agencies.
- To develop core competency in the field of Biomedical Engineering to gain technical expertise in biology and medicine for effective contribution in the development and improvement of health care solutions.

- To study various medical instrumentation systems, drug delivery systems and health management systems.

Electrocardiograph: Fibrillators and Defibrillators – Pacemakers – Arrhythmia Simulator. Ventilators: Basic principles – generators – inspiratory phase – cycling mechanisms – expiratory phase – ventilatory adjuncts – anaesthetic machines.

Electro EncephaloGraph: Multi channel EEG recording system – epilepsy – evokedpotential – Visual, Auditory and Somatosensory – MEG (Magneto Encephalon Graph) – EEG bio feedback instrumentation. Sliding theory of contraction: Recording and analysis of EMG waveforms – fatigue characteristics – Muscle stimulators – nerve stimulators – nerve conduction velocity measurement.

Measurement of mechanics of breathing: Spirometer – Lung volumeand 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 and time controlled – flow – patient cycle ventilators – humidifiers – nebulizers – inhalators.

Diagnosis: Basic principles of echo technique – display techniques A, B and M mode – ultrasound as diagnostic tool – echocardiogram – abdomen – obstetrics – gynaecology – ophthalmology.

Heart lung machine: Disc and membrane type oxygenerators – finger pump – roller pump, – Haemo Dialyser unit – Lithotripsy – principles of cryogenic technique – application – endoscopy – laproscopy. Patient monitoring system: ICU – post operative – ICCU – single and multichannel telemetry. Transmission of Biosignals over telephone lines – digital central monitoring systems for patient monitoring.

REFERENCES

1. Joseph J. Carr and John M. Brown, Introduction to Biomedical equipment technology, Pearson education, 4th edition, 2008.
2. John G.Webster, Medical Instrumentation Application and Design, Wiley India Edition, 3rd edition, 2007.
3. L.A. Geddes and L.E. Baker, Principles of Applied Biomedical Instrumentation, John Wiley Publications, 3rd Edition, 2008.

COURSE OUTCOMES

Student will be able to

1. Demonstrate the principles of electronics used in designing various diagnostic equipment.
2. Have in-depth knowledge about different streams in Biomedical Engineering with greater emphasis on health care equipments and the advanced technologies such as Telemedicine, Telemetry, Medical Imaging, etc.
3. Provide a better technical support with exposure to the hospitals and health care industry.

4. Understand the various techniques and applying for the betterment of the patients.
5. Understand critical care units and its importance

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓						✓	
CO2	✓	✓					✓		✓
CO3	✓	✓	✓		✓				
CO4	✓	✓		✓					
CO5	✓				✓				✓

19EIRIPEXX / 19PEIRIPEXX	COMPUTATIONAL NEURO ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Neural engineering and rehabilitation research applies neuroscience and engineering methods to analyze central and peripheral nervous system function and to design clinical solutions to neurological disorders or injury.
- To study the basics of Nervous system.
- To understand the development and arrangement of neural tissue.
- To study the neuronal disorders and injuries.
- To study the repairing and reconstruction mechanism of nervous system.

Introduction to computational neuroscience – motivation for biophysical modeling. Theory and modeling in neuroscience: Descriptive Vs. Functional models – Turing Vs. Neural computation. Introduction to anatomy and cellular basis of nervous system.Introduction to differential equations and theory of dynamical systems.

Equivalent circuit model: Electromotive, resistive and capacitive properties of cell membrane, change in membrane potential with distance, voltage clamp experiment and Hodgkin and Huxley's model of action potential.

Ionic channels – ionic currnets – experimental techniques : voltage and space clamp experiments. The Hodgkin – Huxley formalism – activation and inactivation kinetics – complete model for action potential generation. Hodgkin – Huxley Vs. Markov models.

Qualitative Hodgkin – Huxley theory – voltage clamp techniques – Hodgkin – Huxley equations methods. Simplified neuron models: Simplifications of the Hodgkin – Huxley model: FitzHugh – Nagumo – Rinzel model. Abstract Models: phase model – rate model – McCulloch – Pitts neuron – integrate and fire neuron model.

Synapses and synaptic plasticity – simplified and phenomenological models of synaptic functions.synaptic transmission: electrical and chemical. Gated transmission at the nerve muscle synapse and central synapses – neurotransmitters. Cellular basis of learning: synaptic plasticity – The Hebbian rule

of learning – variations for the Hebbian rule. Long term synaptic potentiation and depression. Synaptic plasticity on different time scales.

Basics of modeling neural networks: The two or three levels of neural dynamics. Supervised learning rules: Perceptron learning rule – Adaptation in linear neurons, Widrow – Hoff rule – objective functions and gradient descent – multilayer networks and back propagation. Unsupervised learning rules: Principle Component Analysis – decorrelation – Winner – take – all networks and clustering. Basic neural network architectures: feed – forward – feedback – lateral connections.

REFERENCES

1. Dayan, P. and L.F. Abbott, Theoretical Neuroscience: Computational and Mathematical modeling of neural systems, MIT Press, 2001.
2. W. Gerstner and W.M. Kistler, Spiking Neuron Models, Cambridge University Press, 2002.
3. Arabib, M.A., Erdi, P. and Szentagothai, J., Neural Organization: Structure, functions and dynamics, MIT Press, 1997.
4. Lauren Fausett, Fundamentals of Neural Networks, Prentice Hall, New Jersey, 1994.
5. V.Z. Marmarelis, Advanced methods of physiological system modeling, Springer, 1989.

COURSE OUTCOMES

Through this course of study students will be able to

1. Understand the application of basic science and engineering techniques.
2. Develop methods to record from and exert control over the nervous system.
3. Understand and develop the models of associated organ systems.
4. Can carryout research in the analysis of memory of physiological systems.
5. Apply clinically for validation through research

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓							
CO2	✓	✓				✓	✓		
CO3	✓	✓	✓		✓				
CO4	✓	✓		✓					✓
CO5		✓	✓	✓	✓			✓	✓

19EIRIPEXX / 19PEIRIPEXX	COMPUTATIONAL METHODS AND CANCER MODELLING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Cancer Modelling is to analyze the origin of cancer and basics of Molecular Biology.
- To study the cause for Cancer.
- To understand the depth understanding of development of Cancer.

- To study the various types of cancer and its treatment methods.
- To study and design the mathematical models of various cancer.

Cancer: Definition, Benign Tumors Vs. Malignant Tumors, Types of Cancer, Common Symptoms, Molecular Hallmarks of Cancer – Growth Signal Autonomy, Evasion of Growth Inhibitory Signals, Evasion of Apoptosis (Programmed Cell Death), Unlimited Replicative Potential, Angiogenesis (Formation of New Blood Vessels), Invasion and Metastasis, Molecular Basis of Cancer – Cancer Genes (Oncogenes and Tumor Suppressor Genes), Carcinogenesis – A Multistep Process, Evidences for Multistage Models of Carcinogenesis

Global Cancer Incidence and Mortality: Data Source and Measurements, Overall Cancer Risk, Incidence and Mortality Patterns for Common Cancers, Issues in Interpreting Temporal Trends, Analytical Methods for Epidemiological Studies – Ecological Studies, Cross – Sectional Studies, Cohort Studies, Case – Control Studies, Interpretation of Epidemiology Findings, Molecular Epidemiology

Introduction to computational neuroscience – motivation for biophysical modeling. Theory and modeling in neuroscience: Descriptive vs. functional models – Turing vs. neural computation. Introduction to anatomy and cellular basis of nervous system. Introduction to differential equations and theory of dynamical systems.Equivalent circuit model: Electromotive, resistive and capacitive properties of cell membrane, change in membrane potential with distance, voltage clamp experiment and Hodgkin and Huxley's model of action potential.

Ionic channels – ionic currnets – experimental techniques : voltage and space clamp experiments. The Hodgkin – Huxley formalism – activation and inactivation kinetics – complete model for action potential generation.Hodgkin – Huxley vs Markov models.Qualitative Hodgkin – Huxley theory – voltage clamp techniques – Hodgkin – Huxley equations methods. Simplified neuron models: Simplifications of the Hodgkin – Huxley model: FitzHugh – Nagumo – Rinzel model.

Abstract Models: phase model – rate model – McCulloch – Pitts neuron – integrate and fire neuron model.Synapses and synaptic plasticity – simplified and phenomenological models of synaptic functions.synaptic transmission: electrical and chemical. Gated transmission – at the nerve muscle synapse and central synapses – neurotransmitters.

REFERENCES

1. Dayan P. and L.F. Abbott, Theoretical Neuroscience: Computational and Mathematical modeling of neural systems, MIT Press, 2001.
2. W. Gerstner and W.M.Kistler, Spiking Neuron Models, Cambridge University Press, 2002.
3. Arabib M.A., Erdi P. and Szentagothai J., Neural Organization: Structure, functions and dynamics, MIT Press, 1997.
4. Teicher, Beverly A., Tumor Models in Cancer Research Series: Cancer Drug Discovery and Development, 2nd ed. Springer, 2011.

5. V.Z. Marmarelis, Advanced methods of physiological system modeling, Springer, 1989.

COURSE OUTCOMES

Through this course of study students can able to

1. Understand the basics of molecular biology and cancer.
2. Analyse how Cancer develops and progresses.
3. Design the mathematical modelling and the causes of cancer can be analysed.
4. Understandvarious treatments methods and Imaging of cancer and the research problems can be solved to the extent.
5. Do research in the area of cancer modeling

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓				✓			
CO2	✓	✓							✓
CO3	✓	✓	✓		✓		✓		
CO4	✓	✓		✓					
CO5	✓						✓	✓	✓

19EIRIPEXX / 19PEIRIPEXX	BIOSIGNAL PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To build a strong base for developing algorithms for signal processing systems and Imaging systems.
- To develop competency in terms of logical thinking, programming and application skills.
- To train and motivate students for pursuing higher education and research for developing cutting edge technologies.

Signals and Systems: Introduction to discrete time signals and systems – Properties – LTI system. Signal conversion: Conversion requirement for biomedical signals – signal conversion circuits. Discrete Fourier Transform (DFT) – properties – circular convolution – FFT computation using DIT and DIF algorithms.

FIR design: Windowing techniques – need and choice of windows – Linear phase characteristics. IIR design: Analog filter design – approximation methods – Warping – prewarping – Frequency transformation. Wavelet transformation: Introduction – basic principles.

Spectral analysis: Estimation of power density spectrum – periodogram – parametric model based spectral linear prediction theory – estimation using Auto Regressive (AR), Moving Average (MA) andAuto Regressive Moving Average (ARMA) models. Estimation of parameters – spectral error measure – EEG analysis.

Adaptive filters: Principle noise canceller model – 50 Hz adaptive cancelling using a sine wave model – maternal ECG cancellation in fetal electrocardiography –

ECG QRS detection techniques – estimation of R-R interval – estimation of ST segment inclination – arrhythmia analysis monitoring – long term ECG recording – basics of ECG data reductiontechniques.

Electromuscular Signal Processing: Basic electromyography, EMG data acquisition, rectification and averaging. Neurological signal processing: The EEG Signals and its Characteristics – EEG Analysis – time frequency domain method – detection of spikes and spindles – detection of alpha, beta and gamma waves. Least squares and polynomial modelling: The Markov model and Markov chain – dynamics of sleep – wake Transition – hypnogram Model Parameters.

REFERENCES

1. Rangaraj M. Rangayyan: Biomedical Signal Analysis, John Wiley, 2002.
2. John G. Proakis, Dimitris G. Manolakis: Digital Signal Processing – Principles, Algorithms and Applications, Prentice Hall of India, 4th edition, 2005.
3. P. Ramesh Babu: Digital Signal Processing, Scitech Publications, India, 4th edition, 2007.
4. John L.Semmlow: Biosignal and Medical Image Processing – Matlab Based Applications, Marcel Dekker Inc., New York, 2nd edition, 2009.
5. D. C. Reddy, Biomedical Signal Processing – Principles and Techniques, Tata McGraw Hill Publishing company Ltd., 2nd reprint, 2006.

COURSE OUTCOMES

Student will be able to

1. Understand the fundamental techniques and applications of digital signal processing with emphasis on biomedical signals.
2. Implement algorithms based on discrete time signals.
3. Understand Circular and linear convolution and their implementation using DFT analyse signals using discrete Fourier transform.
4. Understand efficient computation techniques such as DIT and DIF FFT algorithms.
5. Analyse the biological signls for the scope of diagnosis

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓				✓			
CO2	✓	✓					✓		✓
CO3	✓	✓	✓		✓			✓	
CO4	✓	✓		✓					
CO5				✓			✓	✓	✓

19EIRIPEXX / 19PEIRIPEXX	TRANSPORTATION IN LIVING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To familiarize the student with various transportation mechanism in living systems.

- To understand the concepts of organs.
- To study about the internal organs.

Introduction

Organization of the human body – cells – tissues – different organs.

Heat transport: Body temperature regulation based on thermostat principle and its operation – transportation in tissues – muscle, skin and other organs in different environmental temperatures.

Transportation of fluids: Blood transport through internal organs – urogenitary – cardio pulmonary and central nervous system.

Gastro intestine system: Diffusion – osmosis – electro osmosis – ultra filtration – reverse osmosis through natural membrane and artificial synthetic membranes.

Lymph: Transportation through internal organs, urogenitary, cardio pulmonary, central nervous and gastro intestine systems. Problems on lymph transfer in human body.

Mass transfer: Constituents of blood, urine, mass transfer in kidney, skeletal, nervous, gastro intestine and cardio pulmonary systems. Comparison with artificial organs.

REFERENCES

1. David O.Cooney, An introduction to fluid, heat & mass transport process – Principles, Vol.1, Marcel Dekker Inc., Newyork, 1976.
2. William F. Ganong, Review of Medical Physiology, McGraw Hill Medical, 22nd edition, 2005.
3. Charles Herbert Best, Norman Burke Taylor, John Burnard West, Best and Taylor's physiological basis of medical practice,Williams and Wilkins, Baltimore, 12th edition, 1991.

COURSE OUTCOMES

Student will be able to

1. Understand the internal organs.
2. Understand the organs functioning in detail.
3. Know the Physics involved in the body fluids.
4. Understand in depth knowledge of human systems.
5. Know about the minarels and liquids present in the body.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓	✓		✓				
CO2	✓	✓						✓	
CO3	✓	✓	✓		✓				
CO4	✓	✓		✓	✓		✓		
CO5	✓				✓				

19EIRIPEXX / 19PEIRIPEXX	CANCER BIOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To familiarize the student with cancer and Molecular biology.

Fundamentals of cancer biology : Regulation of cell cycle – Mutations that cause changes in signal molecules – Effect on receptor – Signal switches – Tumor suppressor genes – Modulation of cell cycle in cancer – Different forms of cancers, diet and cancer – Cancer screening and early detection – Detection using biochemical assays – Tumor markers – Molecular tools for early diagnosis of cancer.

Principles of carcinogenesis: Theory of carcinogenesis – Chemical carcinogenesis – Metabolism of carcinogenesis – X–ray radiation – Mechanism of radiation carcinogenesis.

Principles Of Molecular Cell Biology Of Cancer: Signal targets and cancer – Activation of kinases – Oncogenes – Identification of oncogenes – Retroviruses and oncogenes – Detection of oncogenes – Oncogenes/proto oncogene activity – Growth factors related to transformation – Telomerases.

Principles of cancer metastasis: Clinical significances of invasion – Heterogeneity of metastatic phenotype – Metastatic phenotype – Metastatic cascade – Basement membrane disruption – Three step theory of invasion – Proteinases and tumor cell invasion.

New molecules for cancer therapy: Different forms of therapy – Chemotherapy – Radiation therapy – Detection of cancers – Prediction of aggressiveness of cancer – Advances in cancer detection – Use of signal targets towards therapy of cancer.

REFERENCES

1. Weinberg, R.A., The Biology of Cancer, Garland Science, 2007.
2. Pelengaris, S. and Khan. M., The Molecular Biology of Cancer, Blackwell Publishing, 2006.
3. Macdonald, F. and Ford, C.H.J., Molecular Biology of Cancer, BIOS Scientific Publication, 2005.
4. Roger John Benjamin King, Mike W. Robins, Cancer Biology, Pearson prentice hall, 3rd edition, 2006.
5. Ruddon, R.W., Cancer Biology, Oxford University Press, 2nd Edition, 1995.

COURSE OUTCOMES

Student will be able to

1. Have clear understanding of basics of cancer and its types.
2. Understand the causes of Cancer.
3. Analyse the modalities for the detection of Cancer.

4. Develop cancer detecting modules.
5. Help the society by the developed products.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓				✓		✓	✓
CO2	✓	✓					✓		
CO3	✓	✓	✓		✓				
CO4	✓	✓		✓					✓
CO5				✓	✓		✓	✓	✓

19EIRIPEXX / 19PEIRIPEXX	COMPUTATIONAL METHODS AND BONE MODELLING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To study about the Mathematical Modelling.

- To have knowledge on the Anatomy and physiology of Bones.
- To know how Cancer developes in Bones and affects its function.

Introduction to Bone Tissues – structure of bone tissues – primary and secondary bone – compact and cancellous bones – other types. Mechanical properties of materials and bones – elastic properties – strength – fracture mechanics properties – Modelling fracture in tension – as a composite – micro damage – Modelling and reconstruction: need for feedback control – Bone Modelling of cancellous bone – functions of internal remodeling – changing the grain.

Techniques associated with the study of bone – new material on computational methods, imaging of bone structure – strain gauging of live animals – Clinically related issues – elementary stress analysis of bone – bone prostheses and implants – non – invasive measurement of bone integrity.

Introduction to computational neuroscience – motivation for biophysical modeling. Theory and modeling in neuroscience: Descriptive vs. functional models – Turing vs. neural computation. Introduction to anatomy and cellular basis of nervous system.Introduction to differential equations and theory of dynamical systems.Equivalent circuit model: Electromotive, resistive and capacitive properties of cell membrane, change in membrane potential with distance, voltage clamp experiment and Hodgkin and Huxley's model of action potential.

Ionic channels – ionic currents – experimental techniques: voltage and space clamp experiments. The Hodgkin – Huxley formalism – activation and inactivation kinetics – complete model for action potential generation.Hodgkin – Huxley vs Markov models.Qualitative Hodgkin – Huxley theory – voltage clamp techniques – Hodgkin – Huxley equations methods. Simplified neuron models: Simplifications of the Hodgkin – Huxley model: FitzHugh – Nagumo – Rinzel model.

Abstract Models: phase model – rate model – McCulloch – Pitts neuron – integrate and fire neuron model. Synapses and synaptic plasticity – simplified and phenomenological models of synaptic functions. Synaptic transmission: electrical

and chemical. Gated transmission at the nerve muscle synapse and central synapses – neurotransmitters.

REFERENCES

1. Stephen C. Cowin, "Bone Mechanics Handbook, Second Edition", CRC Press, 2001.
2. John D. Currey**,** "Bones: structure and mechanics", Princeton University Press, 2002.
3. Arabib M.A., Erdi P. and Szentagothai J., Neural Organization: Structure, functions and dynamics, MIT Press, 1997.
4. Teicher, Beverly A., Tumor Models in Cancer Research Series: Cancer Drug Discovery and Development, 2nd ed. Springer, 2011.

COURSE OUTCOMES

Student will be able to

1. Understand the types of bone tissues and its structures.
2. Analyse the causes of Bone Cancer.
3. Model the different types of bones and Cancer affected Bones.
4. Do research on the theraptics on Bone Cancer.
5. Design new modalities for diagnosis with study analysis.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓							
CO2	✓	✓				✓		✓	
CO3	✓	✓	✓		✓		✓	✓	
CO4	✓	✓		✓				✓	✓
CO5	✓			✓		✓	✓		✓

19EIRIPEXX / 19PEIRIPEXX	MEDICAL IMAGING SYSTEMS AND RADIO THERAPY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To acquire knowledge about the various medical imaging techniques.
- To understand the fundamental principle and working of the medical imaging systems involved in the diagnosis of health care.

X–Rays: Principle and production of soft X–Rays, Selection of anodes, heel pattern, Scattered Radiation, Porter – Bucky systems, Cooling System, Testing for various parameters of the unit, principles of Angiography and Fluoroscopic Techniques, Image Intensifiers, Single plane and bi plane recording units, digital subtraction angiography, mammography, dental X–ray units.

Tomography: Principle, Plane of Movement, Multisection Radiography, Computerised Axial Tomography, Type of Detection, image reconstruction, Spiral CT, Transverse Tomography, 3D Imaging.

Emission Imaging: Alpha, Beta, Gamma Emission, different types of Radiation Detectors, G.M. & Proportional Counters, Pulse Height Analysers, Isotopic, Scanners, Isotopic Diagnosis of RBC Destruction Rate, GI Bleedings Iron

Concentration, Liver Functions, Functions of Gamma Camera, PET, SPECT, PET/CT.

Magnetic Resonance Imaging: Principle of MRI, MRI instrumentation, Imaging Different Sections of the Body, Tissue Characterization, MR Spectroscopy, Functional MRI.

Therapy Using X–Rays and Isotopes 9 Direct and Indirect effects of high energy radiation, Units for radiation Exposure, Depth Dose curves, Linear Accelerator Betatron, Cobalt and Cesium Therapy, Computation of Absorbed Dose Level, Automatic Treatment Planning, Hazardous Effects of Radiation, Radiation measuring units, Allowed Levels, ICRP regulation Protection Methods.

REFERENCES

1. Chesney D.N. and Chesney M.O., X-Ray Equipments for Students Radiographer, Blackwell Scientific Publications, Oxford, 1971.
2. Alexander, Kalender and Linke, Computer Tomography, John Wiley, Chichster, 1986.
3. Steve Webb, The Physics of Medical Imaging, Adam Hilger, Philadelpia, 1988.
4. Peggy. W, Roger.D.Ferimarch, MRI for Technologists, McGraw Hill Publications, New York, 1995.
5. Donald Graham, Paul Cloke, Martin Vosper, Principles of Radiological physics, Churchill Livingston, 5th Edition.
6. Donald W. McRobbice, Elizabeth A. Moore, Martin J. Grave and Martin R. Prince, MRI from picture to proton, Cambridge University press, New York, 2006.
7. Jerry L. Prince and JnathanM. Links, “Medical Imaging Signals and Systems”, Pearson Education Inc. 2006.

COURSE OUTCOMES

Student will be able to

1. Understand the different methods and modalities used for medical imaging.
2. Learn the preferred medical imaging methods for routine clinical applications.
3. Understand the engineering models used to describe and analyze medical images.
4. Apply these tools to different problems in medical imaging.
5. Develop drugs with the research Analysis

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓				✓		✓	
CO2	✓	✓				✓	✓		✓
CO3	✓	✓	✓		✓			✓	
CO4	✓	✓		✓		✓			
CO5			✓	✓				✓	✓

19EIRIPEXX / 19PEIRIPEXX	WAVELET TRANSFORMS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To learn the fundamental concepts of wavelet

To apply the wavelet techniques for various biomedical signals.

To do analysis with the signals and processing

Introduction to Wavelets: Introduction to Multirate signal processing – Decimation and Interpolation, Quadrature Mirror Filters, Subband coding, Limitations of Fourier transform, Short time Fourier transform and its drawbacks, Continuous Wavelet transform, Time frequency representation, Wavelet System and its characteristics, Orthogonal and Orthonormal functions and function spaces.

Multiresolution Concept and Discrete Wavelet Transform: Multiresolution formulation of wavelet systems – signal spaces, scaling function, wavelet function and its properties, Multiresolution analysis, Haar scaling and wavelet function, Filter banks – Analysis and Synthesis, 1D and 2D Discrete wavelet transform, Wavelet Packets, Tree structured filter bank, Multichannel filter bank, Undecimated wavelet transform.

Wavelet System Design: Refinement relation for orthogonal wavelet systems, Restrictions on filter coefficients, Design of Daubechies orthogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets.

Wavelet Families: Continuous Wavelets – Properties of Mexican hat wavelet, Morlet, Gaussian and Meyer wavelets. Orthogonal wavelets – Properties of Haar wavelets, Daubechies wavelets, Symlets, Coiflets and Discrete Meyer wavelets. Properties of Biorthogonal wavelets, Applications of wavelet families.

Wavelet Applications: Denoising of Signals and Images, Image enhancement, Edge detection, Image Fusion, Image compression, Wavelet based feature extraction, Analysis of phonocardiogram signals, Analysis of EEG signals, Speech enhancement for hearing aids.

REFERENCES

1. M. Vetterli and J. Kovacevic, Wavelets and sub band coding', Prentice Hall, 1995.
2. C.SidneyBurrus, Ramesh Gopinath&HaitoGuo, 'Introduction to wavelets and wavelet transform', Prentice Hall, 1998.
3. MetinAkay, 'Time frequency and wavelets in biomedical signal processing', Wiley – IEEE Press, October 1997.
4. Raguveer m Rao&Ajith S. Bopardikar, 'Wavelet transforms – Introduction to theory and applications', Addison Wesley, 1998.
5. S.Mallet, 'A Wavelet tour of signal processing', Academic Press 1998.
6. G.Strang and T.Nguyen, 'Wavelet and filter banks', Wesley and Cambridge Press.
7. P.P.Vaidyanathan, 'Multi rate systems and filter banks', Prentice Hall 1993.

COURSE OUTCOMES

Student will be able to

1. Understand an in-depth knowledge about the basic concepts of wavelet and speech analysis

2. Apply wavelet for various physiological signals
3. Analyse the signal features and its functions
4. Do mathematical analysis on various types of Bio signals
5. Develop new algorithms for early diagnosis

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓							
CO2	✓	✓						✓	
CO3	✓	✓	✓		✓		✓		
CO4	✓	✓		✓		✓			✓
CO5	✓		✓	✓				✓	✓

19EIRIPEXX / 19PEIRIPEXX	BIOINFORMATICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To impart knowledge on various aspects of bioinformatics.

To study in detail about DNA and its formation.

Basic Concepts of Molecular Biology: Cells – Chromosomes, DNA, RNA, Proteins, Central dogma of molecular biology, Genomes and Genes – Genetic code, Transcription, Translation and Protein synthesis. Web based genomic and proteomic data bases: NCBI, Gen Bank.

Sequence alignments: Dot plot – Pair – wise sequence alignments – local and global – Sequence similarity and distance measures – Smith – Waterman algorithm, Needleman – Wunch algorithm, Multiple sequence alignment – Sum – of – Pairs measure – Star and tree alignments – PAM and BLOSUM, Phylogenetic analysis.

Informational view of Genomic data: Genomic Signal Processing – DNA Spectrograms – Identification of protein coding regions – Gene expression – Microarrays, Microarray image analysis.

Gene structure in Prokaryotes and Eukaryotes: Molecular Structure Prediction – Basic concepts and terminologies related to molecular structures – Basic molecular Visualization – RNA secondary structure prediction – Protein folding problem – Protein Threading – Protein Visualization – Introduction to Drug Discovery.

Software Tools: Use of Tools for basic and specialized sequence processing such as: BLAST, FASTA, RasMol, Phylip, Clustal W.

REFERENCES

1. Setubal, Meidanis, Introduction to Computational Molecular Biology, Thomson: Brooks/Cole, International Student Edition, 2003.
2. Jean – Michel Claverie, Cedric Notredame,Bioinformatics – A Beginners Guide, Wiley – Dreamtech India Pvt Ltd, 2nd edition, 2007.
3. Lesk, Introduction to Bioinformatics, Oxford University Press, Indian Edition, 3rd edition, 2008.

4. Higgins and Taylor, Des Higgins, Willie R. Taylor, Bioinformatics: Sequence, structure and databanks, Oxford University Press, Indian Edition, 2003.
5. Bryan P. Bergeron, Bioinformatics Computing, Prentice Hall of India, 2003.
6. Jiang, Xu and Zhang, Current topics in Computational Molecular Biology, Ane Books, New Delhi, 2004.

COURSE OUTCOMES

Student will be able to

1. Understand the concept of Gene structures.
2. Acquire awareness about the computational biology.
3. Work with various software tools.
4. Understands the various aspects of informatics applied in health industry so that quality of health care is improved.
5. Analyse the gene formations and diseases.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓					✓		
CO2	✓	✓				✓		✓	
CO3	✓	✓	✓		✓				✓
CO4	✓	✓		✓					
CO5			✓	✓				✓	✓

19EIRIPEXX / 19PEIRIPEXX	MEDICAL ETHICS AND STANDARDS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

Achieve familiarity with some basic ethical framework& understand how these ethical frame works can help us to think through contemporary questions in medical ethics.

Students will be able to know about the legal and ethical principles and application of these principles in health care settings & gain knowledge about the medical standards that to be followed in hospitals.

Introduction to Medical Ethics: Definition of Medical ethics, Scope of ethics in medicine, American medical Association code of ethics, CMA code of ethics – Fundamental Responsibilities, The Doctor and The Patient, The Doctor and The Profession, Professional Independence, The Doctor And Society.

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

Hospital Accreditation Standrads: Accrediation – JCI Accreditation & its Policies. Patient centered standards, Healthcare Organization management standards.

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

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

REFERENCES

1. Domiel A. Vallero, "Biomedical Ethics for Engineers", Elsevier Pub.1st edition, 2007.
2. Biomedical Ethics: A Canadian Focus. Johnna Fisher (ed.), Oxford University Press, Canada, 2009.
3. Robert M. Veatch, "Basics of Bio Ethics", Second Edition. Prentice Hall Inc., 2003.
4. Physical Environment Online: A Guide to The Joint Commission's Safety Standards is published by HC Pro, Inc. 2010.
5. Joint Commission Accreditation Standards for Hospitals, 2nd edition, 2003.
6. Ben Mepham, Bioethics – "An Introduction for the Biosciences", 2nd edition, 2008, Oxford.

COURSE OUTCOMES

Upon completion of this course the student should be able to demonstrate a measurable increase in their knowledge, skills and abilities related to:

1. Legal and professional guidelines for the health professions.
2. Public duties and consent.
3. Guidelines to obtain medical standards in hospitals.
4. Medical ethics, legal ethics and the differences associated with the medical society.
5. Standards for the devices.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓				✓		✓	✓
CO2	✓	✓					✓		
CO3	✓	✓	✓		✓				✓
CO4	✓	✓		✓			✓		
CO5	✓	✓		✓				✓	

OE - OPEN ELECTIVES

19EIRIOEXX/ 19PEIRIOEXX	COMPUTERS IN MEDICINE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To familiarize the student with use of computers in medicine

To use computers for bio signal analysis

To automate the hospitals with the help of computers

Introduction: Computer hardware and software – programming languages – use in medical field – need of computing hospitals – cost effectiveness – help of computerization to physicians.

Patient data base management: Computerized medical records – security. Computer in clinical laboratory – database approach – automated clinical laboratory and analysis – computerized specimen analysis – analysis of ECG, EEG and EMG. Chromosome analysis by computer – computerized cytology and histogram – automated scanning for cervical cancer.

Basics of computer assisted medical imaging: Nuclear medicine – digital subtraction radiography – computerized ultra sonography – X–ray, CT, Nuclear magnetic resonance. Basics of computer assisted medical decision making – general model algorithms – fuzzy set theory – cognitive set theory – cognitive models – QMR, KES and TIA.

Computer in intensive care units: metabolic balance up keeping – pulmonary function evaluation – Cardio vascular evaluation – Computer assisted therapy – computer for case of renal disorders.

Computer aids for the handicapped: basic discussion with examples – introduction to computer assisted instruction in medicine – ISDN in medicine.

REFERENCE

R.D. Lele, Computers in medicine, Tata McGraw Hill Publishing Company Limited, 2nd reprint, 2008.

COURSE OUTCOMES

Student will be able to

1. Exposed to PC hardware as well as various microprocessor family.
2. Hardware behind data acquisition.
3. Scope of virtual reality in health care.
4. Develop insight knowledge about the biometrics and network security.
5. Automate the existing systems with computers.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓						✓	
CO2	✓	✓				✓			

CO3	✓	✓	✓		✓		✓		✓
CO4	✓	✓		✓					
CO5				✓	✓			✓	✓

19EIRIOEXX/ 19PEIRIOEXX	TISSUE AND STEM CELL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To understand basics of Tissue Engineering.

To understand fundamentals of cell mechanisms.

To teach the Physical & biological principles that serve as the scientific basis for understanding the interactions of biological molecules and cells with biomaterials employed for the fabrication of permanent implantable prostheses and as matrices for tissue engineering.

To understand application of Tissue Engineering.

Tissue: Definition – structure – organization and types. Vascularity and angiogenesis – basic wound healing – cell migration – therapeutic and in – vitro testing.

Cell: Types – differentiations – different kind of matriX–cell – cell interaction. Cell culture: expansion – transfer – storage – characterization. Molecular biology: Cell signalling molecules – hormone – growth factor and delivery in tissue engineering. Cell attachment: differential cell adhesion – receptor – ligand binding – cell surface markers.

Scaffold and transplant: Biomaterials for tissue engineering – degradable materials (collagen, silk and polylactic acid) – porosity – mechanical strength – 3 – D architecture – cell incorporation. Tissues for replacing bone – cartilage – tendons – ligaments – skin and liver.Basic transplant immunology – stems cells – introduction – haematopoiesis.

Case study: cell transplantation for liver – musculoskeletal – cardiovascular and neural systems. Ethical – FDA and regulatory issues of tissue engineering.

Stem Cells: Origin, characterization, potential applications of human stem cells – Protocols for isolation and identification of stem cells – Differentiation of cells from human – neurospheres into neurons – astrocytes and oligodendrocytes – Immuno labelling. Gene therapy: immune rejection in stem cell therapy – new therapy for autoimmune disease – prenatal diagnosis of genetic abnormalities using fetal CD34+ stem cells.

REFERENCES

1. Sameul E. Lynch, De Robertis, J Geng, Tissue Engineering, Elsevier, 3rd Edition, 2007.
2. Clemens van Blitterswijk, Tissue Engineering, Academic Press, 2008
3. Robert. P.Lanza, Robert Langer & William L. Chick, Principles of Tissue Engineering, Academic Press, 2007.

4. B. Palsson, J.A. Hubbell, R. Plonsey and J.D. Bronzino, Tissue Engineering, CRC Press, 2003.
5. Kursad and Purksen, Embryonic Stemcell, Humana Press, 2002.

COURSE OUTCOMES

By successfully completing this course, students will be able to:

1. Understand the importance of tissue engineering in the field of biomedical engineering.
2. Understand the mechanisms involved in interaction of different materials with cells and tissues.
3. Explain different methods involved in characterization and preparation of biomaterials in tissue engineering.
4. Apply the knowledge in creating new models in drug delivery systems using synthetic and basic knowledge on stem cells and its various functional applications and therapy.
5. Design an implant for tissue replacement.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓						✓	
CO2	✓	✓					✓		
CO3	✓	✓	✓		✓				✓
CO4	✓	✓		✓					✓
CO5					✓	✓	✓	✓	✓

19EIRIOEXX/ 19PEIRIOEXX	RADIOLOGICAL EQUIPMENTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To understand the generation of X-ray and its uses in imaging

To know the techniques used for visualizing various sections of the body.

To learn the principles of different radio diagnostic equipment in Imaging

To discuss the radiation therapy techniques and radiation safety.

X – Rays : Production of X-rays – Various components of radiographic systems – Electrical circuit for X-ray unit – filament circuits and mA control- HT circuits- KV control –exposure switching and control of exposure timers- types of X-ray tubes for various medical applications. Rating charts of X-ray tubes.

Radiation Techniques: Scattered radiation and its control in radiography – collimators – pinky grids – absorbed dose - Basics of tables & arms. Fluoroscopy systems – TV chain for fluroscopy – Properties of X -ray films &screens - Characteristics of imaging system by modulation transfer function.

Exposure Controls : Automatic exposure controls - Photo timers - types - limitations - performance - serial film chargers – types - radiographic considerations - film exposure time - photo timer applications - automatic brightness control system.

Angiogrphy: Basic of digital angiography - Image processors for digital angiography - processor architecture – Temporal integration techniques for digital angiography- digital subtraction angiography.

Radiotherapy: Physical principles of radiotherapy. Dosage data for clinical applications. Measurement of output and use of ISODOSE charts. Collimators and beam direction devices. Telemetry sources and acceptance calibration. Safety protocols & protection. Principles of linear accelerators for radiation therapy. Radiation therapy planning.

REFERENCES

1. Chesneys , 'Equipment for Student Radiographers', 4th Edition, Wiley-Blackwell Publiishers, 1994.
2. Carr & Brown, 'Introduction to Biomedical Equipment Technology' Pearson Education, Asia, 1993.
3. R. S. Khandpur, 'Handbook of Bio-Medical Instrumentation', Tata McGraw Hill, 1989.
4. J.Webster, 'Bioinstrumentation', Wiley & Sons, 2004.

COURSE OUTCOMES

The student is exposed to the

1. Basics of radiation and its effects.
2. Various imaging modalities and current techniques.
3. Radiation safety and precautions to be followe in the Hospitals.
4. Advanced radiation theraphy for cancer treatment.
5. Knowledge of radiation and its effects.

	MAPPING OF COs WITH POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓		✓					
CO2	✓	✓					✓	✓	✓
CO3	✓	✓	✓		✓			✓	
CO4	✓	✓		✓		✓	✓		✓
CO5	✓			✓	✓			✓	✓

19EIRIOEXX/ 19PEIRIOEXX	SPORTS MEDICINE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To teach the key principles of sports medicine education.
- To enable the students with the knowledge of Biomechanics for the muscles an bones.
- To elaborate about the classification of sport injuries an physiological exercices.

Meaning and concept of sports medicine, scope of sports medicine in physical education and sports. History of Sports Medicine in India. Prevention of sports injuries. Role of Physical Educators and Coaches in the prevention of sports injuries. Pre-conditioning injury prevention exercises and drives Static Stretching exercises. Therapeutic exercise and their classification.

Sports Injuries: - Terminology and classification of common sports soft tissue injuries, Pathological changes in sprains, strain and contusion and their

management. Regional injuries and their management- injuries of head, ears, eyes, nose, back, shoulders, elbows, hand, abdomen, thighs, knee, leg and ankle.

Rehabilitation procedures of sports injuries, Principles of rehabilitation of injuries, Therapeutic modelties i.e cryotherapy , hydrotherapy, electrotherapy and lesser therapy. Massage and its techniques.

Physiology of exercise, short and long term effects of exercise on muscular tissues, Physiological principles of development of strength, endurance, speed and flexibility.

Heart role and exercise. Threshold for training effects on heart, Cardiac reserve capacity, blood pressure and exercise. Lungs ventilation during rest and exercise, change in lungs diffusions during muscular activities.

REFERENCES

1. Armstrong and Tuckler, “Injuries in Sports”, Staples Press, London 1964
2. Bolan, J.P and Rasch, P.J , ”Treatment and Prevention of Athletic Injuries”, The Inter-state Printers and Publishers, 1967.
3. Morehouse, L.E and Rasch, P.J, “Sports Medicine for Trainers”, Philadephia, W.B. Saunder CO.,1963.
4. Ryans Allan,”Medical Care of the Athlete”, McGraw Hill, 2003.
5. Pande, P.K. “ Know How Sports Medicine?” AP Publications, Jalandhar, 2014.

COURSE OUTCOMES

The student is exposed to the

1. Awareness in sport Medicine.
2. Techniques to be applied for sports injuries.
3. Applications of Medical techniques for athelette.
4. Physiological exercices for various human systems and developmental strength.
5. New ideas for design projects.

	MAPPING OF COs WITH POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓						✓	✓
CO2	✓	✓					✓		✓
CO3	✓	✓	✓		✓			✓	
CO4	✓	✓		✓		✓	✓		✓
CO5			✓	✓	✓			✓	✓

19EIRIOEXX/ 19PEIRIOEXX	COMPUTATIONAL BIOENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Neural engineering and rehabilitation research applies neuroscience and engineering methods to analyze central and peripheral nervous system function and to design clinical solutions to neurological disorders or injury.
- To study the basics of Nervous system
- To understand the development and arrangement of neural tissue
- To study the neuronal disorders and injuries

- To study the repairing and reconstruction mechanism of nervous system.

Introduction to Computational Neuroscience – motivation for biophysical modeling. Theory and modeling in neuroscience : Descriptive vs. functional models -Turing vs. neural computation. Introduction to anatomy and cellular basis of nervous system.Introduction to differential equations and theory of dynamical systems.

Equivalent circuit model: Electromotive, resistive and capacitive properties of cell membrane, change in membrane potential with distance, voltage clamp experiment and Hodgkin and Huxley's model of action potential.

Ionic channels – ionic currnets- experimental techniques : voltage and space clamp experiments. The Hodgkin-Huxley formalism – activation and inactivation kinetics – complete model for action potential generation.Hodgkin-Huxley vs Markov models.

Qualitative Hodgkin-Huxley theory – voltage clamp techniques – Hodgkin-Huxley equations methods. Simplified neuron models: Simplifications of the Hodgkin-Huxley model: FitzHugh – Nagumo- Rinzel model. Abstract Models: phase model – rate model – McCulloch-Pitts neuron – integrate and fire neuron model.

Synapses and synaptic plasticity – simplified and phenomenological models of synaptic functions.synaptic transmission: electrical and chemical. Gated transmission at the nerve muscle synapse and central synapses – neurotransmitters.Cellular basis of learning: synaptic plasticity – The Hebbian rule of learning – variations for the Hebbian rule. Long term synaptic potentiation and depression. Synaptic plasticity on different time scales.

Basics of modeling neural networks: The two or three levels of neural dynamics. Supervised learning rules : Perceptron learning rule - Adaptation in linear neurons, Widrow-Hoff rule – objective functions and gradient descent – multilayer networks and back propagation. Unsupervised learning rules : Principle Component Analysis – decorrelation – Winner-take-all networks and clustering. Basic neural network architectures: feed-forward – feedback – lateral connections.

REFERENCES

1. Dayan P and L.F.Abbott, Theoretical Neuroscience: Computational and Mathematical modeling of neural systems, MIT Press, 2001.
2. W. Gerstner and W.M.Kistler, Spiking Neuron Models, Cambridge University Press, 2002.
3. Arabib M.A, Erdi P and Szentagothai J, Neural Organization: Structure, functions and dynamics, MIT Press, 1997.
4. Lauren Fausett, Fundamentals of Neural Networks, Prentice- Hall, New Jersey, 1994.
5. V.Z. Marmarelis, Advanced methods of physiological system modeling, Springer, 1989.

COURSE OUTCOMES

Through this course of study students will be able to

1. Understand the application of basic science and engineering techniques,
2. Develop methods to record from and exert control over the nervous system
3. Understand and develop the models of associated organ systems.
4. Can carryout research in the analysis of memory of physiological systems
5. Apply neural networks for detection and analysis of diseases.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓							
CO2	✓	✓							
CO3	✓	✓	✓		✓				
CO4	✓	✓		✓					
CO5	✓		✓	✓				✓	✓

19EIRIOEXX/ 19PEIRIOEXX	HEALTH CARE SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To make the student to understand health care sector
- To give awareness about hospital set up in a larger perspective with an emphasis on the systems.

Environmental Issues: Introduction: Theoretical frame work - Environment - Internal and External – Environmental Scanning – Economic Environment – Competitive Environment – Natural Environment – Politico Legal Environment – Socio Cultural Environment - International and Technological Environment.

Introduction to Health Care: A Conceptual Approach to Understanding the Health Care Systems: Evolution – Institutional Settings - Out Patient services – Medical Services – Surgical Services – Operating department – Pediatric services – Dental services – Psychiatric services – Casualty & Emergency services – Hospital Laboratory services – Anesthesia services – Obstetrics and Gynecology services – Neuro – Surgery service – Neurology services.

Overview of Health Care Sector in India: Primary care – Secondary care – Tertiary care – Rural Medical care – urban medical care – curative care – Preventive care – General & special Hospitals-Understanding the Hospital Management – Role of Medical, Nursing Staff, Paramedical and Supporting Staff - Health Policy - Population Policy - Drug Policy – Medical Education Policy

Health Care Regulation:WHO, International Health regulations, IMA, MCI, State Medical Council Bodies, Health universities and Teaching Hospitals and other Health care Delivery Systems

Epidemiology Issues: Epidemiology -Aims – Principles – Descriptive, Analytical and Experimental Epidemiology - Methods - Uses

REFERENCES

1. Zweifel.Peter, Breyer Friedrich, and MathiasKifmann, 'Health economics', Springer, 2009.

2. Y.Shanmugasundaram, 'Theory and practice of health economics in India', Institute for Advanced Studies & Research, 1994.

COURSE OUTCOMES

The student is exposed to the

1. Hospital administration.
2. Various environmental challenges in Health care domain
3. History and overview of healthcare system in the country.
4. Understands the regulation and standards.
5. Epidemiology Principles

	MAPPING OF COs WITH POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓							
CO2	✓	✓					✓		
CO3	✓	✓	✓		✓		✓	✓	
CO4	✓	✓		✓		✓			✓
CO5			✓	✓	✓	✓	✓	✓	✓

19EIRIOEXX/ 19PEIRIOEXX	TELEMEDICINE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To teach the key principles for telemedicine and health.

To enable the students with the knowledge of telemedical standards, mobile telemedicine and its applications.

Telemedicine, telehealth and telecare: History of telemedicine – Main phases of telemedicine – Pre electronic telemedicine. Electronic telemedicine Technical Requirements – Type of information and standards, audio, data, Fax, Video Types of communications and networking – networking architecture. POTS, ISDN, ATM Other Fixed networks – Air/airless communications, RF, Microwaves, Satellite, GSM, CDPD (Cellular Digital Packet Data) Acquisition/ displays – Acquisition systems Cameras, Scanners, Other medical specialized acquisition system.

Display systems: Analogue devices, LCD, Laser displays, Holographic representations, Virtual screen devices Computation / storage systems: Magnetic, Mixed, Optical (laser) devices (only brief description required).

Telemedicine applications: Teleradiology: Basic parts of a teleradiography system, Image acquisition and management, display, communication, interpretation Telepathology: Applications, requirements, security and confidentiality tools, telequantitation at distance. Telecytology: Applications, Telecardiology: requirements, portable solutions Telehome – Care Home based applications, Teleoncology: Applications, Telesurgery, telepsychiatry, Teledermatology Techniques.

Internet in telemedicine: Basic concepts – Security – secure socket layer – Firewalls – proxies. Personal Communication, Medical data sharing needs for telemedicine – Internet problems, Distant training, teleworking and telecasting. Ethical and legal aspects of telemedicine: confidentiality, patient rights and consent – ethical and legal aspects of internet – telemedical malpractice.

Constraints for the wide spread use of telemedicine: constraints linked to economy, social acceptance Strategic planning for telemedicine implementation. Analysis of the present situation and the demand Objectives and strategies – Plan of implementation, Forces affecting technology transfer scenarios for telemedicine.

REFERENCES

1. Olga Ferrer, Roca M. Sosa, Marcelo C, Hand Book of Telemedicine, IOS Press, 3rd edition, 2002.
2. Ling Guan, Multimedia image and video processing, CRC Press, 2000.
3. Thorsten M. Buzug, Heinz Handels, Dietrich Holz, Telemedicine: Medicine and Communication, Springer – Verlag, 2001.
4. Douglas V. Goldstein, e-Healthcare: Harness the power of Internet, e-commerce and e-care, Jones and Barlett Publishers.
5. C. Norris, Essentials of Telemedicine and Telecare, John Wiley& Sons 2002.

COURSE OUTCOMES

The student is exposed to the

1. Technologies applied in multimedia using telemedicine.
2. Protocols behind encryption techniques for secure transmission of data.
3. Applications of telehealth in healthcare.
4. Concept of the fundamental concepts necessary to for any telemedicine and telehealth activity.
5. Telemedicine and ways of connecting nodal hospitals

	MAPPING OF COs WITH POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓					✓		
CO2	✓	✓					✓		
CO3	✓	✓	✓		✓		✓	✓	
CO4	✓	✓		✓		✓			✓
CO5					✓	✓	✓	✓	✓

19EIRIOEXX/ 19PEIRIOEXX	MODELLING OF PHYSIOLOGICAL SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To understand the fundamental engineering aspects of modelling Physiological systems.

To utilize concepts derived from biomedical research to aid in the design of engineering systems.

To apply system techniques and methods to biomedical problems.

Biological control system: similarities and differences – components of living control system – Model and Analog – system properties – resistance – storage – distributed and lumped systems. Mathematical approach – electrical analogues. Approaches to modelling: Mathematical modelling – classification of models – characteristics of models. Purpose of physiological modeling and signal analysis – linearization of nonlinear models – model formulation – identification – validation and Simulation Different approaches of modeling physiological systems – linear modeling – distributed modeling – nonlinear modeling – time – varying modeling.

Nonparametric modeling: Volterra models – Wienermodels – efficient volterra kernel estimation – analysis of estimation errors. Parametric modeling: Basic parametric model forms – estimation procedures – Volterra kernels of nonlinear differential equations – discrete – time volterra kernels of NARMAX models – from Volterra kernel measurements to Parametric models – equivalence between continuous and Discrete – parametric models.Introduction to various process controls like cardiac rate – blood pressure – respiratory rate – blood – glucose regulation – pharmacokinetic modeling – compartmental models – blood – tissue models.

Equivalent circuit model: Electromotive, resistive and capacitive properties of cell membrane – change in membrane potential with distance – voltage clamp experiment – voltage dependent membrane constant and simulation of the model – model for strength – duration curve – model of the whole neuron – Huxley model of isotonic muscle contraction – modeling of EMG – motor unit firing – amplitude measurement – motor unit and frequency analysis.

Physiological modelling: Electrical analog of blood vessels – model of systematic blood flow – model of coronary circulation – transfer of solutes between physiological compartments by fluid flow – counter current model of urine formation – model of Henle's loop – linearized model of the immune response – Germ, Plasma cell, Antibody, system equation and stability criteria.

Electrical circuit model of oxygenation: A model of immune response to disease (Block Diagram) – modelling of multi input/multi output systems: The two – input case – Applications of two – input modelling to physiological systems – Multi – input case spatiotemporal and spectro temporal modelling. Respiratory system: Modeling oxygen uptake by RBC and pulmonary capillaries mass balancing by lungs – gas transport mechanism of lungs and O_2 and CO_2 transport in blood and tissues.

Case studies on modeling of physiological system: Modeling of nerve action potential: Hodgkin – Huxley model.

Modeling of skeletal muscle contraction: Huxley Cross Bridge model. Modeling of myoelectrical activity.

Modeling of cardiovascular system: Block diagram representation of cardio vascular system.

REFERENCES

1. David T. Westwick, Robert E. Kearney, Identification of Nonlinear Physiological Systems, Wiley – IEEE Press, 2003.

2. Michael C. K. Khoo, Physiological Control Systems – Analysis, simulation and estimation, Prentice Hall of India, 2001.
3. J. Enderle, S. Blanchard, J. Bronzino, Introduction to Biomedical Engineering, Academic Press, 3rd edition, 2012.
4. Suresh.R.Devasahayam, Signals & Systems in Biomedical Engineering, Springer, 2000.
5. V.Z. Marmarelis, Advanced methods of physiological system modeling, Springer, 1999.
6. James V. Candy, Signal Processing: The Model Based approach, John Wiley sons, Newyork, 2006.
7. L.Stark, Neurological Control System, Plenum Press, New York, 1968.
8. R.B. Stein, Nerve and Muscle, Plenum Press, New York, 1980.

COURSE OUTCOMES

Student will be able to

1. Acquire an insight into and understanding of the utilization of models, system analysis and analog simulation in the field of bioengineering.
2. Understand basic concepts of modeling for designing biological model.
3. Model and simulate physiological processes for better understanding.
4. Use various simulation softwares for modeling biological systems.
5. Understand micro level analysis of cell signaling.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓							
CO2	✓	✓				✓			
CO3	✓	✓	✓		✓		✓	✓	
CO4	✓	✓		✓					✓
CO5	✓	✓	✓	✓					

19EIRIOEXX/ 19PEIRIOEXX	BIOMECHANICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide the knowledge of mechanical concepts as applied to human movement.
- To study about the bone structure and cartilage.
- To study the structure, movements, and loads applied to spine, shoulder and hip.
- To study about the fluid mechanic system applied to human body

Basic Biological Principles: Diffusion – surface tension and viscosity – characteristics – influencingfactors – biological applications. Introduction to mechanics: Review of principles of mechanics – vector mechanics – Resultant forces of Coplanar and Non – coplanar – Concurrent and non – concurrent forces – parallel force in space – Equilibrium of coplanar forces – Newton's laws of motion – work and energy – moment of inertia. Fluid mechanics: Introduction – viscosity and capillary viscometer – rheological properties of blood – laminar flow – Couette flow and Hagen – poiseuille equation – turbulent flow.

Hard tissues: Bone structure – composition and mechanical properties of bone – , viscoelastic properties – Maxwell and Voight models – anisotropy – electrical properties of bone – fracture mechanism and crack propagation in bones – fracture fixators – repairing of bones – mechanical properties of collagen rich tissues, teeth and its properties.

Soft tissues: Structure and functions of cartilages, tendons – ligaments – stress – strain relationship – soft tissue mechanics – mechanical testing of soft tissues standard sample preparation – cross – section measurement – clamping of the specimen – strain measurement – environmental control, time dependent properties of testing.

Bones, joints and loco motor systems: Joints – classification based on structural, functional and regional – characters – mechanism of lubrication of synovial joints. Bone – composition – classification. Biomechanics of joints: Skeletal joints – basic considerations – basic assumption and limitations – forces and stresses – mechanics of the elbow, shoulder, spinal column, hip, knee and ankle.

Locomotion: Basis – gait analysis and goniometry – ergonomics – foot pressure measurements – force platform – mechanics of foot. Total Hip Prosthesis: requirements – types of components – Stress analysis and instrumentation, Knee Prosthesis. Cardiovascular mechanics: Heart valves – artificial valves – biological and mechanical valves development – testing.

REFERENCES

1. Donald R. Peterson and Joseph D. Bronzino, Biomechanics Principles and applications, CRC press, Taylor & Francis Group, LLC, 2008.
2. Duane Knudson, Fundamentals of Biomechanics, Springer publication, 2nd Edition, 2007.
3. R. McNeill Alexander, Biomechanics, Chapman and Hall, New York, 1975.
4. D. N.Ghista, Biomechanics of Medical Devices, Marcel Dekker, New York, 1982.
5. A.Z. Tohen and C.T. Thomas, Manual of Mechanical Orthopaedics.
6. D.N. Ghista and Roaf, Orthopaedic Mechanics: Procedures and Devices, Academic Press, London, 1978.
7. V.C. Mow and W.C. Hayes, Basic Orthopedic Biomechanics, Lippincott – Raven Publishers, Philadelphia, 1997.

COURSE OUTCOMES

Student will be able to

1. Understand the definition of biomechanics, prostheses orthoses and its classification and design principles.
2. Develop a better understanding of how mechanical principles influence human motion during everyday life.
3. Analyze the forces at joints for various static and dynamic human activities; analyze the stresses and strains in biological tissues.
4. Understand the principles of mechanics that is used to analyze human movement.
5. Analyse the mechanism of joints and bones.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓							
CO2	✓	✓				✓		✓	
CO3	✓	✓	✓		✓		✓		
CO4	✓	✓		✓					✓
CO5	✓	✓		✓	✓				

19EIRIOEXX/ 19PEIRIOEXX	TROUBLESHOOTING OF MEDICAL EQUIPMENTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide knowledge to students to enable them to troubleshoot the various equipments used in hospitals.

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

Testing of passive components and semiconductor devices :

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

Fault Diagnosis In Integrated Circuits: Fault Diagnosis In Analog& Digital Integrated circuits: Fault Diagnosis in Op-Amp Circuits, Digital Troubleshooting Methods, Digital IC Troubleshooters, Circuit board Troubleshooting.

Troubleshooting Of Biomedical Instruments : Trouble shooting of ECG Machine, EEG Machine, Defibrillator Electrosurgical unit, Anaesthesia machine, Autoclaves & sterilizers, Endoscope.

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

REFERENCES

1) R.S.Khandpur, 'Troubleshooting Electronic Equipment- Includes Repair & Maintenance', Tata McGraw-Hill, Second Edition 2009.
2) Dan Tomal and Neal Widmer, 'Electronic Troubleshooting', McGraw Hill, 3rdEdition 2004.
3) Nicholas Cram & Selby Holder, 'Basic Electronic Troubleshooting forBiomedical Technicians', TSTC Publishing, 2nd Edition 2010.
4) World Health Organisation, 'Maintenance & Repair of Laboratory, Diagnosticimaging & Hospital Equipment', Geneva, 1994.

COURSE OUTCOMES

Students will be able to

1. Understand the concepts of Medical Equipments.
2. Understand the functioning of equipments and usage in Hospitals.
3. Techniques about various electronic circuits in medical equipments.
4. Troubleshoot the medical devices
5. Applying the service concepts in developing new features

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓							
CO2	✓	✓							
CO3	✓	✓	✓		✓				
CO4	✓	✓		✓					
CO5		✓	✓	✓					✓

19EIRIOEXX/ 19PEIRIOEXX	DESIGN OF MEDICAL EQUIPMENTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To equip students with basics of design, construction and development process of devices which are used in medical, clinical or laboratory practice

Introduction to Medical Equipments : Define medical device, Classification of medical device, Medical devices medical instrumentation, Origin of bio-potential, Physiological signal, Human machine interface ,Input output and control signal, Data acquisition, Sensor, Amplification, Medical electrical stimulator.

Minimally Invasive Device and Technique : Laparosopic instrumentation, surgical instrumentation in ophthalmology -Phacoemulsification: Instrument and system - Vitrorectomy: Instrument and system- Human machine interface.

Diagnostic Equipment Design : System description of diagnostic equipment: Patient monitoring system, ECG, EEG, Blood pressure monitor, Digital stethoscope, Thermometer, System description and diagram of pulse oximeter, optical fiber optics for circulatory and respiratory system measurement.

Therapeutic Equipment Design : System description of therapeutic equipment: Pacemaker, External cardio vector defibrillator, Implantable cardio vector defibrillator, Deep brain stimulation, Functional electrical stimulator (FES),Hemodialysis delivery system, Mechanical ventilator.

Implant and Prosthesis : System description of various implant and prosthesis: Total hip prosthesis, Joint replacement, Design of artificial pancreas, Drug elutingstent and its engineering design - Intraocular lens implant, Cochlear implants, Heart valves.

REFERENCES

1. Gail Baura, 'Medical Device Technologies: A Systems Based Overview UsingEngineering'**,** Elsevier science, 2002.
2. Martin Culjat, Rahul Singh, Hua Lee,'Medical Devices: Surgical and Image-Guided Technologies', John Wiley & Sons, Reinaldo perez, *Design ofmedical electronic device*, Elsevier science, 2002.

3. C.Richard, Fries, 'Handbook of Medical Device Design', Marcel DekkerAG, 2nd edition 2005.
4. Anthony Y. K, Chan, 'Biomedical device technology: principles and design',Charles Thomas, 2008.
5. Theodore R, Kucklick, 'The Medical Device Ramp-D Handbook',Taylor&Francis Group LLC, 3rd edition 2013.
6. David Prutchi, Michael Norris, 'Design and Development of Medical Electronic Instrumentation: A Practical perspective of the design, construction and test of medical devices', John Wiley & Sons, 2005

COURSE OUTCOMES

Students will be able to

1. Understand the basic design of medical devices.
2. Learn various acquisition modules in Medical devices.
3. Learn various theraptic equipments.
4. Understand the design of implants.
5. Understand more about joint replacements.

MAPPING OF COs WITH POs									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓							
CO2	✓	✓							
CO3	✓	✓	✓		✓			✓	✓
CO4	✓	✓		✓			✓		
CO5					✓	✓	✓		✓

AUDIT COURSES

19EIRIACXX	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission syllabus.

Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the conclusion.

Useful phrases, how to ensure paper is as good as it could possibly be the first-time submission.

REFERENCES

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books) Model Curriculum of Engineering & Technology PG Courses [Volume-I] [41]
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press 3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook. 4. Adrian Wallwork, English.

19EIRIACXX	DISASTER MANAGEMENT	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

Students will be able to:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming.

Introduction Disaster

Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Repercussions Of Disasters And Hazards

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Disaster Prone Areas In India

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

Disaster Preparedness And Management

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Risk Assessment

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Disaster Mitigation Meaning

Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

REFERENCES

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi. 3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi.

19EIRIACXX	SANSKRIT FOR TECHNICAL KNOWLEDGE	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects
- Enhancing the memory power
- The engineering Scholars equipped with the Sanskrit will be able to explode the huge knowledge from ancient literature.

Alphabets in Sanskrit, past/ present/ future tense, simple sentences. Order, introduction of roots technical information about Sanskrit literature. Technical concepts of Engineering – electrical, mechanical, architecture, mathematics

REFERENCES

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

COURSE OUTCOMES

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood.
3. Being a global language, will help to develop logic in students.

19EIRIACXX	VALUE EDUCATION	L	T	P	C

		2	0	0	0

COURSE OBJECTIVES

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Values and self-development –Social values and individual attitude and work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

Importance of cultivation of values, Sense of duty, Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.

Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth. Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature.

Character and Competence –Holy books vs Blind faith, Self-management and Good health, Science of reincarnation, Equality, Nonviolence,Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

REFERENCES

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

COURSE OUTCOMES

Students will be able to

1. Knowledge of self-development.
2. Learn the importance of Human values
3. Developing the overall personality

19EIRIACXX	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals’constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

History of Making of the Indian Constitution:

History, Drafting Committee, (Composition & Working)

Philosophy of the Indian Constitution:

Preamble, Salient Features

Contours of Constitutional Rights & Duties:

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Organs of Governance:

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

Local Administration:

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Pachayati raj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments),

Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Election Commission

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

COURSE OUTCOMES

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

19EIRIACXX	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Introduction and Methodology

Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

Thematic overview

Pedagogical practices are being used by teachers, in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Evidence on the effectiveness of pedagogical practices

Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. eachers' attitudes and beliefs and Pedagogic strategies.

Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Research gaps and future directions

Research design, Contexts, Pedagogy Teacher education, Curriculum and assessment, Dissemination and research impact.

REFERENCES

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher Education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary Education Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

COURSE OUTCOMES

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners.
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.

19EIRIACXX	STRESS MANAGEMENT BY YOGA	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

- To achieve overall health of body and mind
- To overcome stress

Definitions of Eight parts of yog. (Ashtanga)

Yam and Niyam

Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Asan and Pranayam

i) Various yog poses and their benefits for mind & body

ii) Regularization of breathing techniques and its effects-Types of pranayam

REFERENCES

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata.

COURSE OUTCOMES

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

19EIRIACXX	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

- To learn to achieve the highest goal happily

- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

Approach to day to day work and duties
Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,
Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
Chapter 18-Verses 45, 46, 48.
Statements of basic knowledge.
Shrimad Bhagwad Geeta:
Chapter2-Verses 56, 62, 68
Chapter 12 -Verses 13, 14, 15, 16,17, 18
Personality of Role model. Shrimad Bhagwad Geeta:
Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
Chapter 4-Verses 18, 38,39
Chapter18 – Verses 37,38,63

REFERENCES

1. “Srimad Bhagavad Gita” by Swami SwarupanandaAdvaita Ashram (Publication
2. Department), Kolkata
3. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath,
4. Rashtriya Sanskrit Sansthanam, New Delhi.

COURSE OUTCOMES

Students will be able to:

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.

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