SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

B.E-Biomedical Engineering

CURRICULUM and SYLLABI

[For students admitted in 2019-2020]

B.E / B.Tech Regulation 2019

Approved by BOS and Academic Council meetings

SONA COLLEGE OF TECHNOLOGY, SALEM

(An Autonomous Institution)

Courses of Study for B.E./B.Tech. Semester I under Regulations 2019 (CBCS)

Branch: Biomedical Engineering

S.No	Course Code	Course Title	L	T	P	C	Category
Theory							
1	U19ENG101B	English For Engineers - I	1	0	2	2	HS
2	U19MAT102B	Linear Algebra and Multivariable Calculus	3	1	0	4	BS
3	U19PHY103E	Engineering Physics	4	0	0	4	BS
4	U19CHE104G	Engineering Chemistry	3	0	0	3	BS
5	U19PPR105	Problem Solving using Python Programming	3	0	0	3	ES
6	U19BEE106B	Basic Electrical and Electronics Engineering	3	0	0	3	PC
Practical							
7	U19PPL111	Python Programming Laboratory	0	0	2	1	ES
8	U19BEEL113B	Basic Electrical and Electronics Engineering Laboratory	0	0	2	1	PC
9	U19GE101	Basic Aptitude - I	0	0	2	0	EEC
Total Credits						**21**	
Optional Language Elective*							
10	U19OLE1101	French	0	0	2	1	HS
11	U19OLE1102	German					
12	U19OLE1103	Japanese					

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (Not accounted for CGPA calculation)

Approved By

Chairperson, Science and Humanities BoS	Chairperson, Biomedical Engineering BoS	Member Secretary, Academic Council	Chairperson, Academic Council & Principal
Dr.M.Renuga	**Dr.R.S.Sabeenian**	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

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HOD/ Biomedical Engineering, First Semester BE BME Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester II under Regulations 2019 (CBCS)
Branch: Biomedical Engineering

S.No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Category
		Theory					
1	U19ENG201B	English For Engineers - II	2	0	0	2	HS
2	U19MAT202C	Transforms and Differential Equations	3	1	0	4	BS
3	U19CHE204D	Biochemistry	2	0	0	2	BS
4	U19EGR206A	Engineering Graphics	2	0	2	3	ES
5	U19BME201	Biology For Engineers	3	0	0	3	PC
6	U19EC202	Circuit Theory	3	0	0	3	PC
		Practical					
7	U19WPL212	Workshop Practice	0	0	2	1	ES
8	U19PCL208B	Physics and Chemistry Laboratory	0	0	4	2	BS
9	U19GE201	Basic Aptitude - II	0	0	2	0	EEC
					Total Credits	**20**	
		Optional Language Elective*					
11	U19OLE1201	French	0	0	2	1	HS
12	U19OLE1202	German					
13	U19OLE1203	Japanese					

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (Not accounted for CGPA calculation)

Approved By

Chairperson, Science and Humanities BoS	Chairperson, Biomedical Engineering BoS	Member Secretary, Academic Council	Chairperson, Academic Council & Principal
Dr.M.Renuga	Dr.R.S.Sabeenian	Dr.R.Shivakumar	Dr.S.R.R.Senthil Kumar

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13.12.2019 **B.E/B.Tech Regulations-2019**

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester III under Regulations 2019
Branch: Biomedical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1.	U19MAT301B	Probability and Statistics	3	1	0	4
2.	U19BM301	Electronic Devices and Circuits	3	0	0	3
3.	U19EC301	Signals and Systems	3	1	0	4
4.	U19BM302	Anatomy and Human Physiology	3	0	0	3
5.	U19CS307	Programming in C	3	0	0	3
6.	U19GE303	**Mandatory Course :** Essence of Indian Traditional Knowledge	2	0	0	0
Practical						
7.	U19BM303	Electronic Devices and Circuits Laboratory	0	0	2	1
8.	U19BM304	Anatomy and Human Physiology Laboratory	0	0	2	1
9.	U19CS308	C Programming Laboratory	0	0	2	1
10.	U19GE301	Soft Skills and Aptitude – I	0	0	2	1
					Total Credits	**21**

Approved By

Chairman, Fashion Technology BoS **Member Secretary, Academic Council** **Chairperson, Academic Council & Principal**
Dr.R.S.Sabeenian **Dr.R.Shivakumar** **Dr.S.R.R.Senthil Kumar**

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HOD/ Biomedical Engineering, Third Semester BE BME Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester IV under Regulations 2019
Branch: Biomedical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U19BM401	Analog and Digital Integrated Circuits	3	0	0	3
2	U19BM402	Biomedical Instrumentation	3	0	0	3
3	U19BM403	Control System for Biomedical Engineering	3	0	0	3
4	U19BM404	Biomaterials	3	0	0	3
5	U19CS406	Data Structures	3	0	0	3
6	U19GE402	**Mandatory Course :** Environment and Climate Science	2	0	0	0
Practical						
7	U19BM405	Analog and Digital Integrated Circuits Laboratory	0	0	2	1
8	U19BM406	Biomedical Instrumentation Laboratory	0	0	2	1
9	U19CS407	Data Structures Laboratory	0	0	2	1
10	U19GE401	Soft Skills and Aptitude – II	0	0	2	1
					Total Credits	**19**

Approved By

Chairperson, Biomedical BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.R.S.Sabeenian	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

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HOD/ Biomedical Engineering, Fourth Semester BE BME Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester V Regulations 2019
Branch: Biomedical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19BM501	Diagnostic and Therapeutic Equipments I	3	0	0	3	45
2	U19EC510	Digital Signal Processing	3	0	0	3	45
3	U19BM502	Pathology and Microbiology	3	0	0	3	45
4	U19BM503	Biomechanics	3	0	0	3	45
5	U19EC511	Microprocessors and Embedded System Design	3	0	0	3	45
6	noc21-ee107	**Elective-NPTEL Course :** Electrical Measurement and Electronic Instruments	3	0	0	3	45
Practical							
7	U19EC512	Digital Signal Processing Laboratory	0	0	2	1	30
8	U19BEC513	Microprocessors and Embedded System Design Laboratory	0	0	2	1	30
9	U19BM504	Pathology and Microbiology Laboratory	0	0	2	1	30
10	U19GE501	Soft Skills and Aptitude – III	0	0	2	1	30
					Total Credits	**22**	

Approved By

Chairman, Biomedical Engineering BoS — Dr.R.S.Sabeenian

Member Secretary, Academic Council — Dr.R.Shivakumar

Chairperson, Academic Council & Principal — Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/ Biomedical Engineering, Fifth Semester BE BME Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VI Regulations 2019
Branch: Biomedical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19BM601	Diagnostic and Therapeutic Equipment II	3	0	0	3	45
2	U19BM602	Radiological Equipment	3	0	0	3	45
3	U19BM603	Biosensors and Transducers	3	0	0	3	45
4	U19BM901	**Elective –** Hospital Management System	3	0	0	3	45
	U19BM902	**Elective –** Medical Physics					
	U19BM903	**Elective –** Medical Optics					
5	U19BM904	**Elective –** Biometric System Technology	3	0	0	3	45
	U19BM905	**Elective –** Bio Mems					
	U19BM906	**Elective –** Medical Ethics and Standards					
Open Elective							
6	U19CE1003	Energy Efficiency and Green Building	3	0	0	3	45
	U19EE1002	Energy Conservation and Management					
	U19FT1001	Fundamentals of Fashion Design					
	U19FT1002	Garment Manufacturing Technology					
	U19MC1003	Smart Automation					
Practical							
7	U19BM604	Diagnostic and Therapeutic Equipment Laboratory	0	0	2	1	30
8	U19BM605	Biosensors and Transducers Laboratory	0	0	2	1	30
9	U19BM606	Summer Internship / Summer Project	0	0	2	1	30
10	U19GE601	Soft Skills and Aptitude – IV	0	0	2	1	30
					Total Credits	**22**	

Approved By

Chairman, Biomedical Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.S.Prabakar	Dr.R.Shivakumar	Dr.S.R.R.Senthil Kumar

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HOD/ Biomedical Engineering, Sixth Semester BE BME Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VII Regulations 2019
Branch: Biomedical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19BM701	Medical Image Processing	3	0	0	3	45
2	U19BM702	AI in Health and Medicine	3	0	0	3	45
3	U19BM907	**Professional Elective** – Biomedical waste Management	3	0	0	3	45
4	U19BM908	**Professional Elective –** Assist Devices	3	0	0	3	45
5	U19BM909	**Professional Elective** – Rehabilitation Engineering	3	0	0	3	45
6	U19CE1004	**Open Elective –** Disaster Management	3	0	0	3	45
	U19CS1002	**Open Elective –** Cloud Computing					
	U19EE1001	**Open Elective –** Electric Mobility					
	U19EE1003	**Open Elective –** Innovation, IPR and Entrepreneurship Development					
	U19EE1004	**Open Elective –** Renewable Energy Systems					
	U19EE1005	**Open Elective –** Electrification in Building Construction					
	U19FT1001	**Open Elective –** Fundamentals of Fashion Design					
	U19MC1004	**Open Elective –** Fundamentals of Robotics					
Practical							
7	U19BM703	Medical Image Processing Laboratory	0	0	2	1	30
8	U19BM704	AI in Medicine Laboratory	0	0	2	1	30
9	U19BM705	Hospital Training	0	0	2	1	30
					Total Credits	**21**	

Approved By

Chairman, Biomedical Engineering BoS **Member Secretary, Academic Council** **Chairperson, Academic Council & Principal**
Dr.S.Prabakar **Dr.R.Shivakumar** **Dr.S.R.R.Senthil Kumar**

Copy to:-
HOD/ Biomedical Engineering, Seventh Semester BE BME Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VIII Regulations 2019
Branch: Biomedical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Practical							
1	U19BM801	Project Work	0	0	24	12	360
					Total Credits	**12**	

Approved By

Chairman, Biomedical Engineering BoS
Dr.S.Prabakar

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

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HOD/ Biomedical Engineering, Eighth Semester BE BME Students and Staff, COE

SONA COLLEGE OF TECHNOLOGY, SALEM

(An Autonomous Institution)

Courses of Study for B.E./B.Tech. Semester I under Regulations 2019 (CBCS)

Branch: Biomedical Engineering

S.No	Course Code	Course Title	L	T	P	C	Category
Theory							
1	U19ENG101B	English For Engineers - I	1	0	2	2	HS
2	U19MAT102B	Linear Algebra and Multivariable Calculus	3	1	0	4	BS
3	U19PHY103E	Engineering Physics	4	0	0	4	BS
4	U19CHE104G	Engineering Chemistry	3	0	0	3	BS
5	U19PPR105	Problem Solving using Python Programming	3	0	0	3	ES
6	U19BEE106B	Basic Electrical and Electronics Engineering	3	0	0	3	PC
Practical							
7	U19PPL111	Python Programming Laboratory	0	0	2	1	ES
8	U19BEEL113B	Basic Electrical and Electronics Engineering Laboratory	0	0	2	1	PC
9	U19GE101	Basic Aptitude - I	0	0	2	0	EEC
Total Credits						**21**	
Optional Language Elective*							
10	U19OLE1101	French	0	0	2	1	HS
11	U19OLE1102	German					
12	U19OLE1103	Japanese					

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (Not accounted for CGPA calculation)

Approved By

Chairperson, Science and Humanities BoS	Chairperson, Biomedical Engineering BoS	Member Secretary, Academic Council	Chairperson, Academic Council & Principal
Dr.M.Renuga	**Dr.R.S.Sabeenian**	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

Copy to:-

HOD/ Biomedical Engineering, First Semester BE BME Students and Staff, COE

U19ENG101B - ENGLISH FOR ENGINEERS – I
COMMON TO CSE, ECE, EEE, MCT, BME

L	T	P	C
1	0	2	2

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

1. Use grammatical components effectively in both written and spoken communication
2. Develop speaking skills for self-introduction, delivering speeches and technical presentation.
3. Speak effectively in real time and business situations
4. Write email, formal letters and descriptions of graphics
5. Develop skills for writing reports and proposals, and for general purpose and technical writing.

UNIT I

- General Vocabulary, Parts of speech
- Self-introduction - personal information, name, home background, study details, area of interest, hobbies, strengths and weaknesses, projects and paper presentations, likes and dislikes in food, travel, clothes, special features of home town.
- Instructions, Email - fixing an appointment, cancelling appointments, conference details, hotel accommodation, order for equipment, training programme details, paper submission for seminars and conferences
- Paragraph writing – Describing – defining – providing examples or evidences

UNIT II

- Tenses, active and passive voice
- Welcome address, vote of thanks, special address on specific topic.
- Checklists, letter writing - business communication, quotations, placing orders, complaints, replies to queries from business customers, inviting dignitaries, accepting and declining invitations

UNIT III

- Prefixes and Suffixes
- Mini presentation in small groups of two or three on office arrangements, facilities, office functions, sales, purchases, training recruitment, advertising,

applying for financial assistance, applying for a job, team work, discussion, presentation.

- Job application letter and resume, recommendations,

UNIT IV

- Modal verbs and probability, concord
- Situational Role Play - between examiner and candidate, teacher and student, customer and sales manager, hotel manager and organiser, team leader and team member, bank manager and candidate, interviewer and applicant, car driver and client, industrialist and candidate, receptionist and appointment seeker, new employee and manager, employee and employee, p.a. and manager, schedule for training
- Note making, Proposal

UNIT V

- If conditionals
- Situational Role Play - Asking for directions, seeking help with office equipment, clarifying an error in the bill, job details, buying a product, selling a product, designing a website, cancelling and fixing appointments, hotel accommodation, training facilities, dress code, conference facilities.
- Memo, technical report writing - feasibility reports, accident report, survey report

TOTAL: 45 hours

Speaking test will be conducted for 20 marks externally and evaluated along with English for Engineers – I in the End Semester Valuation.

TEXT BOOK

- Technical English I & II, Dr. M. Renuga et al. Sonaversity, 2016

EXTENSIVE READING

- The Story of Amazon.com- Sara Gilbert, published by Jaico
- The Story of Google – Sara Gilbert, published by Jaico

REFERENCE

- Norman Whitby, Business Benchmark – Pre-Intermediate to Intermediate, Students Book, Cambridge University Press, 2006.
- A Course in Communication Skills, P. Kiranmai Dutt, Geetha Rajeevan, C. L. N. Prakash, published by Cambridge University Press India Pvt. Ltd.

U19MAT102B - LINEAR ALGEBRA AND MULTIVARIABLE CALCULUS
Common to ECE and BME

L	T	P	C
3	1	0	4

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

1. apply the concepts of vector spaces and linear transformations in real world applications
2. apply the concepts of eigen values and eigen vectors of a real matrix and their properties in diagonalization and the reduction of a real symmetric matrix from quadratic form to canonical form
3. find the Taylor's series expansion, Jacobians and the maxima and minima of functions of two variables
4. apply appropriate techniques of multiple integrals to find the area and volume
5. apply the concepts of vector differentiation and integration to determine the line, surface and volume integrals.

UNIT I - VECTOR SPACES 12

Vector Space – Linear independence and dependence of vectors – Basis – Dimension – Linear transformations (maps) – Matrix associated with a linear map – Range and kernel of a linear map – Rank-nullity theorem (without proof).

UNIT II - EIGEN VALUES AND EIGEN VECTORS 12

Eigen values and eigen vectors of real matrices – Properties of eigen values and eigen vectors – Cayley-Hamilton theorem – Diagonalization of real symmetric matrices – Reduction of quadratic form to canonical form.

UNIT III - FUNCTIONS OF SEVERAL VARIABLES 12

Functions of several variables – Partial differentiation – Total derivative – Jacobians – Taylor's theorem for function of two variables – Maxima and minima of function of two variables without constraints – Constrained maxima and minima by Lagrange's method of undetermined multipliers.

UNIT IV - MULTIPLE INTEGRALS 12

Double integrals – Change of order of integration – Change of variables from Cartesian to polar coordinates – Area as double integrals in Cartesian coordinates – Triple integrals – Volume as triple integrals in Cartesian coordinates.

UNIT V - VECTOR CALCULUS **12**

Vector differentiation: Scalar and vector valued functions – Gradient, directional derivative, divergence and curl – Scalar potential.

Vector integration: Line, surface and volume integrals – Statement of Green's, Stoke's and Gauss divergence theorems – Simple applications involving squares, rectangles, cubes and rectangular parallelopiped.

Theory: 45 Hours; Tutorial: 15 hours

TOTAL: 60 hours

TEXT BOOKS

1. T. Veerarajan, "Linear Algebra and Partial Differential Equations", McGraw Hill Publishers, 1st Edition, 2018.
2. T. Veerarajan, "Engineering Mathematics for Semesters I & II", McGraw Hill Publishers, 1st Edition, 2019.

REFERENCE BOOKS

1. S. Lipschutz and M. L. Lipson, "Linear Algebra", McGraw Hill Publishers, 6th Edition, 2018.
2. E. Kreyszig, "Advanced Engineering Mathematics", Wiley Publishers, 10th Edition, Reprint, 2017.
3. C. Prasad and R. Garg, "Advanced Engineering Mathematics", Khanna Publishers, 1st Edition, 2018.
4. B. V. Ramana, "Higher Engineering Mathematics", McGraw Hill Publishers, 29th Reprint, 2017.
5. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2018.

U19PHY103E - ENGINEERING PHYSICS
(For Biomedical Engineering)

L	T	P	C
4	0	0	4

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

1. Discuss the dual nature of matter and radiation and the application of wave nature of particles.
2. Describe the basic components of lasers.
3. Analyse the relation between arrangement of atoms and material properties.
4. Explain the ultrasonic inspection technique in the field of medicine.
5. Elucidate the applications of X rays and radioactivity in the field of medicine.

UNIT I - QUANTUM PHYSICS 12

Origin of quantum mechanics – Limitations of classical theory - Dual nature of matter and radiation

Particle nature of radiation - Compton effect - Explanation based on quantum theory - Expression for Compton shift (no derivation).

Wave nature of matter - de Broglie waves - Schrödinger's time independent and time dependent wave equations - Physical significance of wave function - Energy and wave function of an electron trapped in one dimensional box.

Application of wave nature of particles - Electron microscope - Comparison of optical and electron microscope –Transmission electron microscope - Scanning electron microscope - Limitations of electron microscope.

UNIT II - LASERS 12

Basic terms - Energy level - normal population - induced absorption (pumping) - population inversion - meta stable state - spontaneous emission - stimulated emission.

Basic components of a laser - Active medium - pumping technique - optical resonator **Einstein's theory** - Stimulated absorption - spontaneous emission and stimulated emission.

Types of lasers - Solid lasers (Nd:YAG) - Gas lasers (CO_2 laser) - Semiconductor laser (homojunction and hetero junction laser)

Applications - Holography - Construction and reconstruction of hologram - Applications of lasers in science and Engineering.

UNIT III - CRYSTAL PHYSICS **12**

Importance of crystals - Types of crystals - Basic definitions in crystallography (Lattice – space lattice - unit cell - lattice parameters – basis - crystallographic formula) - Seven crystal systems and fourteen Bravais lattices – Lattice planes and Miller indices – Interplanar distance - d spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - Coordination number and Atomic Packing factor for SC, BCC, FCC and HCP Structures - Polymorphism and allotropy.

Crystal imperfections - Point, line and surface defects – Burger vector.

Crystal Structure – Graphite Structure and Diamond Structure.

UNIT IV - ULTRASONICS **12**

Introduction – Ultrasonic waves - Properties of ultrasonic waves.

Production of ultrasonic waves – Magneto striction method – Magnetostriction oscillator - Piezo electric method – Piezo electric oscillator.

Ultrasonic imaging systems – Block diagram of ultrasonic imaging system – A scan, B scan and T-M mode display - Ultrasound pictures of human body – Ultrasonic technique to measure blood flow and heart beat – Physiological effects of ultrasound therapy – Phonocardiography.

UNIT V - MEDICAL PHYSICS **12**

X – rays - Electromagnetic spectrum - Introduction to x- rays – Production of x- ray images – Producing live x- ray images – Radiation given to patients – Nuclear medicine – Sources of radioactivity – Radioisotopes for nuclear medicine – Statistical aspects of radioactivity decay in radioisotopes – Nuclear imaging techniques – Basic instrumentation for nuclear imaging – Gamma ray camera – Positron emission tomography.

TOTAL: 60 hours

TEXT BOOK

- M.N.Avadhanulu, 'Engineering Physics' S.Chand & Company Ltd, New Delhi (2015)
- B. K. Pandey and S. Chaturvedi, Engineering Physics , Cengage Learning India Pvt. Ltd., Delhi, 2019

REFERENCES

- Engineering Physics, Sonaversity, Sona College of Technology, Salem (Revised Edition 2019).
- Rajendran, V, and Marikani A, 'Materials science' TMH Publications, (2004) New Delhi.
- Palanisamy P.K, 'Materials science', SciTech Publications (India) Pvt. Ltd., Chennai, Second Edition (2007)
- Cameran. R, Medical Physics, John Wiley and Sons.
- D. K. Bhattacharya, Poonam Tandon "Engineering Physics" Oxford University Press 2017.
- M.Arumugam, "Applied Physics" Anuradha agencies, kumbakonam 2001

U19CHE104G - ENGINEERING CHEMISTRY
(For Mechatronics and Biomedical Engineering)

L	T	P	C
3	0	0	3

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

1. Analyze the impurities of water, their removal methods and explain the conditioning methods for industrial uses.
2. Outline the principles and applications of electrochemistry to engineering and technology.
3. Analyze the types of corrosion and describe the methods of corrosion control.
4. Discuss the principle and applications of surface chemistry and catalysis in engineering and technology.
5. Describe the basics of nano chemistry, synthesis, properties and applications of nano materials in engineering and technology.

UNIT I - WATER TECHNOLOGY 9

Introduction - Characteristics – hardness – estimation of hardness by EDTA method, alkalinity and its estimation - Boiler feed water – requirements – disadvantages of using hard water in boilers – internal conditioning (colloidal, phosphate, calgon and carbonate conditioning methods) – external conditioning – zeolite process, demineralization process, desalination of brackish water by reverse osmosis.

UNIT II - ELECTROCHEMISTRY 9

Electrode potential - Nernst Equation - derivation and problems based on single electrode potential calculation - reference electrodes - standard hydrogen electrode - calomel electrode – Ion selective electrode - glass electrode - measurement of pH – electrochemical series – significance – electrolytic and electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – potentiometric titrations (redox – Fe^{2+} vs dichromate) – conductometric titrations (acid-base – HCl vs NaOH).

UNIT III - CORROSION AND CORROSION CONTROL 9

Chemical corrosion - Pilling-Bedworth rule – electrochemical corrosion – mechanism - galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – preliminary treatment - Paints constituents and their functions – surface conversion coatings – Galvanizing and Tinning.

UNIT IV - SURFACE CHEMISTRY AND CATALYSIS **9**

Adsorption-types-physical and chemical adsorption – adsorption of gases on solids-adsorption isotherms-Freundlich and Langmuir isotherms-adsorption of solutes from solution – applications of adsorption-role of adsorption in catalytic reactions – basic principles in adsorption chromatography – adsorption in pollution abatement (granular activated carbon and powdered activated carbon) – catalysis-types - characteristics of catalysts - autocatalysis - definition and examples.

UNIT V - NANOCHEMISTRY **9**

Basics - distinction between molecules, nanoparticles and bulk materials – size-dependent properties – nanoparticles: nano cluster, nano rod, nanotube (CNT) and nanowire – Synthesis: precipitation – thermolysis – hydrothermal – solvothermal – electrodeposition - chemical vapour deposition - sol-gel technique – properties and applications of nano materials.

TOTAL: 45 hours

TEXT BOOKS

- P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi, 2010 (15^{th} Edition).
- T. Maruthavanan *et al.*, "Engineering Chemistry", Sonaversity, Sona College of Technology, Salem, Revised Edition 2018.

REFERENCE BOOKS

- H.K. Chopra, A. Parmer, "Chemistry for Engineers", Narosa Publishing House, New Delhi, 110 002, 2016.
- Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd., Chennai, 2009.
- B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 2008.
- Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

U19PPR105 - PROBLEM SOLVING USING PYTHON PROGRAMMING
(Common to BME, CSE, ECE, EEE, IT and MCT)

L	T	P	C
3	0	0	3

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

1. Develop algorithmic solutions to simple computational problems
2. Write simple Python programs
3. Write programs with the various control statements and handling strings in Python
4. Develop Python programs using functions and files
5. Analyze a problem and use appropriate data structures to solve it.

UNIT I - ALGORITHMIC PROBLEM SOLVING 9

Need for computer languages, Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

UNIT II - BASICS OF PYTHON PROGRAMMING 9

Introduction-Python Interpreter-Interactive and script mode -Values and types, variables, operators, expressions, statements, precedence of operators, Multiple assignments, comments, input function, print function, Formatting numbers and strings, implicit/explicit type conversion.

UNIT III - CONTROL STATEMENTS AND STRINGS 9

Conditional (if), alternative (if-else), chained conditional (if-elif-else). Iteration-while, for, infinite loop, break, continue, pass, else. Strings-String slices, immutability, string methods and operations.

UNIT IV - FUNCTIONS AND FILES 9

Functions - Introduction, inbuilt functions, user defined functions, passing parameters - positional arguments, default arguments, keyword arguments, return values, local scope, global scope and recursion. Files -Text files, reading and writing files.

UNIT V - DATA STRUCTURES: LISTS, SETS, TUPLES, DICTIONARIES 9

Lists-creating lists, list operations, list methods, mutability list functions, searching and sorting, Sets-creating sets, set operations. Tuples-Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value- Dictionaries-operations and methods, Nested Dictionaries.

TOTAL: 45 Hours

TEXT BOOKS

- Reema Thareja, "Problem Solving and Programming with Python", Oxford University Press, 2018.
- Allen B. Downey, "Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016 (http://greenteapress.com/wp/think- python/)

REFERENCES

- Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python" , Mc-Graw Hill Education, 2018.
- Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
- Timothy A. Budd," Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
- Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
- Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition, 2013.

U19BEE106B - BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to ECE and BME)

L	T	P	C
3	0	0	3

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

1. Realize the basic concepts of electrical quantities and components.
2. Understand the working of electrical machines.
3. Analyze the construction and characteristics of semiconductor devices.
4. Examine the BJT formation and its characteristics.
5. Enhance the knowledge on Special Devices

UNIT I – BASICS OF ELECTRICAL PERCEPTIONS 9

Definition of Electric Voltage, Current, Power, Power factor & Energy, Ohms law, Kirchhoff's Laws and its applications-Frequency-AC and DC Signals-types of sources-single phase-three phase- Resistance- Inductance-capacitance-Series and parallel combinations.

UNIT II - ELECTRICAL MACHINES 9

DC Generator: construction of DC Machine – working principle of DC Generator – EMF equation – Types of DC Generator. DC Motor: Working principle of DC Motor – Types of DC Motor.Transformer: Working principle of Transformer – EMF equation – Transformation ratio.

UNIT III - PN JUNCTION DIODE 9

Energy band theory-Conductor-Insulator-Semiconductor-Doping-formation of N-type and P-type materials-PN junction Diode – V-I Characteristics- Zener diode- VI characteristics of Zener-Avalanche break down. - Zener effect-Zener diode as voltage regulator.

UNIT IV – BJT 9

Bipolar Junction Transistor – construction-Working principle-Regions of transistor-CB, CE, CC Configurations and Characteristics –Transistor as a switch – Applications of transistor.

UNIT V - SPECIAL DEVICES 9

Construction and Characteristics of - Tunnel Diode-Varactor diode-Photo diode- Photo transistor- SCR-TRIAC-DIAC

Total: 45 hours

TEXT BOOKS

1. D P Kothari and I J Nagrath, “Basic Electrical and Electronics Engineering”, Mc Graw Hills (India) Private Limited, 2014.
2.

REFERENCE BOOKS

1. D. Devaraj, S. K. Bhattacharya, “Basic Electrical and Electronics Engineering”, Pearson India, 2016
2. AbhiChakrabarti, Sudipta Debnath, Soumitra Kumar Mandal, “Basic Electrical & Electronics Book “,Mc Graw Hill Education; Fifth Edition, 2016.
3. Ravish Singh, “ Basic Electrical & Electronics Engineering”, McGraw Hill Education, 2014

U19PPL111 - PYTHON PROGRAMMING LABORATORY

(Common to BME, CSE, ECE, EEE, IT and MCT)

L	T	P	C
0	0	2	1

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

1. Implement the algorithms using basic control structures in Python
2. Develop Python programs to use functions, strings and data structures to solve different types of problems
3. Implement persistent storing information through file operations

LIST OF EXPERIMENTS

1. Draw flowchart using any open source software.
2. Implement programs with simple language features.
3. Implement various branching statements in python.
4. Implement various looping statements in python.
5. Develop python programs to perform various string operations like concatenation, slicing, indexing.
6. Implement user defined functions using python.
7. Implement recursion using python.
8. Develop python programs to perform operations on list and tuples
9. Implement dictionary and set in python
10. Implement python program to perform file operations.

TOTAL: 30 hours

U19BEEL113B - BASIC ELECTRICAL AND ELECTRONICS LABORATORY

(Common to ECE and BME)

L	T	P	C
0	0	2	1

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

1. Identify the active, passive components and measuring instruments.
2. Analysis the electrical quantity at the any point of circuit.
3. Design the circuit based on PN junction diode and BJT.

LIST OF EXPERIMENTS

1. Identification of active and passive electronic components.
2. Study on CRO, Ammeter, Voltmeter, Multi-meter, Function Generator, and DSO.
3. Measurement of DC and AC power supply using measuring instruments.
4. Realization and design problems on ohms law.
5. Realization and design problems on KCL, KVL.
6. Mesh and node analysis of circuit.
7. VI characteristics analysis of PN junction diode.
8. Biasing and characteristics analysis of BJT.
9. CB, CC and CE analysis of BJT.
10. Realization of transistor as switch.

TOTAL: 30 hours

U19GE101 - BASIC APTITUDE – I
(Common to All Departments)

L	T	P	C
0	0	2	0

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

1. Solve fundamental problems in specific areas of quantitative aptitude
2. Solve basic problems in stated areas of logical reasoning
3. Demonstrate rudimentary verbal aptitude skills in English with regard to specific topics

1. Quantitative Aptitude and Logical Reasoning

Solving simple problems with reference to the following topics:

a. Numbers – HCF & LCM
b. Decimal fractions
c. Square roots & cube roots
d. Surds & Indices
e. Logarithms
f. Percentage
g. Averages
h. Coding and Decoding & Visual language

2. Verbal Aptitude

Demonstrating plain English language skills with reference to the following topics:

a. Synonyms
b. Antonyms
c. Verbal analogy
d. Editing passages
e. Sentence filler words

TOTAL: 30 hours

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester II under Regulations 2019 (CBCS)
Branch: Biomedical Engineering

S.No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Category
		Theory					
1	U19ENG201B	English For Engineers - II	2	0	0	2	HS
2	U19MAT202C	Transforms and Differential Equations	3	1	0	4	BS
3	U19CHE204D	Biochemistry	2	0	0	2	BS
4	U19EGR206A	Engineering Graphics	2	0	2	3	ES
5	U19BME201	Biology For Engineers	3	0	0	3	PC
6	U19EC202	Circuit Theory	3	0	0	3	PC
		Practical					
7	U19WPL212	Workshop Practice	0	0	2	1	ES
8	U19PCL208B	Physics and Chemistry Laboratory	0	0	4	2	BS
9	U19GE201	Basic Aptitude - II	0	0	2	0	EEC
					Total Credits	**20**	
		Optional Language Elective*					
11	U19OLE1201	French	0	0	2	1	HS
12	U19OLE1202	German					
13	U19OLE1203	Japanese					

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (Not accounted for CGPA calculation)

Approved By

Chairperson, Science and Humanities BoS	Chairperson, Biomedical Engineering BoS	Member Secretary, Academic Council	Chairperson, Academic Council & Principal
Dr.M.Renuga	Dr.R.S.Sabeenian	Dr.R.Shivakumar	Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/ Biomedical Engineering, Second Semester BE BME Students and Staff, COE

13.12.2019 **B.E/B.Tech Regulations-2019**

U19ENG201B - ENGLISH FOR ENGINEERS – II

L	T	P	C
2	0	0	2

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

1. frame sentences correctly, both in written and spoken forms of language with accuracy and fluency.
2. develop and demonstrate listening skills for academic and professional purposes.
3. draw conclusions on explicit and implicit oral information.
4. develop effective reading skills and reinforce language skills required for using grammar and building vocabulary.
5. read for gathering and understanding information, following directions and giving responses.

UNIT - I

- Cause and effect expressions, adjectives, comparative adjectives
- Listening to conversations, welcome speeches, lectures and description of equipment
- Listening to different kinds of interviews (face-to-face, radio, TV and telephone interviews)
- Understanding notices, messages, timetables, advertisements, graphs, etc.
- Reading passages for specific information transfer

UNIT - II

- Prepositions and dependent prepositions
- Understanding short conversations or monologues,
- Taking down phone messages, orders, notes etc
- Listening for gist, identifying topic, context or function
- Reading documents for business and general contexts and interpreting graphical representations

UNIT - III

- Collocations
- Listening comprehension, entering information in tabular form
- Error correction, editing mistakes in grammar, vocabulary, spelling, etc.
- Reading passage with multiple choice questions, reading for gist and reading for specific information, skimming for comprehending the general idea and meaning and contents of the whole text

UNIT - IV

- Articles, adverbs
- Intensive listening exercises and completing the steps of a process.
- Listening exercises to categorise data in tables.
- Short reading passage: gap-filling exercise related to grammar, testing the understanding of prepositions, articles, auxiliary verbs, modal verbs, pronouns, relative pronouns and adverbs, short reading passage with multiple choice questions.

UNIT - V

- Pronouns
- Listening to extended speech for detail and inference
- Listening and developing hints
- Gap-filling exercise testing the knowledge of vocabulary, collocations, dependent prepositions
- Short reading passages for sentence matching exercises, picking out specific information in a short text

TOTAL: 30 Hours

The listening test will be conducted for 20 marks and reading for 20 marks internally and evaluated along with English for Engineers II in the End Semester Valuation.

TEXT BOOK

1. Technical English I & II, Dr. M. Renuga et al. Sonaversity, 2016

EXTENSIVE READING

1. Who Moved my Cheese? – Spencer Johnson-G. P. Putnam's Sons
2. Discover the Diamond in You – Arindham Chaudhari – Vikas Publishing House Pvt. Ltd

REFERENCES

1. Norman Whitby, Business Benchmark – Pre-Intermediate to Intermediate, Students Book, Cambridge University Press, 2006.
2. A Course in Communication Skills, P. Kiranmai Dutt, Geetha Rajeevan, C. L. N. Prakash, published by Cambridge University Press India Pvt. Ltd.

U19MAT202C - TRANSFORMS AND DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

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

1. apply the classical method to solve linear ordinary differential equations with constant coefficients.
2. apply the Laplace transforms technique and its properties to solve an ordinary differential equation.
3. express a periodic signal as an infinite sum of sine and cosine wave components using Fourier series.
4. apply the Fourier transform techniques to convert the signal in terms of the frequencies of the waves.
5. find the general and singular solutions of linear and nonlinear partial differential equations.

UNIT I - ORDINARY DIFFERENTIAL EQUATIONS **12**

Linear higher order ordinary differential equations with constant coefficients – Cauchy's and Legendre's homogeneous linear ordinary differential equations – Method of variation of parameters.

UNIT II - LAPLACE TRANSFORMS **12**

Laplace transform: Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse function – Initial and final value theorems – Transform of periodic functions.

Inverse Laplace transform: Standard results – Statement of convolution theorem and its applications – Solution of linear second order ordinary differential equations with constant coefficients using Laplace transform.

UNIT III - FOURIER SERIES **12**

General Fourier series – Dirichlet's conditions – Change of intervals – Odd and even functions – Half range sine and cosine series – Root mean square – Parseval's identity – Harmonic analysis.

UNIT IV - FOURIER TRANSFORMS **12**

Fourier transform pair – Properties – Fourier sine and cosine transforms pair – Properties –Transforms of simple functions – Parseval's identity.

UNIT V - PARTIAL DIFFERENTIAL EQUATIONS **12**

Formation of partial differential equations – Lagrange's partial differential equation – Clairaut's form of partial differential equations – Higher order linear partial differential equation with constant coefficients.

TOTAL: 60 Hours

TEXT BOOKS

1. T. Veerarajan, "Transforms and Partial Differential Equations", McGraw Hill Publishers, 3rd Edition, 2016.
2. T. Veerarajan, "Engineering Mathematics for Semesters I & II", McGraw Hill Publishers, 1st Edition, 2019.

REFERENCES

1. E. Kreyszig, "Advanced Engineering Mathematics", Wiley Publishers, 10th Edition, Reprint, 2017.
2. C. Prasad and R. Garg, "Advanced Engineering Mathematics", Khanna Publishers, 1st Edition, 2018.
3. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2018.
4. B. V. Ramana, "Higher Engineering Mathematics", McGraw Hill Publishers, 29th Reprint, 2017.

U19CHE204D - BIOCHEMISTRY

L	T	P	C
2	0	0	2

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

1. outline the fundamentals of biochemistry.
2. analyze the classification of carbohydrates and their properties and applications.
3. discuss the classification of lipids and their biological importance.
4. demonstrate the structure and properties of nucleic acid and protein.
5. describe the classification and the biological clinical applications of enzymes.

UNIT I -INTRODUCTION TO BIOCHEMISTRY **6**

Introduction to Biochemistry - water as a biological solvent - weak acid and bases, pH, buffers, Handerson Hasselbalch equation, physiological buffers in living systems, Energy in living organism - Properties of water and their applications in biological systems - Introduction to Biomolecules, Biological membrane, Clinical application of Electrolytes and radioisotopes.

UNIT II - CARBOHYDRATES **6**

Classification of carbohydrates - mono, di, oligo and polysaccharides - Structure, physical and chemical properties of carbohydrates - Isomerism, racemisation and mutarotation - Digestion and absorption of carbohydrates - Metabolic pathways and bioenergetics – Glycolysis, glycogenesis, glycogenolysis and its hormonal regulation - TCA cycle and electron transport chain - Oxidative phosphorylation - Biochemical aspect of Diabetes mellitus and Glycogen storage Disease.

UNIT III - LIPIDS **6**

Classification of lipids- simple, compound and derived lipids - Nomenclature of fatty acid, physical and chemical properties of fat - Metabolic pathways: synthesis and degradation of fatty acid (beta oxidation), hormonal regulation of fatty acid metabolism, ketogenesis, Biosynthesis of Cholesterol - Disorders of lipid metabolism.

UNIT IV - NUCLEIC ACID and PROTEIN **6**

Structure of purines and pyrimidines, nucleoside, nucleotide, DNA act as a genetic material, chargoffs rule - Watson and crick model of DNA - Structure of RNA and its

type - Metabolism and Disorder of purines and pyrimidines nucleotide - Classification, structure and properties of proteins, structural organization of proteins - classification and properties of amino acids - Separation of protein, Inborn Metabolic error of amino acid metabolism.

UNITV - ENZYME AND ITS CLINICAL APPLICATION 6

Classification of enzymes, apoenzyme, coenzyme, holoenzyme and cofactors - Kinetics of enzymes - Michaelis-Menten equation - Factors affecting enzymatic activity: temperature, pH, substrate concentration and enzyme concentration - Inhibitors of enzyme action: Competitive, non - competitive, irreversible - Enzyme: Mode of action, allosteric and covalent regulation - Clinical enzymology - Measurement of enzyme activity and interpretation of units.

TOTAL: 30 Hours

TEXT BOOKS

1. Rafi MD ―Text book of biochemistry for Medical Students, Second Edition, University Press, 2014.
2. David W. Martin, Peter A. Mayes, Victor W. Rodwell, - Harper's Review of Biochemistry, LANGE Medical Publications, 1981.

REFERENCES

1. Keith Wilson and John Walker, ― Practical Biochemistry - Principles & Techniques, Oxford University Press, 2009.
2. Pamela. C. Champe and Richard. A. Harvey, ― Lippincott Biochemistry Lippincott's Illustrated Reviews, Raven publishers, 1994.

U19EGR206A – ENGINEERING GRAPHICS

L	T	P	C
2	0	2	3

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

1. predict the construction of various curves in civil elevation, plan and machine components.
2. analyze the principles of projection of various planes by different angle to project points, lines and planes.
3. draw the principles of projection of simple solid by the axis is inclined to one reference plane by change of position method.
4. understand the interior details of complex components, machineries by sectioning the solid body. study the development of surfaces for prisms and pyramids.
5. draw the projection of three dimensional objects representation of machine structure and explain standards of orthographic views by different methods.

CONCEPTS AND CONVENTIONS (Not for Examination) 03

Importance of graphics in engineering applications, Use of drafting instrument, BIS conventions and specifications - Size, layout and folding of drawing sheets, Lettering and dimensioning.

COMPUTER AIDED DRAFTING (Not for Examination) 03

Importance 2d Drafting, sketching, modifying, transforming and dimensioning.

UNIT I – PLANE CURVES (Manual drafting) 06

Curves used in engineering practices Conics – Construction of ellipse – Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT II – PROJECTION OF POINTS, LINES AND PLANE SURFACES (CAD software) 12

Projection of points – Projection of straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to one reference planes.

UNIT III – PROJECTION OF SOLIDS (CAD software) 12

Creation of 3D CAD models of pyramids, prisms and solids of revolutions-Sectional views **- (Not for Examination)**

Projection of simple solids like prisms – pyramids – cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV – SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES (CAD software) 12

Sectioning of simple solids like prisms – pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other, (Obtaining true shape of section is not required). Development of lateral surfaces of simple and truncated solids – Prisms – pyramids –cylinders and cones.

UNIT V – Conversion of Isometric Views to Orthographic Views (Manual drafting) 12

Representation of three dimensional objects – General Principles of Orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout of views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

TOTAL: 60 Hours

TEXT BOOKS

1. P. Suresh et al., "Engineering Graphics and Drawing", Sonaversity, Sona College of Technology, Salem, Revised edition, 2012.
2. K.V. Natarajan Engineering Graphics by, Chennai, 17th edition 2003.

REFERENCES

1. Dhananjay A. JoIhe, Engineering Drawing with an introduction to AutoCAD, Tata McGraw Hill Publishing Company Limited, 2008.
2. Basant Agarwal and Agarwal C.M., Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. K. R. Gopalakrishnana, Engineering Drawing (Vol. I & II), Subhas Publications, 1998.
4. Bertoline & Wiebe fundamentals of graphics communication III edition McGrawhill 2002.

U19BME201 – BIOLOGY FOR ENGINEERS

L	T	P	C
3	0	0	3

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

1. analyze the cell growth and structure.
2. classify various nomenclatures of Enzymes.
3. compare different cycles of Metabolism.
4. analyze the human activity with the Genetic nature.
5. design the various industrial applications.

UNIT I - CELL: THE BASIC UNIT OF LIFE **09**

Cell- Basic Properties of Cells- Prokaryotic Cells- Eukaryotic Cells- Cell Cycle and Cell Division- M Phase- Meiosis- Cell Differentiation.

UNIT II - MOLECULAR ANALYSIS AND ENZYMES **09**

Carbohydrates- Amino acids and Proteins- Nucleic Acids- Lipids- Nature of Bonding and Qualitative Tests- Classification and Nomenclature of Enzymes- Co-Factors- Importance of Enzymes.

UNIT III - METABOLISM **09**

Metabolism and Its Concepts- Metabolic Basis for Living - Anabolic and Catabolic Pathways - Concept of Non- Equilibrium and Steady State- Photosynthesis- Photorespiration (C2 Cycle) - C4 Pathways- CAM Cycle (In Succulent Plant) - Factors Affecting Photosynthesis-Respiration- Glycolysis- Fermentation- Aerobic Respiration.

UNIT IV - GENETICS **09**

Mendel's Laws of Inheritance- Gene Interaction- Multiple Alleles- Chromosomal Theory of Inheritance- Linkage- Recombination (Crossing Over) - Chromosome Mapping- Genetic Disorders.

UNIT V - MICROBIOLOGY AND ITS INDUSTRIAL APPLICATIONS **09**

Microorganisms- Growth Kinetics- Culture Media- Sterilization- Microscopy- applications of Microbiology- Immunology and Immunity- Cancer Biology- Stem Cell.

TOTAL: 45 Hours

TEXT BOOKS

1. Wiley,"*Biology for Engineers*", John Wiley & Sons,I Edition,2018.
2. S. ThyagaRajan, N. Selvamurugan, M. P. Rajesh, R. A. Nazeer, Richard W. Thilagaraj, S. Barathi, and M. K. Jaganathan, "*Biology for Engineers*," Tata McGraw-Hill, New Delhi, 2012.

REFERENCES

1. Robert Weaver, "*Molecular Biology*," MCGraw-Hill, 5th Edition, 2012.
2. Kenneth Murphy, "*Janeway's Immunobiology*," Garland Science; 8th edition, 2011.

U19EC202 – CIRCUIT THEORY

L	T	P	C
3	0	0	3

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

1. apply basic laws to calculate the voltage, current and power for ac and dc electric circuit.
2. identify the network topologies of circuits.
3. analyze the dc circuits using network theorems.
4. analyze the resonant circuits and coupled circuits.
5. analyze the two port networks for various parameters.

UNIT I - BASICS OF CIRCUIT ANALYSIS **9**

Review on mesh and nodal analysis – Star Delta Transformation Techniques – Phase Relationship For R, L And C – Impedance, Admittance for R, L And C Elements – Concept of Duality – Dual Network – Graphs of A Network – Trees, Twig, Link and Branches – Incidence Matrix – Tie-Set Matrix Formation and Cut-Set Matrix Formation of a Graph.

UNIT II - CIRCUIT THEOREMS **9**

DC analysis : Superposition Theorem – Thevenin's Theorem – Norton's Theorem – Reciprocity Theorem – Maximum Power Transfer Theorem – Tellegen's Theorem – Millman's Theorem.

UNIT III - SERIES RESONANT CIRCUITS AND COUPLED CIRCUITS **9**

Resonances: Natural Frequency and Damping Ratio – Series Resonance – Impedance and Phase Angle of a Series Resonance Circuit – Voltages and Currents in a Series Circuit – Quality Factor.Coupled Circuits: Self-Inductance – Mutual Inductance – Dot Conversion – Coupling Coefficient – Ideal Transformer.

UNIT IV - TRANSIENTS **9**

Steady State and Transient Response – DC Response of an R-L Circuit – DC Response of an R-C Circuit – DC Response of an R-L-C Circuit – Sinusoidal Response of R-L Circuit – Sinusoidal Response of R-C Circuit – Sinusoidal Response of R-L-C Circuit.

UNIT V - TWO PORT NETWORKS **9**

Two port Network – Open Circuit Impedance (Z) Parameters – Short Circuit Admittance (Y) Parameters –Transmission (ABCD) Parameters – Hybrid (h) Parameters –Inter Relationship of Different Parameters.

TOTAL: 45 Hours

TEXT BOOK

1. A Sudhakar, Shyammohan S Palli, "*Circuits and Networks Analysis and Synthesis*", Mc-Graw Hill, 2019.

REFERENCES

1. Ravish R Singh," Networks Analysis and Synthesis", Mc-Graw Hill Education, 2019.
2. M.L. Soni and J.C. Gupta, A Course in "*Electrical Circuits Analysis"*, Dhanpat Rai & Co.(P), 2015.
3. G.K. Mithal and Ravi Mittal, *"Network Analysis"*, Khanna Khanna Pub, 2017.
4. Umesh Sinha, L.P.Singh,"Circuit and Field Theory", Tech India Publication Series, 2016.
5. Abhijit Chakrabarti, "Circuit Theory Analysis and Synthesis", Dhanpat Rai & CO. (Pvt).Ltd, Educational and technical publishers.

U19WPL212 – WORKSHOP PRACTICE

L	T	P	C
0	0	2	1

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

- **CO1** familiarize with the basic of tools and equipment's used in fitting, carpentry, welding and sheet metal.
- **CO2** fabricate the different simple products in above trades.
- **CO3** produce different joining of metals.

List of Experiments

SECTION 1: FITTING

Tools and Equipment's- Practice in filling.
Making of Vee joint and square (T-fitting) joint.

SECTION 2: SHEET METAL

Tools and Equipment's- Practice
Making of Dust Pan and Funnel.

SECTION 3: WELDING

Tools and Equipment's – Practice
Arc welding of Butt joint and Lap Joint.

SECTION 4: CARPENTRY

Tools and Equipment's- Planning Practice
Making of Half Lap joint and Dovetail Joint.

TOTAL: 30 Hours

U19PCL208B – PHYSICS AND CHEMISTRY LABORATORY

L	T	P	C
0	0	4	2

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

1. apply the principles of optics, electricity and elasticity to determine the Engineering properties of materials.
2. analyse the given water sample to determine the amount of hardness and different types of alkalinity and determine their amount in the given water sample.
3. determine the resistivity of the given fuse wire used for house hold applications. Determine the molecular weight of various polymers, analyse the quality of brass by estimating copper and calculate the amount of chromium present in the given sample of water.

Physics Part - List of Experiments

1. Determination of the thickness of a thin wire by forming interference fringes using air wedge apparatus.
2. Determination of velocity of ultrasonic waves and compressibility of the given liquid using ultrasonic interferometer.
3. Determination of dispersive power of the prism for various pairs of colors in the mercury spectrum using a spectrometer.
4. Determination of wavelength of the laser source.
5. Determination of particle size of lycopodium powder using diode laser.
6. Determination of acceptance angle and numerical aperture of an optical fibre using diode laser.
7. Determination of the Young's modulus of the given material by non-uniform bending method.
8. Determination of rigidity modulus of the material of wire using torsion pendulum
9. Determination of specific resistance of a given wire using Carey Foster's bridge.
10. Determination of coefficient of viscosity of liquid by Poiseuille's method.

Chemistry Part - List of Experiments

1. Estimation of hardness of water sample by EDTA method.
2. Estimation of alkalinity of water sample by indicator method.
3. Estimation of copper in brass by EDTA method.
4. Estimation of HCl acid by pH metry.
5. Determination of iron content in water by spectrophotometric method.
6. Estimation of HCl by conductometry. (HCl vs NaOH)
7. Estimation of mixture of acids by conductometry. (HCl + CH_3COOH vs NaOH)
8. Estimation of ferrous ion by potentiometric titration.
9. Determination of molecular weight of a polymer by viscosity measurements.
10. Estimation of chromium in waste water.

TOTAL: 60 Hours

U19GE201 - BASIC APTITUDE - II

L	T	P	C
0	0	2	0

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

CO1 solve more elaborate problems than those in BA-I in specific areas of quantitative aptitude.

CO2 solve problems of greater intricacy than those in BA-I in stated areas of logical reasoning.

CO3 demonstrate higher than BA-I level verbal aptitude skills in English with regard to specific topics.

List of Experiments

1. QUANTITATIVE APTITUDE AND LOGICAL REASONING

Solving quantitative aptitude and logical reasoning problems with reference to the following topics:

a. Ratio and proportion
b. Partnership
c. Chain rule
d. Ages
e. Profit, loss and discount
f. Geometry
g. Area and volume
h. Data arrangement

2. VERBAL APTITUDE

Demonstrating verbal aptitude skills in English with reference to the following topics:

a. Jumbled sentences
b. Reconstructions of sentences (PQRS)
c. Sentence fillers two words
d. Idioms and phrases
e. Spotting errors
f. Writing captions for given pictures

TOTAL : 24 Hours

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester III under Regulations 2019
Branch: Biomedical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1.	U19MAT301B	Probability and Statistics	3	1	0	4
2.	U19BM301	Electronic Devices and Circuits	3	0	0	3
3.	U19EC301	Signals and Systems	3	1	0	4
4.	U19BM302	Anatomy and Human Physiology	3	0	0	3
5.	U19CS307	Programming in C	3	0	0	3
6.	U19GE303	**Mandatory Course :** Essence of Indian Traditional Knowledge	2	0	0	0
Practical						
7.	U19BM303	Electronic Devices and Circuits Laboratory	0	0	2	1
8.	U19BM304	Anatomy and Human Physiology Laboratory	0	0	2	1
9.	U19CS308	C Programming Laboratory	0	0	2	1
10.	U19GE301	Soft Skills and Aptitude – I	0	0	2	1
					Total Credits	**21**

Approved By

Chairman, Fashion Technology BoS **Member Secretary, Academic Council** **Chairperson, Academic Council & Principal**
Dr.R.S.Sabeenian **Dr.R.Shivakumar** **Dr.S.R.R.Senthil Kumar**

Copy to:-

HOD/ Biomedical Engineering, Third Semester BE BME Students and Staff, COE

U19MAT301B PROBABILITY AND STATISTICS

L	T	P	C
3	1	0	4

COURSE OUTCOMES

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

1. apply the concepts of measures of central tendency, dispersion, correlation to the given data and analyze the results.
2. apply the concepts of random variables and their properties to generate the moments.
3. fit the suitable distribution and its properties to the real world problems and interpret the results.
4. apply the concepts of joint probability distribution and its properties to find the covariance.
5. test the hypothesis of the population using sample information.

UNIT – I BASIC STATISTICS 12

Measures of central tendency (simple arithmetic mean, median, mode) – Quartiles – Measures of dispersion (range, inter-quartile range, quartile deviation, mean deviation, standard deviation, coefficient of variation) – Simple correlation – Curve fitting (straight line and parabola).

UNIT – II RANDOM VARIABLES 12

Discrete and continuous random variables – Probability mass function, probability density function, moments, moment generating function and their properties.

UNIT – III THEORETICAL DISTRIBUTIONS 12

Binomial, Poisson, geometric, uniform, exponential and normal distributions and their properties - Applications.

UNIT – IV TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions, marginal and conditional distributions – Covariance – Correlation – Central limit theorem.

UNIT – V TESTING OF SIGNIFICANCE 12

Sampling distributions - Testing of hypothesis for mean, standard deviation, variance, proportion and differences using normal and t distributions - χ^2- tests for independence of attributes and goodness of fit and F distribution.

Theory: **45 Hours** Tutorial: **15 Hours** Total**: 60 Hours**

TEXT BOOKS:

1. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons Publishers, 11th Edition, Reprint, 2019.
2. T. Veerarajan, "Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks", McGraw Hill Publishers, 4th Edition, 7th Reprint, 2018.

REFERENCE BOOKS:

1. R. A. Johnson and C. B. Gupta, "Miller and Freund's, Probability and Statistics for Engineers", Pearson Publishers, 9th Edition, 2018.
2. S. Ross, "A First Course in Probability", Pearson Publishers, 9th Edition, 2019.
3. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall Publishers, Reprint, 2003.
4. W. Feller, "An Introduction to Probability Theory and its Applications – Volume I", Wiley Publishers, 3rd Edition, 2008.
5. S. P. Gupta, "Statistical Methods", Sultan Chand and Sons Publishers, 15th Edition, 2012.

U19BM301 ELECTRONIC DEVICES AND CIRCUITS 3 0 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Bias the transistors for amplification purpose
2. Analysis the mid-frequency operation of BJT amplifier circuits
3. Calculate cut-off frequencies and bandwidth of BJT amplifier circuit
4. Analysis the Woking principle of FETs
5. Design different types power supplies.

UNIT I TRANSISTOR BIAS STABILITY 9

BJT – Need for biasing – Stability factor - Fixed bias circuit, Load line and quiescent point. Variation of quiescent point due to h FE variation within manufacturers tolerance - Stability factors - Different types of biasing circuits - Method of stabilizing the Q point - Advantage of Self bias (voltage divider bias) over other types of biasing- self bias as a constant current circuit

UNIT II MID-BAND ANALYSIS OF SMALL SIGNAL AMPLIFIERS 9

CE, CB and CC amplifiers - Method of drawing small-signal equivalent circuit - Miller's theorem - Comparison of CB, CE and CC amplifiers and their uses - Methods of increasing input impedance using Darlington connection and bootstrapping – Differential amplifier, Basic BJT differential pair – CMRR.

UNIT III FREQUENCY RESPONSE OF AMPLIFIERS 9

General shape of frequency response of amplifiers - Definition of cut-off frequencies and bandwidth - Low frequency analysis of amplifiers to obtain lower cut-off frequency Hybrid equivalent circuit of BJTs - High frequency analysis of BJT amplifiers to obtain upper cut-off frequency – Gain Bandwidth Product.

UNIT IV FIELD EFFECT TRANSISTORS 9

JFETs – Drain and Transfer characteristics - Current equations - Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage -Channel length modulation, Characteristics – Comparison of MOSFET with JFET.

UNIT V RECTIFIERS AND POWER SUPPLIES 9

Classification of power supplies, Rectifiers - Half-wave, full-wave and bridge rectifiers with resistive load. Analysis for V dc and ripple voltage with C, L, LC and CLC filters.

Lecture : 45 Tutorial : 00 Total hours : 45

TEXT BOOKS

1 Millman and Halkias, "*Integrated Electronics*", 2nd Edition, Tata Mc Graw Hill, 2010.

2 Anil K. Maini and Varsha Agrawal, "*Electronics Devices and Circuits"*, First Edition, Wiley Publications, 2009.

REFERENCE BOOKS

1 Y.N. Bapat, "*Electronic devices and circuits, Discrete and Integrated*", 3rd Edition, Tata Mc Graw Hill, 2011

U19EC301 SIGNALS AND SYSTEMS 3 1 0 4
(Common for ECE& BME)

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Classify the signals as continuous time and discrete time signals and classify systems based on their properties
2. Determine the response of LTI system using convolution sum for DT system and Convolution Integral for CT system
3. Apply Fourier series and Fourier Transform for periodic Signals
4. Analyze system using Laplace transform and realize the structure for CT system
5. Analyze system using Z transform and realize the structure for DT system

12

UNIT I : CLASSIFICATION OF SIGNALS AND SYSTEMS

Continuous-Time and Discrete-Time signals–The Unit Impulse Unit Step, Unit Ramp Signals and other Basic Signals – Operation of Signals -Time Shifting – Time Reversal – Amplitude Scaling – Time Scaling – Signal Addition – Multiplications –Classification of signals- Continuous-Time and Discrete-Time Systems– Basic System Properties - Systems With and Without Memory – Causality – Stability – Time Invariance – Linearity.

12

UNIT II: LINEAR TIME- INVARIANT SYSTEMS

Continuous-Time LTI Systems: The Convolution Integral - graphical and analytical approach – Properties of Linear Time-Invariant Systems – Solution of Differential Equations.

Discrete-Time LTI system: The Convolution sum-tabulation method-matrix multiplication method-graphical and analytical approach – Solution of Difference Equations.

12

UNIT III: ANALYSIS OF CT SIGNALS USING FOURIER SERIES & FOURIER TRANSFORM

Fourier Series Representation (Trigonometric and Exponential) of Continuous-Time Periodic Signals – Properties of Continuous-Time Fourier Series – Representation of Aperiodic Signals: The Continuous-Time Fourier Transform – The Fourier Transform for Periodic Signals – Properties of the Continuous-Time Fourier Transform.

12

UNIT IV: ANALYSIS OF SIGNALS AND SYSTEMS USING LAPLACE TRANSFORM

The Laplace Transform – The Region of Convergence for Laplace Transform– The Inverse Laplace Transform using Partial fraction– Properties of the Laplace Transform–System Function and Block Diagram Representations-Direct Form I and Direct Form II.

12

UNIT V: ANALYSIS OF SIGNALS AND SYSTEMS USING Z-TRANSFORM

The Z-Transform – The Region of Convergence for the Z-Transform –The Inverse Z-Transform using Partial fraction and Long division method– Properties of the Z-Transform – System Function and Block Diagram Representations-Direct Form I and Direct Form II.

Lecture: 45 Tutorial:15 Total hours : 60

TEXT BOOKS

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, "*Signals and Systems*", 2nd E, Prentice Hall India, 2010
2. A.Anand Kumar, "*Signals and Systems*", 3rd Edition, Prentice Hall India,2013

REFERENCE BOOKS

1. M .J. Roberts, "*Signals & Systems Analysis using Transform Methods & MATLAB*", Tata McGraw Hill, 2007
2. Haykin, Simon, and Barry Van Veen. "*Signals and systems",* John Wiley & Sons, 2007.
3. A. NagoorKani, "*Signals & Systems*", Tata McGraw Hill, 2010
4. John G. Proakis, Dimitris G. Manolakis, "*Digital Signal Processing, Principles, Algorithms, and Applications*", 4th E, PHI, 2007
5. Robert A. Gable, Richard A. Roberts, "*Signals & Linear Systems*", 3rd E, John Wiley, 1995
6. Edward W Kamen& Bonnie's Heck, "*Fundamentals of Signals and Systems*", Pearson Education, 2007

U19BM302 ANATOMY AND HUMAN PHYSIOLOGY 3 0 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to –

1. Describe the basic concepts of anatomy and physiology.
2. Recognize the ways the body undergoes change throughout the life span related to cell and organ development.
3. Analyze how the development and progression of structural systems contributes to the body's overall function.
4. Identify basic characteristics of each body system and how they work together as a whole.
5. Differentiate between organ systems of the body and their various functions.

09

UNIT I ORGANIZATION OF HUMAN BODY

Structure of Cell – levels of structural organization - Polarization and Depolarization of Cell, Tissue: Types – Homeostasis -Specialized tissues – functions – Positive and Negative Feedback Mechanism - Muscle Physiology: Muscle physiology and aspects of Skin Resistance.

09

UNIT II RESPIRATORY SYSTEM AND URINARY SYSTEM

Respiratory System: Physiological aspects of respiratory system – Trachea and Lungs - Exchange of gases - Respiratory Mechanism. Types of respiration - Oxygen and carbon dioxide transport and acid base regulation.
Urinary system: Structure of Kidney and Nephron - Mechanism of Urine formation – Urinary reflex – urethra - internal/external sphincters - Homeostasis and blood pressure regulation by urinary system – Storage and elimination.

09

UNIT III BLOOD AND CARDIOVASCULAR SYSTEM

Blood composition - functions of blood – functions of RBC.WBC types and their functions Blood groups – importance of blood groups – identification of blood groups. Blood vessels – Electrical simulation – blood clotting - Wound healing - Anatomy of heart – Properties of Cardiac muscle – Conducting system of heart – Cardiac cycle – Heart sound- Volume and pressure changes and regulation of heart rate –Coronary Circulation. Factors regulating Blood flow – ECG – Einthoven's Triangle.

09

UNIT IV SKELETAL AND SPECIAL SENSORY SYSTEM

Skeletal system: Bone types and functions – Axial Skeleton and Appendicular Skeleton. Joint - Types of Joint – Cartilage structure, types and functions. Special Sensory system- Optics of vision – receptor and neural function of the retina – photochemistry of vision – central neurophysiology of vison – EOG – Physiology of hearing mechanism – hearing loss – audiograms – hearing tests – taste and smell sensors.

09

UNIT V NERVOUS SYSTEM

Structure of a Neuron – Neuroglial Cells - Synapses - Reflex actions of sympathetic and parasympathetic nervous system – Nerve conduction and action potentials - Brain – Electroencephalograph (EEG) - Divisions of brain lobes - Cross Sectional Anatomy of Brain - Cortical localizations and functions. Spinal cord – Tracts of spinal cord – Spinal Nerve - Reflex mechanism – Types of reflex. Autonomic nervous system and its functions.

Lecture : 45 Tutorial : 00 Total hours : 45

TEXT BOOKS

1 Elaine.N. Marieb, “Essential of Human Anatomy and Physiology”, Pearson Education New Delhi, 8th Edition, 2016.

2 Gillian Pocock, Christopher D. Richards, "The Human Body An introduction for Biomedical and Health Sciences", Oxford University Press, USA, 2013.

REFERENCE BOOKS

1 William F. Ganong,"Review of Medical Physiology”, Mc Graw Hill, New Delhi, 25th Edition, 2015.

2 Eldra Pearl Solomon. "Introduction to Human Anatomy and Physiology", W.B.Saunders Company, 2003.

3 Arthur C. Guyton, "Text book of Medical Physiology", Elsevier Saunders, 11th Edition, 2006.

U19CS307 PROGRAMMING IN C 3 0 0 3

COURSE OUTCOMES

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

1. Write simple C programs using console input and output functions
2. Write C programs using arrays, decision making and looping statements
3. Design and develop simple application using functions and pointers.
4. Design and develop real-time applications using structures and unions
5. Design and develop real-time applications using file operation

UNIT I BASICS OF C PROGRAMMING 9

Introduction to programming paradigms - Structure of C program - C programming: Data Types – Storage classes - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Pre-processor directives - Compilation process

UNIT II ARRAYS AND STRINGS 9

Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays – multi-dimensional array- String – string built-in functions – Sorting- Searching

UNIT III FUNCTIONS AND POINTERS 9

Introduction to functions: Function prototype, function definition, function call-Call by Value-Call by reference – Recursion – user defined functions versus built-in functions- Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – pointers to an array – function pointer-indirect pointer.

UNIT IV STRUCTURES 9

Structure – Structure definition-Nested structures – Pointer and Structures – Array of structures – Self-referential structures – bit fields- Union-Dynamic memory allocation - Singly linked list – typedef.

UNIT V FILE PROCESSING 9

Files – Types of file- File Primitives- File access mode- Sequential file access - Random file access - Command line arguments-introduction to TSR programs

TEXT BOOK

1. Ben Clemens “21st Century C ”, Second Edition ,Oreilly Media Inc,2014
2. Deitel and Deitel, “C How to Program”, Pearson Education, New Delhi, 2011.

REFERENCE BOOKS

1. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.
2. Yashavant P. Kanetkar. “Let Us C”, BPB Publications, 14th edition, 2016.
3. Byron S Gottfried, “Programming with C”, Schaum’s Outlines, Second Edition, Tata McGraw-Hill, 2006.
4. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. E. Balagurusamy, “Programming in ANSI C”, seventh edition, Tata McGraw Hill, 2016.

U19GE303 Essence of Indian Traditional Knowledge 2 0 0 0

Course Outcomes

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

1. Understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.
2. Show an ability to comment critically on curriculum proposals that aim to promote science citizenship/scientific literacy
3. Communicate using common medical and psychological terminology, including the skill to discuss commonly used medications, supplements, and surgical procedures
4. Use effective oral and written language skills to communicate scientific data and ideas

Unit I

- Introduction to Vedas 6
- Traditional methodology of Veda – Sat Angas
- Types of Vedas and their application
- Sub Veda – Ayurveda - their modern day application

Unit II

- Basics of Applied Vedic Science 6
- Modern day application of Vedas and procedure
- Ancient Indian Scientific thoughts
- Introduction to the Vedic language "Sanskrit"

UNIT – III- Modern science 6

- Introduction – modern science
- Objectives – modern science
- Architecture in ancient India

UNIT – IV Technology

- India's contribution to science and technology (from ancient to modern) 6
- Nobel laureates of Indian origin and their contribution
- India in space
- Latest achievement from Jan – 2017

UNIT – V- Yoga and Holistic Health Care 6

- Fundamentals of yoga and holistic health
- Human biology
- Diet and nutrition
- Life management
- Contemporary yogic models – case study

Reference Books

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.
4. Roshan Dalal The Vedas: An Introduction to Hinduism's Sacred Texts, Penguin Books 2014. ISBN 13: 9780143066385
5. Raja Ram Mohan Roy, Vedic Physics, Mount Meru Publication ISBN : 9781988207049

Total: 30 hours

U19BM303 ELECTRONIC DEVICES LABORATORY 0 0 2 1

COURSE OUTCOMES

At the end of each experiment, the students will be able to -

1. Operate electronic test equipment and hardware tools to use and the same for conducting experiments
2. Plot the characteristics of given bipolar BJT, Diodes and special diodes to understand their behavior
3. Design, construct and test amplifier circuits and interpret the results

Exp. No.	**List of Experiments**
1.	V-I Characteristics of given Si and Ge Diodes
2.	V-I Characteristics of Zener Diode and Prove that the output voltage gets regulated after the breakdown voltage for variable input voltage in the range of 0.5 V to 8 V of a given Zener Diode
3.	Design Power Supply circuit using half wave and Full wave rectifier with simple capacitor filter.
4.	Analyse Characteristics of the following Special Diodes i. Photo diode ii. Light emitting diode
5.	Analyse the Input and Output Characteristics of BJT (NPN)
6.	Analyse Frequency Response of BJT (CE) using Fixed Bias Amplifier Circuit
7.	Analyse Frequency Response of BJT (CE) using Voltage Divider Bias (self-bias) with and without bypassed Emitter Resistor (CE)
8.	Analyse the frequency response of the Common Collector BJT Amplifier.
9.	Design a Differential amplifier using BJT and Measurement of CMRR.
10	Analyse the Input and Output Characteristics V-I Characteristics of FET.

U19BM304 ANATOMY AND HUMAN PHYSIOLOGY LABORATORY 0 0 2 1

COURSE OUTCOMES

At the end of each experiment, the students will be able to -

1. Estimation and quantification of biomolecules.
2. Separation of macromolecules.
3. Interpreting the metabolic changes in pathological conditions.

List of Experiments

1. Preparation of serum and plasma from blood using Neubaur's Chamber.
2. Measure the amount of blood using blood glucose estimation.
3. Measure the level of creatinine in the blood to check kidney function.
4. Determination of urea in blood and urine by Urease method.
5. Estimation of cholesterol in serum.
6. Separation of proteins by SDS electrophoresis.
7. Separation of amino acids by thin layer chromatography.
8. Separation of DNA by agarose gel electrophoresis.
9. ESR, PCV, MCH, MCV, MCHC, total count of RBCs and hemoglobin estimation.
10. Differential count of different WBCs and blood group identification.
11. Measurement of pH of solutions using pH meter.
12. Ishihara chart for color blindness and Snellen"s chart for myopia and hyperopia - by letters reading and ophthalmoscope to view retina.
13. Determination of percentage Transmittance, Absorbance and concentration of given solution using spectrophotometer.

U19CS308 C PROGRAMMING LABORATORY 0 0 2 1

COURSE OUTCOMES:

After successful completion of the course, the students would be able to

4. Design and develop simple programs using branching, looping statements
5. Develop programs using functions, arrays, structures and string handling
6. Write programs using pointers and dynamic memory allocation and file handling

List of Experiments:

12. Programs using Input, Output and assignment statements.
13. Programs using Branching statements
14. Programs using Looping statements
15. Programs using Functions
16. Programs using Arrays
17. Programs using Structures
18. Programs using Strings
19. Programs using Pointers (both data pointers and function pointers)
20. Programs using dynamic memory allocation
21. Programs using Recursion
22. Programs using Files

TOTAL : 30 hours

Semester-III	U19 GE301- SOFT SKILLS AND APTITUDE – I	L T P C Marks 0 0 2 1 100
Course Outcomes **At the end of the course the student will be able to:**		
1. Demonstrate capabilities in specific soft-skill areas using hands-on and/or case-study approaches		
2. Solve problems of greater intricacy in stated areas of quantitative aptitude and logical reasoning		
3. Demonstrate higher levels of verbal aptitude skills in English with regard to specific topics		
1.Soft Skills	**Demonstrating soft-skill capabilities with reference to the following topics**: a. Attitude building b. Dealing with criticism c. Innovation and creativity d. Problem solving and decision making **e.** Public speaking **f.** Group discussions	
2. Quantitative Aptitude and Logical Reasoning	**Solving problems with reference to the following topics:** a. **Vedic Maths:** Fast arithmetic, multiplications technique, Criss cross, Base technique, Square root, Cube root, Surds, Indices, Simplification. b. **Numbers:** Types, Power cycle, Divisibility, Prime factors & multiples, HCF & LCM, Remainder theorem, Unit digit, highest power. c. **Averages:** Basics of averages and weighted average. d. **Percentages**: Basics of percentage and Successive percentages. e. **Ratio and proportion:** Basics of R &P, Alligations, Mixture and Partnership. f. **Profit ,Loss and Discount**: Basic & Advanced PLD g. **Data Interpretation**: Tables, Bar diagram, Venn diagram, Line graphs, Pie charts, Caselets, Mixed varieties, Network diagram and other forms of data interpretation. h. **Syllogism:** Six set syllogism using Venn diagram and tick and cross method	
3. Verbal Aptitude	**Demonstrating English language skills with reference to the following topics:** a. Verbal analogy b. Tenses c. Prepositions d. Reading comprehension e. Choosing correct / incorrect sentences f. Describing pictures g. Error spotting	

Department of Placement Training
Sona College of Technology.
Salem-636 005.

SEMESTER – III

MANDATORY COURSE

U19GE303 - ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

(Common for IT, ECE and BME)

L	T	P	C
2	0	0	0

Course Outcomes

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

1. understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.
2. show an ability to comment critically on curriculum proposals that aim to promote science citizenship/scientific literacy
3. communicate using common medical and psychological terminology, including the skill to discuss commonly used medications, supplements, and surgical procedures
4. use effective oral and written language skills to communicate scientific data and ideas
5. describe the fundamentals of yoga and its importance

Unit I 6

- Introduction to Vedas
- Traditional methodology of Veda – Sat Angas
- Types of Vedas and their application
- Sub Veda – Ayurveda - their modern day application

Unit II 6

- Basics of Applied Vedic Science
- Modern day application of Vedas and procedure
- Ancient Indian Scientific thoughts
- Introduction to the Vedic language "Sanskrit"

UNIT – III- Modern science 6

- Introduction – modern science
- Objectives – modern science
- Architecture in ancient India

UNIT – IV Technology 6

- India's contribution to science and technology (from ancient to modern)
- Nobel laureates of Indian origin and their contribution
- India in space
- Latest achievement from Jan – 2017

20.05.2020 **B.E. / B.Tech. Regulations 2019**

UNIT – V- Yoga and Holistic Health Care 6

- Fundamentals of yoga and holistic health
- Human biology
- Diet and nutrition
- Life management
- Contemporary yogic models – case study

References

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.
4. Roshan Dalal The Vedas: An Introduction to Hinduism's Sacred Texts, Penguin Books 2014. ISBN 13: 9780143066385
5. Raja Ram Mohan Roy, Vedic Physics, Mount Meru Publication ISBN : 9781988207049

Total: 30 HOURS

20/5/20
Dr. M. Raja
Course Coordinator / Sciences

20.5.2020
Dr. C. Shanthi
HOD / Sciences

20/5
Dr. M. Renuga
Chairperson BOS,
Science and Humanities

20.05.2020 **B.E. / B.Tech. Regulations 2019**

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester IV under Regulations 2019
Branch: Biomedical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U19BM401	Analog and Digital Integrated Circuits	3	0	0	3
2	U19BM402	Biomedical Instrumentation	3	0	0	3
3	U19BM403	Control System for Biomedical Engineering	3	0	0	3
4	U19BM404	Biomaterials	3	0	0	3
5	U19CS406	Data Structures	3	0	0	3
6	U19GE402	**Mandatory Course :** Environment and Climate Science	2	0	0	0
Practical						
7	U19BM405	Analog and Digital Integrated Circuits Laboratory	0	0	2	1
8	U19BM406	Biomedical Instrumentation Laboratory	0	0	2	1
9	U19CS407	Data Structures Laboratory	0	0	2	1
10	U19GE401	Soft Skills and Aptitude – II	0	0	2	1
					Total Credits	**19**

Approved By

Chairperson, Biomedical BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.R.S.Sabeenian	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

Copy to:-

HOD/ Biomedical Engineering, Fourth Semester BE BME Students and Staff, COE

U19BM401 ANALOG AND DIGITAL INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

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

1. Introduce the basic building blocks of linear integrated circuits and the linear and non-linear applications of operational amplifiers.
2. Learn the theory of active filter, ADC and DAC.
3. Introduce the concepts of waveform generation and introduce some special function ICs 555 and 565.
4. Present the Digital fundamentals, Boolean algebra and its applications in digital systems, and familiarize with the design of various combinational digital circuits using logic gates.
5. Introduce the analysis and design procedures for synchronous and asynchronous sequential circuits.

UNIT I OPERATIONAL AMPLIFIER 9

Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Pin details -Linear applications - Inverting, Non-Inverting, summing, subtracting, averaging, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, I-V converter, V-I converters, Non linear applications -Comparators, Schmitt Trigger, Precision rectifier.

UNIT II ACTIVE FILTERS AND DATA CONVERTERS 9

Introduction to Active Filters, LPF, HPF, Band pass, Band reject and All Pass Filters, Basic DAC, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC, Single and Dual Slope ADC. Features and Pin details of DAC and ADC ICs -DAC0800 and ADC0808.

UNIT III OP-AMP, IC-555 & IC 565 APPLICATIONS 9

Oscillators - RC Phase shift and Wein-bridge. Waveform generators - Square, triangular and saw tooth, IC555 Timer - Functional Diagram, Monostable and Astable Operations, IC565 PLL - Block Schematic, Description of Individual Blocks and IC pins, Applications.

UNIT IV DIGITAL INTEGRATED CIRCUITS 9

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, Gray, Alphanumeric codes, Boolean theorems, Various Logic Families, Logic gates, Universal gates, Sum of products and product of sums, Karnaugh map Minimization, Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder –Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder.

UNIT V SEQUENTIAL LOGIC IC'S AND MEMORIES **9**

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, ICs details, Triggering of FF,– state minimization, state assignment, circuit implementation – Design of Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

TOTAL: 45 PERIODS

TEXT BOOK:

1. M. Morris Mano and Michael D.Ciletti, "Digital Design", Pearson, 5th Edition, 2014.
2. Ramakant A. Gayakwad, "OP - AMP and Linear IC's", Prentice Hall, 2012

REFERENCES BOOKS::

1. Taub and Schilling, "Digital Integrated Electronics", Mc Graw Hill, 2017.
2. John.F.Wakerly, "Digital design principles and practices", Pearson Education, 5th Edition, 2018.
3. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", Mc Graw Hill Education, 3rd Edition, 2017.
4. S Salivahanan and V S Kanchana Bhaaskaran, Linear Integrated Circuits, McGraw Hill Education, 3rd Edition, 2018.

U19BM402 BIOMEDICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

At the end of each unit, the students will be able to

1. Summarize various aspects of bio potential recording systems for human anatomy.
2. Interpret the various measurement methods and translate flow of blood as metrics.
3. Outline the objectives and working principles of various radiological and ultrasound equipment's.
4. Explicit bio amplifiers for physiological recordings.
5. Examine the fundamentals of signal generators and analyzers.

UNIT I: BASICS OF BIOPOTENTIALS 9

Origin of Bio-potentials- Electro-Physiology, Bio-potential Electrodes-Bio-Potential Recording, Biological Amplifiers –ECG-EEG-EMG-PCG-EOG-Lead systems and recording methods-Typical waveforms and signal characteristics.

UNIT II: HAEMOTOLOGICAL INSTRUMENTS AND ANALYSIS TECHNIQUE 9

Step Measurement of blood flow-radiographic indicator dye dilution-Thermal convection-Magnetic blood flow rate-Ultrasonic blood flow meter-Sphygmomanometer-Blood gas analyzer-Oximeter-Auto analyzer-Electrophoresis-Colorimeter-Spectrophotometer-Flame photometer.

UNIT III: MEDICAL IMAGING TECHNIQUES 9

Introduction to medical imaging - X-Ray, Computer Tomography (CT),Magnetic Resonance imaging (MRI),Positron Emission Tomography (PET),SPECT,Mammography-Physics of ultrasound imaging- Modes of Scan-Advantages and Disadvantages of ultrasound Scanning-Thermography.

UNIT IV: SIGNAL CONDITIONING CIRCUITS 9

Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier, Impedance matching circuit, Isolation amplifiers – Transformer and optical isolation - Isolated DC amplifier and AC carrier amplifier., Power line interference, Right leg driven ECG amplifier, Band pass filter circuits.

UNIT V: SIGNAL GENERATORS AND ANALYZERS 9

Sine wave generator-Frequency synthesized sine wave generator-sweep frequency generator-Pulse and Square wave generator-Functional generator-Wave analyzer-Applications-Harmonic distortion analyzer-Spectrum analyzer-Applications.

Total Hours: 45

TEXT BOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurements", Pearson India, 2015.
2. Albert D. Helfrick and William David Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Pearson Education India; 1st edition, January 2015.

REFERENCES BOOKS::

1. R S Khandpur, "Handbook of Biomedical Instrumentation", McGraw Hill Education; Third edition, 2015.
2. Ananda Natarajan R, "Biomedical Instrumentation and Measurements", Prentice Hall of India, New Delhi, 2015.
3. Oliver B.M and Cage J.M, "Electronic Measurements and Instrumentation", McGraw Hill, revised edition 2017.
4. Joseph J Carr, "Elements of Electronic Instrumentation and Measurement", Pearson Education India, 3rd edition, 2015.

U19BM403 CONTROL SYSTEMS FOR BIOMEDICAL ENGINEERING

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

At the end of each unit, the students will be able to

1. Interpret the need for mathematical modeling of various systems, representation of systems in block diagrams and signal flow graphs and are introduced to biological control systems
2. Determine the time response of various systems and discuss the concept of system stability
3. Examine the frequency response characteristics of various systems using different charts
4. Appraise the concept of modeling basic physiological systems
5. Identify the application aspects of time and frequency response analysis in physiological control systems.

UNIT I INTRODUCTION 9

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

UNIT II TIME RESPONSE ANALYSIS 9

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

UNIT III FREQUENCY RESPONSE ANALYSIS 9

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

UNIT IV BIOLOGICAL SYSTEM MODELS 9

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

UNIT V BIOLOGICAL CONTROL SYSTEM ANALYSIS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. I.J. Nagarath and M. Gopal, Control Systems Engineering, 5th Edition, Anshan Publishers, 2009.
2. Michael C K Khoo, Physiological Control Systems,WILEY- IEEE Press, Prentice Hall of India, 2018.

REFERENCE BOOKS:

1. Benjamin C. Kuo, Automatic Control Systems, Prentice Hall of India, 2014.
2. John Enderle Susan Blanchard and Joseph Bronzino, Introduction to Biomedical Engineering, 2nd Edition, Academic Press, 2005.
3. Ogata, Katsuhiko and Yanjuan Yang, Modern control engineering, Vol 4, Prentice-Hall, 2010.
4. Bhattacharya and Sriman Kumar, Control systems engineering, Pearson Education India, 2nd Edition, 2012.
5. Richard C. Dorf and Robert H. Bishop, Modern control systems, Pearson, 2004.

U19BM404 BIOMATERIALS **L T P C**

3 0 0 3

COURSE OUTCOMES:

At the end of each unit, the students will be able to -

1. Describe the basic properties of Biomaterials.

2. Analyze the metallic implant materials.

3. Analyze the polymeric implant materials and Composite implant materials.

4. Identify basic characteristics of bio ceramics.

5. Measure the Biocompatibility and analyze the Toxicological Screening of Biomaterials

UNIT I PROPERTIES OF BIOMATERIALS 9

Definition of biomaterials- requirements & 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.

UNIT II METALLIC IMPLANT MATERIALS 9

Stainless steel- Cobalt based alloys- Ti and Ti-based alloys. Importance of stress-corrosion cracking. Host tissue reaction with bio metal- corrosion behaviour and the importance of passive films for tissue adhesion. Hard tissue replacement implant: Orthopedic implants- Dental implants. Soft tissue replacement implants: Percutaneous and skin implants- Vascular implants- Heart valve implants- Tailor made composite in medium.

UNIT III POLYMERIC IMPLANT MATERIALS 9

Polyolefin's- polyamides- acrylic polymers- fluorocarbon polymers- silicon rubbers- acetyls. (Classification according to thermo sets- thermoplastics and elastomers).Viscoelasticbehavior: creep-recovery- stress-relaxation- strain rate sensitivity. Importance of molecular structure- hydrophilic and hydrophobic surface properties- migration of additives (processing aids)- aging and environmental stress cracking. Physiochemical characteristics of biopolymers. Biodegradable polymers for medical purposes- Biopolymers in controlled release systems. Synthetic polymeric membranes and their biological applications.

UNIT IV CERAMIC IMPLANT MATERIAL 9

Definition of bio ceramics. Common types of bio ceramics Aluminum oxides- Glass ceramics- Carbons. Bio resorbable and bioactive ceramics. Importance of wear resistance and low fracture toughness. Host tissue reactions: importance of interfacial tissue reaction (ceramic/bone tissue reaction). Composite implant materials - Mechanics of improvement of properties by incorporating different elements. Composite theory of fiber reinforcement (short and long fibers- fibers pull out). Polymers filled with osteogenic fillers (hydroxyapatite). Host tissue reactions.

UNIT V BIOCOMPATIBILITY AND TOXICOLOGICAL SCREENING OF BIOMATERIALS **9**

Example of physiological control system, difference between engineering and physiological control systems, generalized system properties, models with combination of system elements, linear models of physiological systems-Examples, review of simulation tools in material characteristic analysis, Illustration with real time applications.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Biomaterials- Basic Theory with Engineering Applications C.Mauli Agarwal, Joo L.Ong, Mark R. Appleford, Gopinath Mani. Cambrige University Press, New York- 2016.

REFERENCE BOOKS:

1. Biomaterials Science: An Introduction to Materials in Medicine- By Buddy D. Ratner, et. al. Academic Press, San Diego, 2015.
2. Sujata V. Bhat, Biomaterials, Narosa Publishing House, 2014.

U19CS406 DATA STRUCTURES L T P C

3 0 0 3

COURSE OUTCOMES

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

1. Implement abstract data types for linear data structures
2. Solve real world problems using stack and queue linear data structures
3. Apply various non-linear tree data structures in real time applications
4. Design algorithms to solve common graph problems
5. Analyze various searching, sorting and hashing techniques

UNIT I LINEAR DATA STRUCTURES – LIST 9

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation - Singly linked lists - Circularly linked lists - Doubly-linked lists – Applications of lists

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES 9

Stack ADT – Operations– Evaluating arithmetic expressions - Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Double ended queue – Applications of Stacks and queues.

UNIT III NON LINEAR DATA STRUCTURES – TREES 9

Trees – Traversals – Binary Trees – Expression trees – Applications of trees – Binary search trees - AVL Trees – B-Tree – Heap – Applications of heap -Tries.

UNIT IV NON LINEAR DATA STRUCTURES – GRAPHS 9

Graphs - Representation of graph – Graph traversals – Breadth-first traversal – Depth-first traversal – Minimum Spanning Trees: Prim's algorithm, Kruskal's algorithm – Shortest path algorithms: Dijkstra's algorithm- Applications of Graphs: Topological Sort.

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching - Linear Search – Binary Search, Sorting – Bubble sort– Insertion sort – Merge sort, Hashing - Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

Total Hours: 45

TEXT BOOK:

1. Mark Allen Weiss, "Data structures and Algorithm Analysis in C", Pearson Education, New Delhi, Second Edition, 2012.

REFERENCES BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest , Clifford Stein, “Introduction to Algorithms” ,3rd Edition, MIT Press, 2010.
2. Jean Paul Tremblay and Sorenson, “An Introduction to Data Structures with Applications”, McGraw Hill Publishing Company, New Delhi, Second Edition, 2007.
3. Yedidyah Langsam, Moshe J Augenstein and Aaron M Tanenbaum, “Data Structures using C and C++”, Prentice Hall of India/ Pearson Education, New Delhi, 2006.
4. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Silicon Press, New Jersey, Second Edition, 2005

U19GE402 ENVIRONMENT AND CLIMATE SCIENCE

L	T	P	C
2	0	0	0

Course Outcomes:

At the end of the course, the student will be able to

1. State the importance of the acute need for environmental awareness and discuss significant aspects of natural resources like forests, water and food resources.
2. Explain the concepts of an ecosystem and provide an overview of biodiversity and its conservation.
3. Explain environmental based pollution their causes, effects and their remedial measures
4. Discuss their causes, effects and the control measures of Global Warming, Acid Rain, Ozone Layer Depletion
5. Describe the effect of climate change due to pollution

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 6

Definition, Scope and Importance Forest Resources:- Use and over - exploitation, deforestation, Case Studies, Water Resources:- Use and Over-Utilization of Surface and ground water , Floods, Drought, Food Resources- Effects of Modern Agriculture, Fertilizer- Pesticide Problems–Role of an Individual in Conservation of Natural Resources.

UNIT II ECOSYSTEMS AND BIODIVERSITY 6

Structure and Function of an Ecosystem– Energy Flow in the Ecosystem -Food Chains, Food Webs and Ecological Pyramids.

Introduction to Biodiversity –Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values –India as a Mega-Diversity Nation — Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts – Endangered and Endemic Species of India – Conservation of Biodiversity: In-Situ and Ex-Situ conservation of Biodiversity.

UNIT III ENVIRONMENTAL POLLUTION 6

Definition – Causes, Effects and Control Measures of:- (A) Air Pollution (B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution, Solid Waste Management- Effects and Control Measures of Acid Rain,– Role of an Individual in Prevention of Pollution..

UNIT IV CLIMATE CHANGE ON THE ENVIRONMENT 6

Sustainable Development- - Climate Change- Causes and effects of Global Warming - Effect of global warming in food supply, plants, sea, coral reef, forest, agriculture, economy - Kyoto Protocol in reduction of greenhouse gases - Ozone Layer Depletion - mechanism, effects and control measures- Montreal Protocol to protect ozone layer depletion - Rain Water Harvesting - .Effect of climate change due to air pollution Case study - CNG vehicles in Delhi

UNIT V EFFECT OF CLIMATE CHANGE ON POLLUTION 6

Fungal diseases in forests and agricultural crops due to climatic fluctuations - Growing energy needs - effect of climate change due to non-renewable energy resources. Renewable energy resources in the prevention of climatic changes- Effect of climatic changes in ground water table, garments, monuments, buildings, consumption of energy, agriculture and in electric power sector - Carbon credit - carbon footprint - disaster management -Role of an individual to reduce climate change.

Total Hours: 30

TEXT BOOKS:

1. Miller, T.G. Jr., "Environmental Science", Wadsworth Pub. Co. 2018
2. Anubha Kaushik and Kaushik, "Environmental Science and Engineering" New Age International Publication, 4th Multicolour Edition, New Delhi, 2014.

REFERENCES BOOKS:

1. S. Radjarejesri et al., "Environmental Science" Sonaversity, Sona College of Technology, Salem, 2018.
2. Masters, G.M., "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., 2nd Edition, 2004.
3. Erach, B., "The Biodiversity of India", Mapin Publishing P.Ltd.,Ahmedabad, India.
4. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", 2005, University Grands Commission, Universities Press India Private Limited, Hyderguda, Hyderabad – 500029.

U19BM405	ANALOG AND DIGITAL INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

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

1. Perform mathematical operations and generate different types of waveforms using IC 741 Op-amp.
2. Design monostable and Astable multivibrators using IC 555.
3. Design and implement combinational and sequential circuits using logic gates and breadboards.

List of Experiments:

1. Design of Inverting and Non-Inverting amplifier using Opamp (IC 741)
2. Design of Integrator and Differentiator using Opamp (IC 741)
3. Design of Differential amplifier to find CMRR using Opamp (IC 741).
4. Design of Astable and Monostable multivibrator using Opamp IC 741
5. Design of Schmitt trigger using Opamp (IC 741)
6. Design and implementation of
   (a) Half Adder and Full Adder, Half Subtractor and Full Subtractor
   (b) 4-bit Parallel Adder cum Subtractor
   (c) Magnitude Comparator
7. Design and implementation of
   (a) Code Converters – Binary to Gray and Gray to Binary
   b) BCD to Excess 3 and Excess 3 to BCD
8. Design and implementation of
   (a) Multiplexer and Demultiplexer
   (b) Decoder
   (c) Encoder
   (d) Parity Generator and Checker
9. Design and implementation of
   (a) Asynchronous Counter
   (b) Synchronous Counter
10. Design and implementation of
    (a) Shift Registers – SISO, SIPO and PIPO

Total Hours: 30

U19BM406 BIOMEDICAL INSTRUMENTATION LABORATORY

L	T	P	C
0	0	2	1

COURSE OUTCOMES

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

1. Measure various non-electrical parameters Record the electrical impulses of heart, muscle and brain using ECG, EMG and EEG.
2. Measure various non-electrical parameters using suitable sensors/transducers and
3. Design instrumentation amplifier and filters using simulation tools.

List of Experiments

1. Measure the electrical activity of heart using ECG.
2. Measure the electrical activity of muscles using EMG.
3. Measure the electrical pattern of brains Using EEG.
4. Measure the velocity of blood flow using Blood flow measurement system using ultra sound transducer.
5. Measure the respiration rate using accessories.
6. Measure the rate/rhythm in heart beat using pacemakers.
7. Measure of hearing loss by air conduction and bone conduction using Audiometer.
8. Measure of blood pressure using sphygmomanometer and stethoscope.
9. Conduct Weber and Rinne test for auditory conduction.
10. Design instrumentation amplifier circuit and filter circuits using TINA simulation software.

Total Hours: 30

U19CS407 DATA STRUCTURES LABORATORY

L	T	P	C
0	0	2	1

COURSE OUTCOMES

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

1. Design and develop simple programs using data structures
2. Apply non-linear data structures for various real time applications
3. Design shortest path algorithm for various real life applications

LIST OF EXPERIMENTS

1. Implementation of Lists ,Stacks and Queues
2. Implementation of Binary Tree and Traversal Techniques
3. Implementation of Binary Search Trees
4. Implementation of AVL Trees
5. Implementation of B-trees
6. Implementation of graphs using BFS and DFS.
7. Implementation of Prim's algorithm.
8. Implementation of Kruskal's algorithm
9. Implementation of Dijkstra's algorithm
10. Implementation of Hashing and Collision Resolution Technique.
11. Implementation of Heap
12. Implement of Sorting and searching Techinques

Total Hours: 30

Semester – IV	U19GE401 SOFT SKILLS AND APTITUDE – II	L T P C Marks 0 0 2 1 100

Course Outcomes

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

1. Demonstrate capabilities in additional soft-skill areas using hands-on and/or case-study approaches
2. Solve problems of increasing difficulty than those in SSA-I in given areas of quantitative aptitude and logical reasoning and score 65-70% marks in company-specific internal tests
3. Demonstrate greater than SSA-I level of verbal aptitude skills in English with regard to given topics and score 65-70% marks in company-specific internal tests

1.Soft Skills	**Demonstrating soft-skill capabilities with reference to the following topics:** a. SWOT b. Goal setting c. Time management d. Stress management e. Interpersonal skills and Intrapersonal skills f. Presentation skills g. Group discussions
2. Quantitative Aptitude and Logical Reasoning	**Solving problems with reference to the following topics:** a. Equations: Basics of equations , Linear, Quadratic Equations of Higher Degree and Problem on ages. b. Logarithms, Inequalities and Modulus c. Sequence and Series: Arithmetic Progression, Geometric Progression, Harmonic Progression, and Special Series. d. Time and Work: Pipes & Cistern and Work Equivalence. e. Time, Speed and Distance: Average Speed, Relative Speed, Boats & Streams, Races and Circular tracks and Escalators. f. Arithmetic and Critical Reasoning: Arrangement, Sequencing, Scheduling, Network Diagram, Binary Logic, and Logical Connection. h. Binary number System.- Binary to decimal, Octal, Hexadecimal
3. Verbal Aptitude	**Demonstrating English language skills with reference to the following topics:** a. Critical reasoning b. Theme detection c. Verbal analogy d. Prepositions e. Articles f. Cloze test g. Company specific aptitude questions

1

Department of Placement Training

1

Sona College of Technology, Salem **Department of Sciences (Chemistry)**

SEMESTER – IV

MANDATORY COURSE

U19GE402 - ENVIRONMENT AND CLIMATE SCIENCE

(Common for MCT, IT,FT,ECE and BME)

L	T	P	C
2	0	0	0

Course Outcomes:

At the end of the course, the student will be able to

1. state the importance of the acute need for environmental awareness and discuss significant aspects of natural resources like forests, water and food resources.
2. explain the concepts of an ecosystem and provide an overview of biodiversity and its conservation.
3. explain environmental based pollution their causes, effects and their remedial measures
4. discuss their causes, effects and the control measures of Global Warming, Acid Rain, Ozone Layer Depletion
5. describe the effect of climate change due to pollution

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 6

Definition, Scope and Importance Forest Resources:- Use and over - exploitation, deforestation, Case Studies, Water Resources:- Use and Over-Utilization of Surface and ground water , Floods, Drought, Food Resources- Effects of Modern Agriculture, Fertilizer- Pesticide Problems–Role of an Individual in Conservation of Natural Resources.

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UNIT III ENVIRONMENTAL POLLUTION 6

Definition – Causes, Effects and Control Measures of:- (A) Air Pollution (B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution, Solid Waste Management- Effects and Control Measures of Acid Rain,– Role of an Individual in Prevention of Pollution..

23.01.2021 **B.E. / B.Tech. Regulations 2019**

UNIT IV CLIMATE CHANGE ON THE ENVIRONMENT 6

Sustainable Development- - Climate Change- Causes and effects of Global Warming - Effect of global warming in food supply, plants, sea, coral reef, forest, agriculture, economy - Kyoto Protocol in reduction of greenhouse gases - Ozone Layer Depletion - mechanism, effects and control measures- Montreal Protocol to protect ozone layer depletion - Rain Water Harvesting - .Effect of climate change due to air pollution Case study - CNG vehicles in Delhi

UNIT V EFFECT OF CLIMATE CHANGE ON POLLUTION 6

Fungal diseases in forests and agricultural crops due to climatic fluctuations - Growing energy needs - effect of climate change due to non-renewable energy resources. Renewable energy resources in the prevention of climatic changes- Effect of climatic changes in ground water table, garments, monuments, buildings, consumption of energy, agriculture and in electric power sector - Carbon credit - carbon footprint - disaster management -Role of an individual to reduce climate change.

TOTAL: 30 HOURS

Text Books:

1. Miller, T.G. Jr., "Environmental Science", Wadsworth Pub. Co. 2018
2. Anubha Kaushik and Kaushik, "Environmental Science and Engineering" New Age International Publication, 4th Multicolour Edition, New Delhi, 2014.

References:

1. S. Radjarejesri et al., "Environmental Science" Sonaversity, Sona College of Technology, Salem, 2018.
2. Masters, G.M., "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., 2nd Edition, 2004.
3. Erach, B., "The Biodiversity of India", Mapin Publishing P.Ltd.,Ahmedabad, India.
4. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", 2005, University Grands Commission, Universities Press India Private Limited, Hyderguda, Hyderabad – 500029.

23/1/21
Dr. M. Raja
Course Coordinator / Sciences

23/1/2021
Dr. C. Shanthi
HOD / Sciences

Dr. M. Renuga
Chairperson BOS,
Science and Humanities

23.01.2021 **B.E. / B.Tech. Regulations 2019**

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester V Regulations 2019
Branch: Biomedical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19BM501	Diagnostic and Therapeutic Equipments I	3	0	0	3	45
2	U19EC510	Digital Signal Processing	3	0	0	3	45
3	U19BM502	Pathology and Microbiology	3	0	0	3	45
4	U19BM503	Biomechanics	3	0	0	3	45
5	U19EC511	Microprocessors and Embedded System Design	3	0	0	3	45
6	noc21-ee107	**Elective-NPTEL Course :** Electrical Measurement and Electronic Instruments	3	0	0	3	45
Practical							
7	U19EC512	Digital Signal Processing Laboratory	0	0	2	1	30
8	U19BEC513	Microprocessors and Embedded System Design Laboratory	0	0	2	1	30
9	U19BM504	Pathology and Microbiology Laboratory	0	0	2	1	30
10	U19GE501	Soft Skills and Aptitude – III	0	0	2	1	30
					Total Credits	**22**	

Approved By

Chairman, Biomedical Engineering BoS — Dr.R.S.Sabeenian

Member Secretary, Academic Council — Dr.R.Shivakumar

Chairperson, Academic Council & Principal — Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/ Biomedical Engineering, Fifth Semester BE BME Students and Staff, COE

U19BM501 DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS- I 3 0 0 3

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Elucidate the working and recording setup of all basic cardiac equipment.
2. Explicate the working and recording of all basic neurological equipment.
3. Interpret the recording of diagnostic and therapeutic equipment related to EMG.
4. Explain about measurements of parameters related to respiratory system.
5. Depict the measurement techniques of sensory responses.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	1	-	-	-	-	-	-	-	-	2	1
CO2	2	1	-	1	-	-	-	-	-	-	-	-	2	1
CO3	3	2	1	1	-	-	-	-	-	-	-	-	2	1
CO4	3	2	-	1	-	-	-	-	-	-	-	-	2	1
CO5	2	2	-	1	-	-	-	-	-	-	-	-	2	1

UNIT I CARDIAC DIAGNOSTIC EQUIPMENTS 9

Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor, Holter Monitor, Phonocardiography, ECG machine maintenance and troubleshooting, Cardiac Pacemaker- Internal and External Pacemaker– Batteries, AC and DC Defibrillator- Internal and External, Defibrillator Protection Circuit, Cardiac ablation catheter.

UNIT II NEUROLOGICAL DIAGNOSTIC EQUIPMENTS 9

Clinical significance of EEG, Multi-channel EEG recording system, Epilepsy, Evoked Potential-Visual, Auditory and Somatosensory, MEG (Magneto Encephalograph). EEG Bio Feedback Instrumentation. EEG system maintenance and troubleshooting.

UNIT III MUSCULAR AND BIOMECHANICAL MEASUREMENTS 9

Recording and analysis of EMG waveforms, fatigue characteristics, Muscle stimulators, nerve stimulators, Nerve conduction velocity measurement, EMG Bio Feedback Instrumentation. Static Measurement - Load Cell, Pedobarograph. Dynamic Measurement -Velocity, Acceleration, GAIT, Limb position.

UNIT IV RESPIRATORY MEASUREMENT SYSTEM 9

Instrumentation for measuring the mechanics of breathing - Spirometer -Lung Volume and vital capacity, measurements of residual volume, Pneumotachometer -Airway resistance measurement, Whole body Plethysmograph, Intra-Alveolar and Thoracic pressure measurements, Apnoea Monitor. Types of Ventilators - Pressure, Volume, and Time controlled. Flow, Patient Cycle Ventilators, Humidifiers, Nebulizers, Inhalators.

UNIT V SENSORY MEASUREMENT 9

Psychophysiological Measurements - polygraph, basal skin resistance (BSR), galvanic skin resistance (GSR), Sensory responses - Audiometer-Pure tone, Speech, Eye Tonometer, Applanation Tonometer, slit lamp, auto refractometer.

TOTAL: 45 HOURS

TEXT BOOK

1. John G. Webster, —Medical Instrumentation Application and Design, 4th edition,Wiley India PvtLtd,New Delhi, 2015.
2. Joseph J. Carr and John M. Brown, Introduction to Biomedical Equipment Technology, Pearson education, 2012.

REFERENCES

1. Myer Kutz, —Standard Handbook of Biomedical Engineering & Design, McGraw Hill, 2003.
2. L.A Geddes and L.E.Baker, —Principles of Applied Biomedical Instrumentation, 3rd Edition, 2008.
3. Leslie Cromwell, —Biomedical Instrumentation and Measurement , Pearson Education, New Delhi, 2007.
4. Antony Y.K.Chan, Biomedical Device Technology, Principles and design, Charles Thomas Publisher Ltd, Illinois, USA, 2008.
5. B H Brown, R H Smallwood, D C Barber, P V Lawford and D R Hose, —Medical Physics and Biomedical Engineering, 2nd Edition, IOP Publishers. 2001.

U19EC510 DIGITAL SIGNAL PROCESSING 3 0 0 3

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Describe DFT , FFT and to perform its computations
2. Design FIR digital filters using various techniques
3. Design IIR digital filters using different techniques.
4. Analyse the finite word length effects in signal processing
5. Describe the fundamentals of digital signal processors.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	1	-	-	-	-	2	2	3	3
CO2	3	3	3	3	3	1	-	-	-	-	2	2	3	3
CO3	3	3	3	3	3	1	-	-	-	-	2	2	3	3
CO4	3	3	2	3	3	1	-	-	-	-	2	2	3	3
CO5	3	1	2	1	3	1	-	-	-	-	2	2	3	3

UNIT I DISCRETE FOURIER TRANSFORM AND FFT 9

Introduction to DFT – Efficient computation of DFT- Properties of DFT – FFT algorithms – Radix-2 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms – Circular Convolution - Fast convolution- overlap save method and overlap add method.

UNIT II INFINITE IMPULSE RESPONSE DIGITAL FILTERS 9

Review of design of Analog Butterworth and Chebychev Filters – Design of IIR digital filters using impulse invariance technique – Design of IIR digital filters using bilinear transformation – pre warping – Frequency transformation in digital domain – Realization cascade and parallel form

UNIT III FINITE IMPULSE RESPONSE DIGITAL FILTERS 9

Amplitude and phase responses of FIR filters – Linear phase filters – Windowing techniques for design of linear phase FIR filters: Rectangular- Hamming- Hanning- Kasier window- Gibbs phenomenon –Principle of frequency sampling technique. Realization of FIR filters- Linear and cascade form.

UNIT IV FINITE WORD LENGTH EFFECTS 9

Quantization noise – derivation for quantization noise power- comparison – truncation and rounding error – input quantization error-coefficient quantization error – limit cycle oscillations-dead band- Overflow error-signal scaling

UNIT V DIGITAL SIGNAL PROCESSORS 9

Architectural Features – Von Neumann architecture- Harvard architecture- Bus Architecture and Memory- Multiplier- Shifter- MAC Unit- ALU- Addressing Modes – Address Generation Unit - pipelining- Overview of instruction set of TMS320C54XX. Introduction of TMS320C6748 Processor

TOTAL: 45 HOURS

TEXT BOOK

1. John G Proakis- Dimtris G Manolakis-" Digital Signal Processing Principles- Algorithms and Application"- Pearson/PHI- 4th Edition- 2014
2. B.Venkataramani & M-Bhaskar- "Digital Signal Processor Architecture- Programming and Application"- TMH 2017

REFERENCES

1. Allan V.Openheim, Ronald W.Sehafer & John R.Buck, "Discrete Time Signal Processing"- second edition Pearson/Prentice Hall, 2014.
2. P.Ramesh Babu, "Digital Signal Processing"-SCITECH-2017.
3. S.K.Mitra, "Digital Signal Processing- A Computer based approach"- Tata McGraw-Hill- 2006- New Delhi.
4. S.Salivahanan, A.Vallavaraj, Gnanapriya, "Digital Signal processing" - McGraw Hill / TMH,2019.

U19BM502 PATHOLOGY AND MICROBIOLOGY 3 0 0 3

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Elucidate the basic nature of disease processes
2. Classify diseases and apply knowledge of pathology's role in the diagnosis, staging and management of disease
3. Depict theory and practical skills in microscopy and their handling techniques andstaining procedures
4. Distinguish common infectious agents and the diseases that they cause
5. Illustrate the immunological reactions for the disease diagnosis.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	1	1
CO2	1	1	-	-	-	-	-	-	-	-	-	-	1	1
CO3	1	2	-	1	-	-	-	-	-	-	-	-	1	1
CO4	2	1	1	1	1	-	-	-	-	-	-	-	1	1
CO5	1	1	-	1	-	-	-	-	-	-	-	-	1	1

UNIT I CELL INJURY, CELL ADAPTATIONS AND NEOPLASIA 9

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

UNIT II FLUID AND HEMODYNAMIC DISORDERS 9

Edema, thrombosis, embolism, Ischemia, disseminated intravascular coagulation, infarction, shock, chronic venous congestion. Haematological disorders-Bleeding disorders, Leukaemia's, Lymphomas, Haemorrhage

UNIT III MICROBIOLOGY TECHNIQUES 9

Basics in Microbiology, morphology and classification of bacteria, growth pattern, nutritional requirements, identification of bacteria, culture media and its types, culture techniques and observation of culture, Structure and classification of virus and fungi, methods of sterilization of microbes

UNIT IV MICROSCOPY AND INFECTIOUS DISEASES 9

Microscopy: basic principles of light microscopy - bright field, dark field, phase contrast, fluorescence, Electron microscopy- TEM & SEM. Preparation of samples for light and electron microscope. Staining methods -simple stain, gram stain, AFB stain, capsule and spore staining. Disease caused by bacteria, fungi, protozoal, virus and helminthes.

UNIT V IMMUNOPATHOLOGY 9

Types of Immunity; Innate and acquired, cells involved in immune response, types of Hypersensitivity, Auto-immune disorders: Basic concepts and classification, SLE. Immunodeficiency syndrome including HIV infection. Antibodies and its types, antigen and antibody reactions, Immunological Assay: Immune diffusion, Immuno electrophoresis, RIA and ELISA, monoclonal antibodies.

TOTAL: 45 HOURS

TEXT BOOK

1. Mohan and Harsh, Textbook of pathology, New Delhi, Jaypee brother's medical publishers, 2005.
2. Ramzi S Cotran, Vinay Kumar and Stanley L Robbins, Pathologic Basis of Diseases, 7thEdition, WB Saunders Co., 2005.
3. Ananthanarayanan and Panicker, Microbiology, 10th Edition, Orient blackswan, 2017

REFERENCES

1. Underwood JCE, General and Systematic Pathology, 3rd Edition, Churchill Livingstone, 2000.
2. Dubey RC and Maheswari DK., A Text Book of Microbiology, Chand andCompany Ltd, 2007
3. Prescott, Harley and Klein, Microbiology, 10th Edition, McGraw Hill, 2017.

U19BM503 **BIOMECHANICS** **3 0 0 3**

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Illustrate the principles of mechanics
2. Infer the basics of bio fluid mechanics
3. Utilize the mechanical properties of musculoskeletal elements
4. Examine the biomechanics of joints and implants
5. Design the application of biomechanics into modelling

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	2	1	-	-	-	-	-	-	3	1
CO2	3	3	3	3	3	1	-	-	-	-	-	-	3	2
CO3	2	3	3	3	3	1	-	-	-	-	-	-	3	2
CO4	3	3	3	3	3	1	-	-	-	-	-	-	3	2
CO5	3	3	3	3	3	1	-	-	-	-	-	-	3	2

UNIT I INTRODUCTION TO BIOMECHANICS 9

Introduction – Scalars and vectors, Statics –Resolution and composition of forces, Moments, couple, Resultant, equilibrium of coplanar forces, Dynamics – Linear motion, Newton's laws of motion, Velocity and acceleration, Kinematics – Models, Transducers Constitutive equations – Non-viscous fluid, Newtonian Viscous fluid and Hookean Elastic solid

UNIT II BIOMECHANICS OF BIOFLUID 9

Intrinsic fluid properties, Viscometers, Rheological properties of blood, Pressure-flow relationship for Non-Newtonian Fluids, Fluid mechanics in straight tube, Structure of blood vessels, Material properties and modelling of Blood vessels, Heart – Cardiac muscle characterization, Native heart valves, Prosthetic heart valve fluid dynamics.

UNIT III BIOMECHANICS OF MUSCULOSKELETAL SYSTEM 9

Constitutive equation of viscoelasticity – Maxwell, Voight and Kelvin models, anisotropy, Hard Tissues – Structure, viscoelastic properties, functional adaptation, Soft Tissues –

Structure, functions, material properties and modelling of Soft Tissues – Cartilage, Tendons and Ligaments Skeletal Muscle, Bone fracture mechanics, Implants for bone fractures.

UNIT IV BIOMECHANICS OF JOINTS AND IMPLANTS 9

Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, Free body diagrams, Structure of joints, Types of joints, Biomechanical analysis of elbow, shoulder, spinal column, hip, knee and ankle, Lubrication of synovial joints, Gait analysis, Motion analysis using video

UNIT V MODELLING AND ERGONOMICS 9

Introduction to Finite Element Analysis, finite element analysis of lumbar spine; Ergonomics – Musculoskeletal disorders, Ergonomic principles contributing to good workplace design, Design of a Computer work station, Whole body vibrations, Hand transmitted and whole-body vibrations

TOTAL: 45 HOURS

TEXT BOOK

1. Subrata Pal, Textbook of Biomechanics, Viva Books Private Limited, 2009
2. Y.C. Fung, Bio-Mechanics- Mechanical Properties of Tissues, Springer-Verlag,1998.

REFERENCES

1. Sheraz S. Malik and Shahbaz S. Malik, Orthopaedic Biomechanics Made Easy, Cambridge University Press, 2015.
2. Jay D. Humphrey, Sherry De Lange, An Introduction to Biomechanics: Solids and Fluids, Analysis and Design, Springer Science Business Media, 2004.
3. Shrawan Kumar, Biomechanics in Ergonomics, Second Edition, CRC Press 2007.
4. Neil J. Mansfeild, Human Response to Vibration, CRC Press, 2005.
5. Carl J. Payton, Biomechanical Evaluation of movement in sports and Exercise, 2008.
6. Krishna B. Chandran, Ajit P. Yoganathan and Stanley E. Rittgers, BiofluidMechanics: TheHuman Circulation, Taylor and Francis, 2007

U19EC511 MICROPROCESSOR AND EMBEDDED SYSTEM DESIGN 3 0 0 3COURSE OUTCOMES

At the end of the course, the student will be able to

1. Develop assembly language program to solve mathematical problems using 8086.
2. Understand the architecture and addressing modes, of Intel 8051 microcontroller.
3. Design the embedded system application using 8051 microcontroller.
4. Analyze the hardware and software components of embedded system and its designprocess.
5. Develop a real time applications using embedded design process.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	3	3	2	3	3	1	1	2	1	3	3
CO2	1	2	2	3	2	1	2	3	1	1	2	1	3	2
CO3	2	2	3	2	3	1	2	2	1	1	1	1	3	3
CO4	2	2	2	3	2	3	2	3	1	1	2	1	3	2
CO5	2	3	3	3	3	3	3	2	2	3	2	3	3	2

UNIT I MICROPROCESSOR 9

8086 Microprocessor Architecture – Addressing Modes – Instruction Set – Assembly Language Programming

UNIT II MICROCONTROLLER 9

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

UNIT III INTERFACING MICROCONTROLLER 9

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

UNIT IV EMBEDDED SYSTEM AND RTOS CONCEPTS 9

Introduction – Application Areas – Categories of Embedded System – Specialties of Embedded system - Overview of Embedded System Architecture – Hardware Architecture – Software Architecture – Communication Software-Architecture of the Kernel – Task and Task Scheduler – Interrupt Service Routines – Semaphores – Mutex – Mailboxes – Message – Queues – Event Registers– Pipes – Signals –Timers.

UNIT V BIOMEDICAL APPLICATIONS USING EMBEDDED SYSTEM 9

Case Study of an Automatic Mask vending machine using MUCOS RTOS – Case study of blood pressure meter – Case study of pulse Oximeter.

TOTAL: 45 HOURS

TEXT BOOK

1. Soumitra Kumar Mandal , "Microprocessors and Microcontrollers, Architecture, Programming and Interfacing using 8085, 8086 and 8051", McGrawHill Companies,2018.
2. K.V.K.K. Prasad, "Embedded/Real – Time Systems: Concepts, Design & Programming", Reprint Edition,Dreamtech,New Delhi,India,2013.

REFERENCES

1. Douglas V Hall, "Microprocessor and Interfacing : Programming and Interfacing", Edition-3Tata McGrawHill Companies, 2019.
2. A.K. Ray and K.M.Burchandi, "Intel Microprocessors Architecture Programming and Interfacing", McGraw Hill International Edition, 2006.
3. Raj Kamal, "Embedded system : Architecture,Programming and Design", McGraw Hill International,Second Edition, 2010.

U19EC512 DIGITAL SIGNAL PROCESSING LABORATORY 0 0 2 1

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Perform convolution, sampling and FFT operations on signals using MATLAB and DSP Processor
2. Design FIR and IIR filters using MATLAB and DSP Processor
3. Perform arithmetic operations and generate the signals using DSP Processor

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	-	2	-	-	-	-	-	-	-	1	1
CO2	3	2	2	-	2	2	1	-	-	1	1	-	2	3
CO3	3	2	1	1	3	1	-	-	1	-	-	2	2	3

List of Experiments

1. Generation of Discrete time signals
2. Linear and Circular convolution
3. Auto and Cross Correlation
4. Sampling and effect of Aliasing
5. Design of FIR and notch type of Filters
6. Design of IIR Filters
7. Frequency analysis using DFT and FFT
8. Waveform generation of ECG,EEG signals
9. Up sampling and down sampling operations

Using TMS320C54 Processor

1. Arithmetic operations using DSP
2. Sampling of input signal
3. Implementation of FIR and IIR Filters
4. Linear convolution
5. Calculation of FFT
6. Study of TMS320C6748 Processor.

TOTAL: 30 HRS

U19EC513 MICROPROCESSORS AND EMBEDDED SYSTEM DESIGN LABORATORY **0 0 2 1**

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Develop and implement the arithmetic and logical operations using assemblylanguage for 8086 microprocessors
2. Develop and implement the interfacing of peripheral with 8051 microcontrollerusing embedded 'C' programs
3. Develop and implement the sensors interfacing with Arduino development board.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	2	-	-	3	-	-	3	3
CO2	3	3	2	2	2	-	2	-	-	2	-	-	3	2
CO3	3	3	2	2	3	-	2	-	-	3	-	-	3	2

List of Experiments

Experiments based on 8086 microprocessor developed using assembly language

1. 8 bit / 16 bit addition, subtraction, multiplication, division using 8086
2. Logical operations, sorting of numbers, string manipulation using 8086

Experiments based on 89C5X microcontroller developed using Embedded 'C'environment

3. Timers, Serial port and Parallel I/O port access using 89C5X
4. Interfacing of LED, Key switches using 89C5X.
5. Interfacing of 7 Segment display using 89C5X.

Experiments based on Arduino board (UNO, Nano, Node MCU) interfacing

6. Serial data communication using Arduino.
7. Interfacing LED, Key switch, relay, and buzzer.
8. Interfacing Potentiometer, Thermistor, LDR.
9. Interfacing servo motors.
10. I2C devices.
11. IR sensors.
12. Measurement of Bio medical signals.
13. Interfacing WiFi and Blue tooth modules.
14. Data monitoring in cloud using IOT **TOTAL: 30 HRS**

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Illustrate the pathological state of different clinical conditions
2. Describe the staining characteristics of bacteria and differentiate these bacteriaaccording to microscopic morphologies
3. Perform antigen antibody reactions

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	-	-	-	-	-	-	-	-	-	1	-
CO2	1	1	1	1	-	-	-	-	-	-	-	-	1	1
CO3	1	1	1	-	-	-	-	-	-	-	-	-	1	1

List of Experiments

1. Urine analysis (physical and chemical examination)
2. Determination of bleeding time and clotting time
3. Differential count of Blood cells using Leishman's stain
4. Abnormal forms of RBC
5. Haematology slides of anaemia and leukaemia
6. Study of bone marrow charts
7. Histopathological examination of benign and malignant tumours (demonstration)
8. Handling of Microscopes: calibration of Microscopes
9. Test for motility (Hanging drop method)
10. Simple stain test
11. Gram stain test
12. AFB stain test
13. Capsule stain test
14. Isolation of nucleic acids from bacteria (demonstration)
15. Immunodiffusion (antigen –antibody reactions)
16. Enumeration of microorganisms **TOTAL: 30 HRS**

B-E-V Sem
2019-Batch

Semester – V	U19GE501 : SOFT SKILLS AND APTITUDE - III	L	T	P	C	Marks
		0	0	2	1	100

Course Outcomes
At the end of the course the student will be able to:

1. Demonstrate capabilities in supplementary areas of soft-skills and job-related selection processes using hands-on and/or case-study approaches
2. Solve problems of advanced levels than those in SSA-II in specified areas of quantitative aptitude and logical reasoning and score 70-75% marks in company-specific internal tests
3. Demonstrate greater than SSA-II level of verbal aptitude skills in English with regard to given topics and score 70-75% marks in company-specific internal tests

1.SOFT SKILLS

Demonstrating soft-skill capabilities with reference to the following topics:

a. **Career planning:** Importance; Exploring various career options, Field research, Social media management; Process, benefits and limitations of career planning; Mapping SWOT and GOALS to career planning; Self-evaluation

b. **Resume writing :** Build credentials and resume, Positioning yourself and your career, JD mapping, Video resume, Relevant resume phrases and components; Cover letter; Portfolio management and Social media cover

c. **Group discussion :** Skills needed for GD; Frequently Asked topics and Practice; Types of topics; Various framework and tools to handle GD; Practice and assessment

d. **Teamwork :** Definition and importance of team-building; Stages of team-building; Communication within a team; Various styles of teams and their analysis; Activities demonstrating a team

e. **Leadership skills :** Role of a leader; Difference between a manager and a leader; Various Leadership styles; Compelling qualities of a leader; Famous leaders and their impact to the world; Self-assessment

f. **Interview skills :** Process and types of interview; Appearance and grooming etiquette; Do's and Don'ts (Before – During interview); Brainstorming interview possible questions; Hot seat; Transactional Analysis for effective communication and handling interviewers; mock interviews and assessment parameters discussion

g. **Mock interviews :** Frequently Asked Questions practice and assessment; Discussion and demonstrations on Stress and Technical interviews; Group interview

h. **Mock GDs :** Frequently Asked Topics Practice; Assessment and feedback

2.QUANTITATIVE APTITUDE AND LOGICAL REASONING	**Solving problems with reference to the following topics :** a. **Geometry:** 2D, 3D, Coordinate Geometry, and Height & Distance. b. **Permutation & Combinations :** Principles of counting, Circular Arrangements and Derangements. c. **Probability:** Addition & Multiplication Theorems, Conditional Probability and Bayes Theorem. d. **Statistics :** Mean Median, Mode, Range and Standard Deviation. e. **Interest Calculation :**Simple Interest and Compound Interest f. **Crypto arithmetic:** Addition and Multiplication based problem. g. **Logical Reasoning :**Blood Relations, Directions Test, Series, Odd man out, Analogy, Coding & Decoding, Problems and Input – Output Reasoning. h. Statement & Assumptions, Statements & Arguments, Inference. i. **Company Specific Pattern :**Infosys and TCS company specific problems
3. VERBAL APTITUDE	**Demonstrating English language skills with reference to the following topics:** a. Subject verb agreement b. Selecting the best alternative for the stated parts of given sentences c. Reading comprehension d. Contextual synonyms e. Sentence fillers f. Writing a story for a given picture g. Company specific aptitude questions

Dr.S.Anita

Head/Training

Department of Placement Training
Sona College of Technology,
Salem-636 005.

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VI Regulations 2019
Branch: Biomedical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19BM601	Diagnostic and Therapeutic Equipment II	3	0	0	3	45
2	U19BM602	Radiological Equipment	3	0	0	3	45
3	U19BM603	Biosensors and Transducers	3	0	0	3	45
4	U19BM901	**Elective –** Hospital Management System	3	0	0	3	45
	U19BM902	**Elective –** Medical Physics					
	U19BM903	**Elective –** Medical Optics					
5	U19BM904	**Elective –** Biometric System Technology	3	0	0	3	45
	U19BM905	**Elective –** Bio Mems					
	U19BM906	**Elective –** Medical Ethics and Standards					
Open Elective							
6	U19CE1003	Energy Efficiency and Green Building	3	0	0	3	45
	U19EE1002	Energy Conservation and Management					
	U19FT1001	Fundamentals of Fashion Design					
	U19FT1002	Garment Manufacturing Technology					
	U19MC1003	Smart Automation					
Practical							
7	U19BM604	Diagnostic and Therapeutic Equipment Laboratory	0	0	2	1	30
8	U19BM605	Biosensors and Transducers Laboratory	0	0	2	1	30
9	U19BM606	Summer Internship / Summer Project	0	0	2	1	30
10	U19GE601	Soft Skills and Aptitude – IV	0	0	2	1	30
					Total Credits	**22**	

Approved By

Chairman, Biomedical Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.S.Prabakar	Dr.R.Shivakumar	Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/ Biomedical Engineering, Sixth Semester BE BME Students and Staff, COE

U19BM601 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT II L T P C
3 0 0 3

COURSE OUTCOMES

On successful completion of this course, the student will be able to

- Classify the various equipment used in ICU.
- Illustrate the types of diathermies and its applications.
- Infer the basics of critical care equipment and its application in medicine.
- Explain the various extracorporeal and special diagnostic devices used in hospitals.
- Summarize the importance of patient safety against electrical hazard

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CO/PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
Cos	**Programme Outcomes (Pos) and Programme Specific Outcome (PSOs)**														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO1 1**	**PO1 2**	**PS O1**	**PS O2**	**PS O3**
CO1	2	1	1	-	2	-	-	-	1	1	-	-	1	-	-
CO2	1	1	-	1	2	-	-	-	1	-	-	-	-	-	-
CO3	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-
CO4	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-
CO5	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-

UNIT I PATIENT MONITORING AND BIOTELEMETRY 9

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

UNIT II DIATHERMY 9

Introduction to Diathermy – Short wave diathermy, ultrasonic diathermy, Microwave diathermy, Surgical Diathermy- Principle of surgical diathermy, Surgical diathermy machine, Safety Aspects in Electro-Surgical units, Surgical diathermy analyzers.

UNIT III EXTRACORPOREAL DEVICES& SPECIAL CARE TECHNIQUES 9

Need for heart lung machine, functioning of bubble, disc type and membrane type oxygenators, finger pump, roller pump, Anesthesia Machine, Hemo Dialyser unit, Oxygen concentrator – Lithotripsy, Principles of Cryogenic technique and application, Endoscopy, Laparoscopy, Otoscopes.

UNIT IV DENTAL EQUIPMENT 9

Need for Dental care-Dental Patient Chairs, Operatory Cabinetry, Delivery Systems, Dental Operatory Lights, X-ray Imaging Equipment, Sterilization Equipment, Handpieces, Utility Equipment, Specialized equipment's –Intraoral Cameras, introduction to Chairside CAD/CAM Systems, Dental 3D Imaging Systems, Surgical Microscopes, Dental Lasers, Endodontic Equipment, Dental Sleep Medicine Equipment.

UNIT V PATIENT SAFETY 9

Physiological effects of electricity – important susceptibility parameters – Macro shock – Micro shock hazards – Patient's electrical environment – Isolated Power system – Conductive surfaces-Electrical safety codes and standards – IEC 60601-1 2005 standard, Basic Approaches to Protection against shock, Introduction to HVAC system, Electrical safety analyzer – Testing the Electric system.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. John G. Webster, Medical Instrumentation Application and Design, Wiley India Pvt. Ltd, New Delhi, 4th edition, 2015.
2. Joseph J. Carr and John M. Brown, Introduction to Biomedical Equipment Technology, Pearson education, 2012.

REFERENCE BOOKS:

1. Leslie Cromwell, Biomedical Instrumentation and measurement, Prentice Hall of India, New Delhi, 2nd edition, 2015.
2. Richard Aston, Principles of Biomedical Instrumentation and Measurement, Merril Publishing Company, 1990.
3. L.A Geddes and L.E.Baker, Principles of Applied Biomedical Instrumentation, 3rd edition,2008.
4. Myer Kutz, Standard Handbook of Biomedical Engineering and Design, McGraw Hill,2003.
5. Khandpur.R.S, Handbook of Biomedical Instrumentation, Tata McGraw Hill, New Delhi, 3rd edition, 2014.

U19BM602 **RADIOLOGICAL EQUIPMENT** **L T P C**

3 0 0 3

COURSE OUTCOMES

On successful completion of this course, the student will be able to

- Describe the working principle of X-ray machine and its application.
- Illustrate the principle of computed tomography.
- Interpret the technique used for visualizing various sections of the body using MRI
- List the applications of radio nuclide imaging.
- Explain the methods of radiation safety.

CO/PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Cos	**Programme Outcomes (Pos) and Programme Specific Outcome (PSOs)**													
	PO1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	1	3	3	3	-	1	-	-	-	-	1	2	2	-
CO2	3	1	3	3	3	-	1	-	-	-	-	1	2	2	-
CO3	3	1	3	3	3	-	1	-	-	-	-	1	2	2	-
CO4	3	1	3	3	3	-	1	-	-	-	-	1	2	2	-
CO5	3	1	3	3	3	-	1	-	-	-	-	1	2	2	2

UNITI MEDICAL X-RAY EQUIPMENT 9

Nature of X-rays- X-Ray absorption – X- Ray Equipment – X-Ray Tube, collimator, Bucky Grid, power supply, Digital Radiography- discrete digital detectors, storage phosphor and film scanning, X-ray Image Intensifier tubes – Fluoroscopy –Digital Fluoroscopy, Angiography- cineangiography, Digital subtraction Angiography, Mammography.

UNITII COMPUTED TOMOGRAPHY 9

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

UNITIII MAGNETIC RESONANCE IMAGING 9

Fundamentals of magnetic resonance- - rotation and precession – Relaxation processes T1 and T2, Instrumentation of MRI system-System magnet (Permanent, Electro magnet and Super conductors), generations of gradient magnetic fields, Radio Frequency coils, shim coils, Principle of Fmri and DTI.

UNITIV NUCLEAR MEDICINE SYSTEM 9

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

UNITV RADIATION THERAPY AND RADIATION SAFETY 9

Radiation therapy- Effects of Radiation- linear accelerator, Tele gamma Machine– stereotactic radiotherapy, 3D conformal radiation therapy – Intensity-Modulated Radiation Therapy – Image-Guided Radiation Therapy, Brachy therapy and Gamma knife- Dosimeter- film badges, Thermo Luminescent dosimeters- electronic dosimeter-Radiation protection in medicine-radiation protection principles-ICRP.

TOTAL:45PERIODS

TEXTBOOKS:

1. Willam R Hendee and Russell Ritenour, Medical Imaging Physics, Wiley-Liss, Fourth Edition 2002.
2. Paul Suetens, Fundamentals of Medical Imaging, Second Edition, Cambridge university press, Second Edition2009.

REFERENCEBOOKS

1. Steve Webb,The Physics of Medical Imaging, Adam Hilger,Philadelpia,1988
2. Gopal B.Saha, Physics and Radio biology of Nuclear Medicine, Springer, Third edition, 2006.
3. B.H.Brown, PV Lawford, RHSmall wood, DRHose, DCBarber,Medical physics and biomedical Engineering, -CRC Press, 1999.
4. MyerKutz,Standard hand book of Biomedical Engineering and design,McGrawHill,2003.

U19BM603 BIOSENSORS AND TRANSDUCERS L T P C

3 0 0 3

COURSE OUTCOMES:

At the end of the course learners will be able to

- Describe the purpose and methods of measurements
- Classify the Biomedical Sensors and Transducers.
- Interpret about the Photoelectric and Piezoelectric Transducers
- Describe the principle and components of Biosensors.
- Explain the principles of Biochemical sensors.

CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	-	-	-	-	-	-	-	-	-	1	1	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	1	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	1	
CO4	3	2	2	-	-	-	-	-	-	-	-	1	1	-	-
CO5	3	2	2	-	2	2	-	-	-	-	-	1	2	2	2

UNIT I SCIENCE OF MEASUREMENT 9

Measurement System–Instrumentation–Classification and Characteristics of Transducers– Static and Dynamic– Errors in Measurements– Calibration–Primary and secondary standards

UNIT II DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS 9

Strain Gauge: Gauge factor, Types of strain gauges - Biomedical applications, strain gauge as displacement & pressure transducers. Active type: Thermocouple–biomedical applications. LVDT, Capacitive transducer, Inductive transducer. Passive types: Thermo Resistive- Resistance Temperature Detectors (RTD), Thermistor, biomedical applications.

UNIT III PHOTOELECTRIC AND PIEZOELECTRIC TRANSDUCERS 9

Phototube, scintillation counter, Photo Multiplier Tube (PMT), photovoltaic, Photoconductive cells, photo diodes, phototransistor, Spectrophotometry. Piezoelectric transducers- modes of operation of piezoelectric crystals- uses of piezoelectric materials and transducers, biomedical applications as ultrasound transducers.

UNIT IV INTRODUCTION TO BIOSENSOR 9

Basic principle and Components of a biosensor, Molecular recognition, Classification of biosensors based on transducers, Piezoelectric biosensors, Magneto elastic biosensors, Field effect transistor-based biosensor, Calorimetric biosensor, Non-invasive biosensors

UNIT V CHEMICAL BIOSENSORS 9

Electrochemical techniques and Characteristics, Ionization transducers, electrochemical transducers, Membranes used in biosensors for selectivity, Enzymatic biosensors, Biomarkers for diagnosis of diseases, Glucose oxidase-based glucose biosensors for diabetes: Non-invasive and Implantable glucose biosensors. Biomedical applications of enzyme biosensors.

TOTAL: 45 PERIODS

TEXTBOOKS

1. A.K.Sawhney,"Electrical & Electronics Measurement and Instrumentation",10th edition,

Dhanpat Rai & Co,NewDelhi,2010.

2. Principles of Applied Biomedical Instrumentation L.A Geddas and L.E.Baker – John

Wiley and sons.

3.Chandran Karunakaran Kalpana Bhargava Robson Benjamin,Biosensors and Bioelectronics, 1st Edition, Hardcover ISBN: 9780128031001, Imprint: Elsevier , Published Date: 29th July 2015.

REFERENCES

1. Ernest O Doebelin and Dhanesh N Manik, Measurement systems, Application and design, 5th edition, Mc Graw-Hill,2007.
2. Keith Brindley, Sensors & Transducers, Heinemann Newnes, Great Britain, 1988 Harry Thomas , Handbook of Bio medical Instrumentation, Reston, Virginia 2000
3. Xueji Zhan , Electrochemical Sensors, Biosensors and their Biomedical Applications 1st Edition
4. L.A Geddas and L.E.Baker, "Principles of Applied Biomedical Instrumentation", John
5. Wiley and Sons, Third Edition, Reprint 2008.
6. Albert D. Helfrick and William D.Cooper. "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.

U19BM905 **BIOMEMS** **L T P C**
3 0 0 3

COURSE OUTCOMES:

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

- Describe the basics of MEMS and Micro systems.
- Illustrate the manufacturing and fabrication of micro systems.
- Explain the functions, properties of sensors and actuators
- Infer about the Microfluidic systems and its applications
- Apply the knowledge of MEMS in Biomedical Engineering.

CO/PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (POs) and Programme Specific Outcome (PSOs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO1 1**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	3	3	3	-	-	-	-	-	-	1	3	2	-
CO2	3	3	3	3	3	-	-	-	-	-	-	1	3	2	-
CO3	3	3	3	3	3	-	-	-	-	-	-	1	3	2	-
CO4	3	3	3	3	3	-	-	-	-	-	-	1	3	2	-
CO5	3	3	3	3	3	1	-	-	-	-	-	1	3	2	1

UNIT I INTRODUCTION TO MEMS 9

Introduction-MEMS and Microsystems, Microsystem products. Principles of Micro systems- Microsensors - acoustic wave sensors, chemical sensors, optical sensors, Pressure sensors, thermal sensors, Microactuation, MEMS with Microactuators, Microaccelerometers, Microfludics. Micro system design and fabrication- Ion and Ionization, Electrochemistry.

UNIT II MICRO FABRICATION 9

Silicon Micro fabrication: Lithography. Etching Methods, Thin-Film Deposition Processes, Ion Implantation, Wet-Bulk Surface Micromachining, Dry-Bulk Surface Micromachining. Electroplating, Substrate Bonding. Soft Fabrication Techniques: Soft Lithography, Micro molding, Three-Dimensional Photo polymerization, Smart Polymers and Hydrogels. Surface micro machining, Coating technology and CVD, LIGA process.

UNIT III MICROSENSORS AND ACTUATORS 9

Mechanics for MEMS design- static bending of thin plates, mechanical vibration, thermo mechanics, fracture and thin film mechanics. Mechanical sensors and actuators – beam and cantilever – micro plates, strain, pressure and flow measurements, Thermal sensors and actuators- actuator based on thermal expansion, thermal couples, thermal resistor, Shape memory alloys- Inertia sensor, flow sensor.

UNIT IV MICROFLUIDIC SYSTEMS 9

Fluid dynamics, continuity equation, momentum equation, equation of motion, laminar flow in circular conduits, fluid flow in micro conduits, in sub micrometer and nanoscale. Microscale fluid, expression for liquid flow in a channel. Fluid actuation methods- electro wetting, thermocapillary effect, electro osmosis, dielectrophoresis. Microfluid dispenser, microneedle, micro pumps-continuous flow system, micromixers

UNIT V APPLICATIONS OF MEMS IN MEDICINE 9

Minimally Invasive Surgery, Point-of-Care Clinical Diagnosis, Cardiovascular, Diabetes, Endoscopy, Neurosciences, Oncology, Ophthalmology, Dermabrasion, Tissue Engineering, Cell-Based Biosensors, Homeland Security, CAD for MEMs, MEMS based drug delivery, micro total analysis systems (MicroTAS) detection and measurement methods, electronic nose.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Tai- Ran Hsu "MEMS & Microsystems design and manufacture", Tata McGraw- Hill, New Delhi, 2007.
2. Wanjun Wang, Steven A.Soper" BioMEMS – Technologies and applications", CRCPress, Boca Raton,2007.
3. Abraham P. Lee and James L. Lee, BioMEMS and Biomedical Nano Technology,Volume I, Springer 2006.

REFERENCES:

1. P.Rai- Choudhury " MEMS and MOEMS Technology and Applications", PHI Learning , New delhi, 2000.
2. NitaigourPremchandMahalik, " MEMS", Tata McGraw Hill Publishing Company,NewDelhi, 2007
3. Chang Liu, " Foundations of MEMS", Pearson Education International, New Jersey, USA, 2nd Edition, 2011.

U19BM904 **BIOMETRIC SYSTEM TECHNOLOGY** **L T P C**

3 0 0 3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Explain the principles of different biometric systems.
- Design the fingerprint biometric technology.
- Illustrate the face biometric system technology.
- Classify the Different voice scan techniques.
- Analyze the fusion in multi-biometric system technology.

CO/PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes (POs) and Programme Specific Outcome (PSOs)**														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	-	-	2	-	-	-	-	-	-	1	2	2	-
CO2	3	3	-	2	2	-	-	-	-	-	-	2	2	2	3
CO3	3	3	-	2	2	-	-	-	-	-	-	2	2	2	3
CO4	3	3	-	2	2	-	-	-	-	-	-	2	2	2	3
CO5	3	3	-	-	-	-	-	-	-	-	-	2	2	2	3

UNITI INTRODUCTION TO BIOMETRICS 9

Introduction and background –biometric technologies–passive & active biometrics-Biometrics Vs traditional techniques– Operation and Benefits of a biometric system–Key biometric processes: verification, identification and matching–Performance measures in biometric systems: FAR, FRR, FTE, FTA - Need for strong authentication – Protecting privacy and biometrics and policy–Biometric applications.

UNITII FINGERPRINT IDENTIFICATION TECHNOLOGY 9

Fingerprint Patterns, Fingerprint Features, Fingerprint Image, width between ridges-Fingerprint Image Processing - Minutiae Determination - Fingerprint Matching: Fingerprint Classification, Matching policies.

UNITIII FACE RECOGNITION TECHNIQUES 9

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

UNITIV VOICE SCAN TECHNIQUES 9

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

UNITV FUSION IN BIOMETRICS 9

Introduction to Multi biometric - Information Fusion in Biometrics - Issues in Designing a Multi biometric System-Sources of Multiple Evidence- Levels of Fusion in Biometrics-Sensor level, Feature level, Rank level, Decision level fusion - Score level Fusion. Examples – bio potential and gait based biometric systems.

TOTAL:45PERIODS

TEXTBOOKS:

1. James Wayman, Anil Jain, Davide Maltoni and Dario Maio, Biometric Systems, Technology Design and Performance Evaluation, Springer,2005.
2. David D.Zhang, Automated Biometrics: Technologies and Systems, Kluwer Academic Publishers, New Delhi,2000.
3. Arun A.Ross, Karthik Nanda kumar and JainA K, Handbook of Multi biometrics, Springer, NewDelhi,2006.

REFERENCEBOOKS:

1. Paul Reid, Biometrics for Network Security, Pearson Education,2004.
2. Nalini K Ratha and Ruud Bolle,Automatic fingerprint Recognition System,Springer,2003
3. JainL.C,Hayashi I, LeeS.B and Halici U, Intelligent Biometric Techniques in Fingerprint and Face Recognition, CRC Press, 1999.
4. John Chirillo and Scott Blaul, ImplementingBiometricSecurity,JohnWiley,2003.
5. Kung S.Y, Lin H.S and Mak Webometric Authentication: A Machine Learning Approach, Prentice Hall,2005.

U19BM901 **HOSPITAL MANAGEMENT SYSTEM** **L T P C**

3 0 0 3

COURSE OUTCOMES:

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

- Describe the basics of Hospital Management.
- Illustrate the knowledge of Human resource management and marketing in hospitals.
- Apply various Quantitative methods in healthcare management.
- Amalgamate their knowledge in Hospital information system and supportive services.
- Explain the quality and safety aspects in Hospital.

CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1			3		2	3	3					1			3
CO2			3		2	3	3					1			3
CO3			3			3	3					1			3
CO4			3		3	2						1			3
CO5			3			3	3	3				1			3

UNIT I INTRODUCTION TO HOSPITAL ADMINISTRATION 9

Distinction between Hospital and Industry, Challenges in Hospital Administration, Hospital Planning, Equipment Planning, Functional Planning, Current Issues in Hospital Management, Telemedicine, Bio-Medical Waste Management, Role of Manager, Leadership, Motivation, Organizational behaviour, Strategic planning, Ethics and Law, Fraud and abuse.

UNIT II HUMAN RESOURCE MANAGEMENT AND MARKETING 9

Principles of HRM, Functions of HRM, Profile of HRD Manager, Tools of HRD, Human Resource Inventory, Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines, Methods of Training, Evaluation of Training, Leadership grooming and Training, Promotion, Transfer, Quality Improvements, Managing healthcare professionals.

UNIT III QUANTITATIVE METHODS IN HEALTHCARE MANAGEMENT 9

Introduction to quantitative decision making methods in healthcare management, Forecasting, Decision making in healthcare facilities, Facility location, Facility layout, Reengineering, Staffing, Scheduling, Productivity, Resource allocation, Supply chain and inventory management, Quality Control, Project Management, Queuing models and capacity planning.

UNIT IV HOSPITAL INFORMATION SYSTEM AND SUPPORTIVE SERVICES 9

Management Decisions and Related Information Requirement, Clinical Information Systems, Administrative Information Systems, Support Service Technical Information Systems, Medical Transcription, Medical Records Department, Central Sterilization and Supply Department – Pharmacy, Food Services, Laundry Services.

UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL MANAGEMENT 9

Quality system, Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004. Features of ISO 9001, ISO 14000, Environment Management Systems. NABA, JCI, NABL. Security, Loss Prevention, Fire Safety, Alarm System, Safety Rules. Health Insurance & Managing Healthcare, Managing costs and revenues. Medical Audit, Hazard and Safety in a hospital Setup.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R.C. Goyal, Hospital Administration and Human Resource Management, PHI, 4th Edition, 2006.
2. G.D. Kunders, Hospitals – Facilities Planning and Management, TMH, New Delhi, 5th Reprint, 2007.

REFERENCE BOOKS:

1. Sharon B. Buchbinder and Nancy H. Shanks, Introduction to Healthcare Management, Jones and Bartlett Learning, 2017
2. Blane, David, Brunner, Health and SOCIAL Organization: Towards a Health Policy for the 21st Century, Eric Calrendon Press, 2002.
3. Yasar A. Ozcan, Quantitative Methods in Healthcare management, Jossey Bass- John Wiley and Sons, 2009.

U19BM906 MEDICAL ETHICS AND STANDARDS L T P C
3 0 0 3

COURSE OUTCOMES:

On completion of this course the student will be able to:

- Describe the Social responsibilities in healthcare systems.
- Summarize about the Bioethics.
- Apply the Legal and professional guidelines for the hospital accreditation.
- Evaluate the hospital safety aspects.
- Categorize the medical equipment safety standards.

CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						3	2	3	2			1			2
CO2						3	2	3	2			1			2
CO3			2			3	2	3	2			1			2
CO4			2			3	2	3	2			1			2
CO5			2			3	2	3	2			1			2

UNIT I INTRODUCTION TO MEDICAL ETHICS 9

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

UNIT II ETHICAL THEORIES & MORAL PRINCIPLES 9

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

UNITIII HOSPITAL ACCREDITATION STANDRADS 9

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

UNIT IV HOSPITAL SAFETY STANDARDS 9

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-Smoking Prohibitions, Managing Hazardous Material and Waste, Maintaining Fire Safety Equipment, Features, Testing, Maintaining, and Inspecting Medical Equipment.

UNIT V MEDICAL EQUIPMENT SAFETY STANDARDS 9

General requirements for basic safety & essential performance of medical equipment. IEC 60601 standards, Indian and International standards, ISO standards - Base Standard- general requirement of electrical medical devices, Collateral Standards.

TOTAL: 45 PERIODS

TEXT BOOK(S):

1. Domiel A Vallero, Biomedical Ethics for Engineers, Elsevier Pub.1st edition,2007
2. Johnna Fisher, Biomedical Ethics: A Canadian Focus., Oxford University Press Canada,2009.

REFERENCES:

1. Robert M Veatch, The Basics of Bio Ethics, 3rd Edition. Routledge,2011.
2. Physical Environment Online: A Guide to The Joint Commission's Safety Standards is published by HCPro, Inc.2010
3. Joint Commission Accreditation Standards for Hospitals, 6th Edition2018.
4. Ben Mepham, Bioethics-An Introduction for the biosciences, 2nd Edition, Oxford University Press,2008.

U19BM903 **MEDICAL OPTICS** **L T P C**

3 0 0 3

COURSE OUTCOMES:

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

- Review the principles in photonics.
- Infer the fundamentals of optical properties of tissues.
- Apply the laser principles in surgery.
- Classify the photonics and diagnostic applications.
- Apply the concepts of laser in therapeutic applications.

CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PS O1	PS O2	PS O3
CO1	3	2	3	2								1	3	2	
CO2	3	2	3	2								1	3	2	
CO3	3	2	3	2	2	2		1				1	3	2	1
CO4	3	2	3	2	2	1		1				1	3	2	1
CO5	3	2	3	2	2	1		1				1	3	2	1

UNIT I INSTRUMENTATION IN PHOTONIC **9**

Review of basic properties of light – Snell's Law, Reflection, Refraction, Scattering, fluorescence and phosphorescence. Instrumentation for absorption, Scattering and emission measurements, excitation light sources – high pressure arc lamp, LEDs, Lasers. Optical filters. Optical detectors - Time resolved and phase resolved detectors, optical tweezers.

UNIT II OPTICAL PROPERTIES OF THE TISSUES **9**

Light transport inside the tissue, optical properties of tissue. Laser Characteristics as applied to medicine and biology-Laser tissue Interaction-Chemical, Thermal, Electromechanical. Photo ablative processes.

UNIT III SURGICAL APPLICATIONS OF LASER **9**

Lasers in ophthalmology- Dermatology -Dentistry-Urology-Otolaryngology- Tissue welding- Laser Safety Procedures.

UNIT IV NON-THERMAL DIAGNOSTIC APPLICATIONS 9

Optical coherence tomography, Elastography, Laser Induced Fluorescence (LIF)-Imaging, FLIM Raman Spectroscopy and Imaging, FLIM - Holographic and speckle application of lasers in biology and medicine.

UNIT V THERAPEUTIC APPLICATIONS 9

Phototherapy, Photodynamic therapy (PDT) - Principle and mechanism - Oncological and non- oncological applications of PDT – Bio-stimulation effect – applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Markolf H.Niemz, "Laser-Tissue Interaction Fundamentals and Applications", Springer, 2007.
2. Paras N. Prasad, "Introduction to Bio photonics", A. John Wiley and sons, Inc. Publications, 2003.

REFERENCES:

1. Tuan Vo Dinh, "Biomedical photonics – Handbook", CRC Press LLC, 2003.
2. Mark E. Brezinski, "Optical Coherence Tomography: Principles and Applications", Academic Press, 2006.
3. R. Splinter and B.A. Hooper, "An Introduction to Biomedical Optics", Taylor and Francis, 2007.
4. Helena Jelinkova, "Lasers for Medical Applications: Diagnostics, Therapy and Surgery'',Woodhead Publishing, 1st Edition, 2013.

U19BM902 **MEDICAL PHYSICS** **L T P C**

3 0 0 3

COURSE OUTCOMES:

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

- Outline about non-ionizing radiation, interaction with tissue and its effects.
- Compare the sensory stimuli intensities.
- Analyze how ionizing radiation interacts with the human body.
- Identify the fundamentals of radioactivity and radioactive isotopes.
- Classify the different methods of radiation detectors.

CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	1	1	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-

UNIT I NON-IONIZING RADIATION AND ITS MEDICAL APPLICATIONS 9

Introduction and objectives - Tissue as a leaky dielectric - Relaxation processes, Debye model, Cole-Cole model, Overview of non-ionizing radiation effects-Low Frequency Effects- Higher frequency effects. Physics of light, Measurement of light and its unit- limits of vision and color vision an overview, Ultraviolet.

UNIT II PHYSICS OF THE SENSES 9

Introduction and objectives - Cutaneous sensation - The chemical senses -Audition -Vision -Psychophysics

UNIT III PRINCIPLES OF RADIOACTIVE NUCLIDES Radioactive Decay – Spontaneous Emission – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology ,Decay series, Production of radio nuclides -Cyclotron produced Radionuclide- Reactor produced Radio- nuclide-fission and electron Capture reaction, Target and Its Processing Equation for Production of Radio nuclides, radio nuclide Generator -Technetium generator.

UNIT IV RADIOACTIVE DECAY AND INTERACTION OF RADIATION WITH MATTER 9

Spontaneous Fission- Isomeric Transition-Alpha Decay-Beta Decay-Positron Decay-Electron Capture-Interaction of charged particles with matter-Specific ionization, Linear energy transfer range, Brems-strahlung, Annihilation, Interaction of X and Gamma radiation with matter, Photoelectric effect, Compton Scattering, Pair production, Attenuation of Gamma Radiation Interaction of neutron with matter and their clinical significance.

UNIT V SCINTILLATION, SEMICONDUCTOR AND GAS FILLED DETECTORS

9

Scintillation Detectors - Solid Scintillation Counters - Gamma-Ray Spectrometry-Liquid Scintillation Counters-Characteristics of Counting Systems-Gamma Well Counters-Thyroid Probe-Principles of Gas-Filled Detectors - Ionization Chambers-Geiger–Muller Counters

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gopal B. Saha, Physics and Radiobiology of Nuclear Medicine, 4th Edition, Springer, 2013.
2. B H Brown, R H Smallwood, D C Barber, P V Lawford and D R Hose, ―Medical Physics and Biomedical Engineering, 2nd Edition, IOP Publishers.2001.

REFERENCES:

1. S.Webb ― The Physics of Medical Imaging, Taylor and Francis, 1988
2. J.P.Woodcock, ―Ultrasonic,Medical Physics Handbook series 1, Adam Hilger, Bristol, 2002
3. HyltonB.Meire and Pat Farrant ―Basic Ultrasound John Wiley & Sons, 1995

U19BM605 BIOSENSORS AND TRANSDUCERS LABORATORY **L T P C**
0 0 2 1

COURSE OUTCOMES:

After completion of this course the students will be able to

- Evaluate the performance of temperature, pressure, displacement & torque - measurement using relevant sensors/transducers.
- Demonstrate the characteristics of an LDR, load cell & pH electrodes.
- Infer the characteristics of Biosensors and transducers.

CO/PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes (POs) and Programme Specific Outcome (PSOs)**														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO1 1**	**PO1 2**	**PS O1**	**PS O2**	**PS O3**
CO1	3		2									2		2	
CO2	3		2									2		2	
CO3	3	3	2			2						2		2	

List of Experiments:

1. Temperature measurement using AD590 IC sensor
2. Displacement measurement by using a capacitive transducer
3. Experiment on optical Transducers- LDR, LED, Photo Transistors
4. Pressure and displacement measurement by using LVDT
5. Tensile and compressive Load Measurement using Load Cell
6. Torque measurement using Strain gauge
7. Characteristics Study of Bio transducers – Pressure, Temperature, Humidity
8. Characteristics Study of Bio electrodes – ECG, EMG, EEG
9. Study & Characterization of pH electrodes.
10. Measurement of Blood Glucose Level
11. Study of PCR Kit
12. Study of Gas Sensors

U19BM604 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LAB **L T P C**
0 0 2 1

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Measure the different bioelectrical signals.
- Analyze the various physiological signals using telemetry.
- Demonstrate various diagnostic and therapeutic techniques.

CO/PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2									2		2	
CO2	3		2									2		2	
CO3	3	3	2			2						2		2	

LIST OF EXPERIMENTS:

1. Measurement of visually and auditory evoked potential
2. Galvanic skin resistance (GSR) measurement
3. Measurement of output intensity from shortwave and ultrasonic diathermy
4. Measurement of various physiological signals using biotelemetry
5. Electrical safety measurements
6. Measurement of stimulation current waveforms used in medical stimulator
7. Analyze the working of ESU–cutting and coagulation modes
8. Study the working of Defibrillator and pacemakers
9. Study of ECG, EEG and EMG electrodes.
10. Study of ventilators and Ultrasound Scanners
11. Study of speech signals using speech signal trainer kit.
12. Measurement of Oxygen Saturation and Heart Rate using Pulse-oximeter

TOTAL: 30 PERIODS

Semester –VI	U19GE601-SOFT SKILLS AND APTITUDE – IV (Common to All except Civil)	L	T	P	C	Marks
		0	0	2	1	100

Course Outcomes

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

1. Demonstrate capabilities in job-oriented company selection processes using the hands-on approach
2. Solve problems of any given level of complexity in all areas of quantitative aptitude and logical reasoning and score 70-75% marks in company-specific internal tests
3. Demonstrate advanced-level verbal aptitude skills in English and score 70-75% marks in company-specific internal tests

1. Soft Skills	**Demonstrating Soft -Skills capabilities with reference to the following topics:** a. Mock group discussions b. Mock interviews c. Mock stress interviews
2. Quantitative Aptitude and Logical Reasoning	**Solving problems with reference to the following topics:** a. Functions and Polynomials b. Clocks and Calendars c. Data Sufficiency: Introductions, 3 Options Data Sufficiency, 4 Options Data Sufficiency and 5 Options Data Sufficiency. d. Logical reasoning: Cubes, Non Verbal reasoning and Symbol based Reasoning. e. Decision making table and Flowchart Campus recruitment papers: Solving of previous year questions paper of all major recruiters f. Miscellaneous: Cognitive gaming Puzzles-(Picture, Word and Number based), IQ Puzzles, Calculation Techniques and Time Management Strategies. g. Trigonometry.- Concepts
3. Verbal Aptitude	**Demonstrating English language skills with reference to the following topics:** a. Writing captions for given pictures b. Reading comprehension c. Critical reasoning d. Theme detection e. Jumbled sentences f. Writing a story on given pictures g. Company specific verbal questions

Dr.S.Anita

Head/Training

Department of Placement Training

BME

U19BM1001 **HOSPITAL MANAGEMENT** **L T P C**

3 0 0 3

COURSE OUTCOMES:

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

- Describe the basics of Hospital Management.
- Illustrate the knowledge of Human resource management and marketing in hospitals.
- Apply various Quantitative methods in healthcare management.
- Amalgamate their knowledge in Hospital information system and supportive services.
- Explain the quality and safety aspects in Hospital.

CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12	PSO 1	PSO 2	PSO 3
CO1			3		2	3	3					1			3
CO2			3		2	3	3					1			3
CO3			3			3	3					1			3
CO4			3		3	2						1			3
CO5			3			3	3	3				1			3

UNIT I **INTRODUCTION TO HOSPITAL ADMINISTRATION** **9**

Distinction between Hospital and Industry, Challenges in Hospital Administration, Hospital Planning, Equipment Planning, Functional Planning, Current Issues in Hospital Management, Role of Manager, Leadership, Motivation, Organizational behaviour, Strategic planning, Ethics and Law, Fraud and abuse.

UNIT II **HUMAN RESOURCE MANAGEMENT AND MARKETING** **9**

Principles of HRM, Functions of HRM, Profile of HRD Manager, Tools of HRD, Human Resource Inventory, Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines, Methods of Training, Leadership grooming and Training, Promotion, Transfer.

UNIT III QUANTITATIVE METHODS IN HEALTHCARE MANAGEMENT 9

Introduction to quantitative decision-making methods in healthcare management, Forecasting, Decision making in healthcare facilities, Facility location, Facility layout, Reengineering, Staffing, Scheduling, Productivity, Resource allocation, Supply chain and inventory management, Quality Control, Project Management, Queuing models and capacity planning.

UNIT IV HOSPITAL INFORMATION SYSTEM AND SUPPORTIVE SERVICES 9

Clinical Information Systems, Administrative Information Systems, Support Service Technical Information Systems, Medical Records Department, Central Sterilization and Supply Department – Pharmacy, Food Services, Laundry Services, Telemedicine.

UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL MANAGEMENT 9

Quality system, Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004. Features of ISO 9001, ISO 14000, Environment Management Systems. NABA, JCI, NABL. Security, Loss Prevention, Fire Safety, Alarm System, Safety Rules.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. 1.R.C. Goyal, Hospital Administration and Human Resource Management, PHI, 4th Edition, 2006.
2. 2.G.D. Kunders, Hospitals – Facilities Planning and Management, TMH, New Delhi, 5th Reprint, 2007.

REFERENCE BOOKS:

1. 1.Sharon B. Buchbinder and Nancy H. Shanks, Introduction to Healthcare Management, Jones and Bartlett Learning, 2017
2. 2.Blane, David, Brunner, Health and SOCIAL Organization: Towards a Health Policy for the 21st Century, Eric Calrendon Press, 2002.
3. 3.Yasar A. Ozcan, Quantitative Methods in Healthcare management, Jossey Bass- John Wiley and Sons, 2009.

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VII Regulations 2019
Branch: Biomedical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19BM701	Medical Image Processing	3	0	0	3	45
2	U19BM702	AI in Health and Medicine	3	0	0	3	45
3	U19BM907	**Professional Elective** – Biomedical waste Management	3	0	0	3	45
4	U19BM908	**Professional Elective –** Assist Devices	3	0	0	3	45
5	U19BM909	**Professional Elective** – Rehabilitation Engineering	3	0	0	3	45
6	U19CE1004	**Open Elective –** Disaster Management	3	0	0	3	45
	U19CS1002	**Open Elective –** Cloud Computing					
	U19EE1001	**Open Elective –** Electric Mobility					
	U19EE1003	**Open Elective –** Innovation, IPR and Entrepreneurship Development					
	U19EE1004	**Open Elective –** Renewable Energy Systems					
	U19EE1005	**Open Elective –** Electrification in Building Construction					
	U19FT1001	**Open Elective –** Fundamentals of Fashion Design					
	U19MC1004	**Open Elective –** Fundamentals of Robotics					
Practical							
7	U19BM703	Medical Image Processing Laboratory	0	0	2	1	30
8	U19BM704	AI in Medicine Laboratory	0	0	2	1	30
9	U19BM705	Hospital Training	0	0	2	1	30
					Total Credits	**21**	

Approved By

Chairman, Biomedical Engineering BoS **Member Secretary, Academic Council** **Chairperson, Academic Council & Principal**
Dr.S.Prabakar **Dr.R.Shivakumar** **Dr.S.R.R.Senthil Kumar**

Copy to:-
HOD/ Biomedical Engineering, Seventh Semester BE BME Students and Staff, COE

U19BM701 **MEDICAL IMAGE PROCESSING** **L T P C**
3 0 0 3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Discuss the Fundamentals of Medical Image Processing.
- Classify the various Intensity Transformation and Filtering Methods.
- Explain about the Image Segmentation and Restoration.
- Summarize the Registration and Visualisation process in Medical Image
- Illustrate the Image Compression and Retrieval techniques.

CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes (Pos) and Programme Specific Outcome (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	3	-	-	-	-	-	1	1	3	2	-
CO2	3	2	1	3	3	-	-	-	-	-	2	2	3	3	-
CO3	3	2	1	3	3	-	-	-	-	-	2	2	3	3	-
CO4	3	2	1	3	3	-	-	-	-	-	2	2	3	3	-
CO5	3	2	1	3	3	-	-	-	-	-	2	2	3	3	-

UNIT I FUNDAMENTALS OF MEDICAL IMAGE PROCESSING AND TRANSFORMS9

Overview of Image Processing system and human Visual system, Image representation – pixel and voxels, Gray scale and color models, Medical image file formats- DICOM, ANALYZE 7.5, NIFTI and INTERFILE, Discrete sampling model and Quantization, Relationship between the pixels, Arithmetic and logical operations, Image quality and Signal to Noise ratio, Image Transforms- 2D DFT, DCT, KLT.

UNIT II INTENSITY TRANSFORMATION AND FILTERING 9

Gray level transformation- Log transformation, Power law transformation, Piece wise linear transformation. Histogram processing- Histogram equalization, Histogram Matching, Spatial domain Filtering-Smoothing filters, sharpening filters, Frequency domain filtering- Smoothing filters, Sharpening filters, Homomorphic filtering. Medical image enhancement with Hybrid filters.

UNIT III IMAGE SEGMENTATION ANDRESTORATION 9

ROI definition -Detection of discontinuities–Edge linking and boundary detection – Region based segmentation- Morphological processing, Active contour models. Image Restoration- Noise models– Restoration in the presence of Noise – spatial filtering, Periodic noise reduction by frequency domain filtering, linear position- Invariant degradation, Estimation of degradation function, Inverse filter-Weiner filtering-Geometric transformation.

UNIT IV REGISTRATION AND VISUALISATION 9

Feature representation and description, Registration–Rigid body transformation, principal axes registration, and feature based. Visualisation-Orthogonal and perspective projection in medicine, Surface based rendering, Volume visualisation in medicine.

UNIT V IMAGE COMPRESSION AND RETRIEVAL 9

Image compression: Introduction- Image compression models, Error free compression, Lossy compression methods, and Image compression standards - JPEG, Medical image Archive and retrieval system, Quality evaluation of compressed medical images.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Pearson Education,3rd edition, 2016.
2. Wolfgang Birkfellner, Applied Medical Image Processing: A Basic course, CRC Press, 2011.

REFERENCE BOOKS:

1. Isaac N. Bankman, Handbook of Medical Image Processing and Analysis, 2nd Edition, Elsevier, 2009.
2. AtamP.Dhawan, Medical Image Analysis, Wiley-Interscience Publication, NJ, USA 2003.
3. Milan Sonka, Image Processing, Analysis And Machine Vision, Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.
4. Anil Jain K, Fundamentals of Digital Image Processing, PHI Learning Pvt. Ltd., 2011.
5. Willliam K Pratt, Digital Image Processing, John Willey, 2002.

U19BM702 AI IN HEALTH AND MEDICINE L T P C

3 0 0 3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Classify the models of Artificial intelligence
- Describe the collection of Decision-making models in AI.
- Identify the appropriate computational tools in biomedicine.
- Analyse the performance of specific models as applied to biomedical problems
- Interpret the ethics in artificial intelligence

CO/PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes (Pos) and Programme Specific Outcome (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	-	-	-	-	2	2	2	-
CO2	3	3	1	1	2	-	-	-	-	-	-	2	2	2	-
CO3	3	3	-	1	2	-	-	-	-	-	-	2	2	2	-
CO4	3	3	2	2	2	-	-	-	-	-	-	2	2	2	-
CO5	3	3	2	1	-	1	-	1	-	-	-	2	2	2	2

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9

Philosophical foundations of AI: History, Computational models of Intelligence. Intelligent agents - Agent based system. Review of relevant mathematical and statistical concepts: logarithmic loss, cross entropy optimizing cost functions; linear and logistic regression. Knowledge Representation and Reasoning: Prepositional logic, first-order logic, probabilistic reasoning.

UNIT II DECISION-MAKING 9

Basics of utility theory, sequential decision problems - decision network– policy -Decision process in infinite horizon: Optimal policy, Value iteration - policy iteration- Partially observable decision process – Decisions in Multi agent system: elementary game theory.

UNIT III LEARNING TECHNIQUES 9

Forms of Learning: supervised & semi-supervised, unsupervised, reinforced, and transfer learning. Supervised & semi-supervised: Decision trees, non-parametric methods for learning, support vector machines. Unsupervised: basic and advanced clustering techniques, dimensionality reduction (feature selection and feature extraction). Reinforced Learning.

UNIT IV AI IN DIAGNOSIS AND PROGNOSIS 9

Unique characteristics and challenges in medicine and healthcare; History, intelligent and expert systems in medicine. Risk stratification, patient outcome prediction, disease progression modeling. Clinical decision-making and intelligent systems to support evidence-based medicine – Case Studies.

UNIT V AI IN TREATMENT AND MEDICAL ETHICS 9

Treatment Effect Estimation – Medical Question Answering - Analysis of tissue morphology and other medical imaging applications - Ethics of AI: bias, fairness, accountability, and transparency in machine learning; Ethical, Legal, and Social Issues of AI in medicine and healthcare.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Stuart Russell and Peter Norvig, - "Artificial Intelligence: A Modern Approach", Pearson Education, 2014.
2. David Pool and Alan Mackworth, - "Artificial Intelligence: Foundations of Computational agents", Cambridge University, 2011.
3. Gerhard Weiss, ―Multi Agent Systems‖, Second Edition, MIT Press, 2013.

REFERENCE BOOKS:

1. Michael Matheny, Sonoo Thadaney Israni, Mahnoor Ahmed, and Danielle Whicher, Editors "Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril", National Academy of Sciences, USA, 2019.
2. Tony J. Cleophas and Aeilko H. Zwinderman. "Machine Learning in Medicine - a Complete Overview". Springer. 2015.
3. Peter Harrington. 2012. Machine Learning in Action. Manning Publications Co., Greenwich, CT, USA.
4. Selected seminal and contemporary readings from peer-reviewed literature such as Proceedings of Machine Learning in Healthcare, Artificial Intelligence in Medicine, IEEE Transactions on Biomedical and Health Informatics, and other relevant venues.

U19BM907 **BIOMEDICAL WASTE MANAGEMENT** **L T P C**

3 0 0 3

COURSE OUTCOMES:

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

- Summarize the overview of biomedical waste management.
- Apply knowledge in coding and treatment of biomedical waste
- Classify the different types of waste disposal procedures and management
- Develop knowledge in safety and regulatory guidelines in waste management
- Illustrate different methods of solid, biomedical, and hazardous waste management

CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes (Pos) and Programme Specific Outcome (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		2			1	2					1			2
CO2	2	2		1		1	1					1			2
CO3	2		2			1	1					1			2
CO4	2					1	1					1			2
CO5	2					1	1					1			2

UNIT I INTRODUCTION AND TYPES OF BIOMEDICAL WASTE 9

Definition – Types of wastes, major and minor sources of biomedical waste, Categories and classification of biomedical waste – infectious waste, genotoxic waste, waste sharps, composition of bio medical waste, hazard of biomedical waste, need for disposal of biomedical waste, waste minimization.

UNIT II IMPACTS & LEGISLATION 9

Health impacts – direct and indirect Hazards, potential hazards, basic information, infection, infection agents; Legislation – bio medical waste handling rules – CPCB guidelines, BARC guidelines; radioactive waste disposal – WHO guidelines – management in developing countries.

UNIT III GENERATION AND SEGREGATION ` 9

Color coding – yellow, red, blue, white –contents of waste bag, label. Biomedical waste – collection and handling – infection control system – needle sticks injury, hospital policy – segregation, decontaminating, disinfection unit – autoclaving, sharp waste containers, shredding, incrimination. biomedical symbol, microwave, hydropulbing, plasma torch.

UNIT IV TREATMENT AND DISPOSAL METHODS 9

Various methods of refuse processing, recovery, recycle and reuse, composting, aerobic and anaerobic, incineration, pyrolysis and energy recovery, Disposal methods – Impacts of open dumping, site selection, sanitary land filling, design criteria and design examples, leachate and gas collection systems, leachate treatment.

UNIT V MANAGEMENT ISSUES AND SAFETY REGULATIONS 9

Recycling, reuse, health and safety practices, protective equipments usage, occupational health programmers. Safety, budget allocation, maintenance, records, annual reports. Hazardous Substance Safety-OSHA Hazard Communication Standard, DOT Hazardous Material Regulations, Healthcare Hazardous Materials, Medical Gas Systems, Hazardous Waste Operations and Emergency Response Standard, Respiratory Protection.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Tweedy, James T., Healthcare hazard control and safety management-CRC Press_Taylorand Francis. 2014.
2. Anantpreet Singh, Sukhjit Kaur, Biomedical Waste Disposal, Jaypee Brothers MedicalPublishers (P) Ltd. 2012.
3. Mohd Faisal Khan, Hospital Waste Management: Principle and Guidelines, Kanishka Publishers, 2010.

REFERENCE BOOKS:

1. Pavoni et al., "Handbook of solid waste disposal: materials and energy recovery.Composting,sanitary landfill, innovations in disposal, materials recovery, energy recovery, European solid waste management, and selection of solid waste management techniques".1975.
2. R.C.Goyal, ―Hospital Administration and Human Resource Management‖, PHI – Fourth Edition, 2006
3. V.J. Landrum, ―Medical Waste Management and disposal, Elsevier, 1991
4. Madhuri Sharma, Hospital Waste Management and its Monitoring, Jaypee Brothers Mediacal Publishers, 2007.
5. Mohammad Mohsin, Hospital: Waste Management, VDM Publishing, 2010.

U19BM908 **ASSIST DEVICES** **L T P C**
3 0 0 3

COURSE OUTCOMES:

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

- Interpret the various mechanical techniques that will help in assisting the heart functions.
- Describe the underlying principles of hemodialyzer machine.
- Indicate the methodologies to assess the hearing loss.
- Evaluate the types of assistive devices for mobilization.
- Explain about TENS and biofeedback system.

CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes (Pos) and Programme Specific Outcome (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	-	-	1	-	-	-	-	-	2	2	1	1
CO2	2	2	3	-	-	1	-	-	-	-	-	2	2	1	1
CO3	2	2	3	-	1	1	-	-	-	-	-	2	2	1	1
CO4	2	2	3	-	1	1	-	-	-	-	-	2	2	2	1
CO5	2	2	3	-	-	1	-	-	-	-	-	2	2	1	1

UNIT I CARDIAC ASSIST DEVICES 9

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

UNIT II HEMODIALYSERS 9

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

UNIT III HEARING AIDS 9

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

UNIT IV PROSTHETIC AND ORTHODIC DEVICES 9

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

UNIT V RECENT TRENDS 9

Transcutaneous electrical nerve stimulator, bio-feedback.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Gerr M. Craddock Assistive Technology-Shaping the future, IOS Press, 1st edition, 2003.
2. Tracy, K. (2003). Willem Kolff and the Invention of the Dialysis Machine. Mitchell Lane Pub.
3. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph.D, Bronzino, Clinical Engineering, CRC Press, 1st edition,2010.

REFERENCE BOOKS:

1. Cardiac Assist Devices, Daniel Goldstein (Editor), Mehmet Oz (Editor),Wiley-Blackwell April 2000 ISBN: 978-0-879-93449-1
2. 3D Printing in Orthopaedic Surgery, Matthew Dipaola , Elsevier 2019 ISBN 978 -0-323-662116
3. Kenneth J. Turner Advances in Home Care Technologies: Results of the match Project,Springer, 1stedition, 2011.
4. Marion. A. Hersh, Michael A. Johnson,Assistive Technology for visually impaired and blind,Springer Science & Business Media, 1st edition, 12-May-2010.
5. Joseph D. Bronzino, The Biomedical Engineering Handbook, Third Edition: Three Volume Set, CRC Press,2006.

U19BM909 **REHABILITATION ENGINEERING** **L T P C**

3 0 0 3

COURSE OUTCOMES

At the end of the course learners will be able to

- Explain the basic principles of rehabilitation Engineering
- Design orthotic and prosthetic devices
- Distinguish various types of mobility aids
- Enumerate Auditory and speech assist devices
- Differentiate sensory augmentation and its substitution

CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes (Pos) and Programme Specific Outcome (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1				1						1	1	1	
CO2	3	1	2	2	2	1						2	2	2	
CO3	3	2	3		2	2						2	2	2	
CO4	3	3		2	2	2						2	2	2	
CO5	3	3	2	2	2							2	2	2	

UNIT I INTRODUCTION TO REHABILITATION 9

Definition, Concept of Rehabilitation: Types of Physical Impairments, Principles of Assistive Technology Assessment, Principles of Rehabilitation Engineering - Key Engineering Principles,Key Ergonomic Principles, Engineering Concepts in Sensory & Motor rehabilitation.

UNIT II ORTHOTICS & PROSTHETICS IN REHABILITATION 9

Types of orthosis - FO,AFO,KAFO,HKAFO and prosthesis, Partial Foot Prostheses – Foot – ankle assembly, Trans femoral Prostheses, Prosthetic Hand, Advance and automated prosthetics and orthosis, Externally powered and Controlled orthotics & prosthetics, - FES system, Restoration of Hand function, Restoration of standing and walking.

UNIT III MOBILITY AIDS 9

Electronic Travel Appliances (ETA): Path Sounder, Laser Cane, Ultrasonic Torch, Sonic Guide, Light Probes, Nottingham Obstacle Sensors, Electro cortical Prosthesis, Polarized Ultrasonic Travel aids, Materials used for wheel chairs, Type of Wheel Chairs, design of wheel Chair, Walking frames, Parallel bars, Rollators, Quadripods, Tripods & walking sticks, Crutches.

UNIT IV AUDITORY AND SPEECH ASSIST DEVICES 9

Types of deafness, hearing aids, application of DSP in hearing aids, Cochlear implants, Voice synthesizer, speech trainer.

UNIT V SENSORY AUGMENTATION AND SUBSTITUTIONS 9

Classification of Visual Impairments, Prevention and cure of visual impairments, Visual Augmentation, Tactile vision substitution, auditory substitution and augmentation, tactile auditory substitution, Assistive devices for the visual impaired.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Joseph D. Bronzino, The Biomedical Engineering Handbook, Third Edition: Three Volume Set, CRC Press, 2006
2. MacLauchlan, M, and Gallagher, P, Enabling Technologies – Body Image and Body Function, Churchill Livingstone, 2004.
3. Mann, W.C., (Ed). Smart Technology for Aging, Disability, and Independence – The State of the Science, Wiley, New Jersey, 2005..

REFERENCE BOOKS:

1. Muzumdar, A, Powered Upper Limb Prostheses – Control, Implementation and Clinical Application, Springer, 2004.
2. Rory A Cooper, An Introduction to Rehabilitation Engineering, Taylor &Francics, CRC Press, 2006.
3. Horia- Nocholai Teodorecu, L.C.Jain ,Intelligent systems and technologies in rehabilitation Engineering; CRC; December 2000.

U19BM703 MEDICAL IMAGE PROCESSING LABORATORY L T P C
0 0 2 1

COURSE OUTCOMES:

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

- Create an algorithm using intensity transformation and analyze the characteristics of the given image.
- Develop a program to analyze the texture of digital image using statistical properties.
- Apply segmentation and thresholding technique to obtain region of interest of a digital image.

CO/PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
CO's	**Programme Outcomes (Po's) and Programme Specific Outcome (PSO's)**														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**	**-**
CO2	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**	**-**
CO3	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**	**-**

LIST OF EXPERIMENTS:

1. Perform digital Image fundamental operations -Resizing, Cropping, Image conversion and basic arithmetic operations.
2. Develop an algorithm for Image Enhancement using histogram equalization.
3. Implement DFT analysis of digital images using masking operation.
4. Apply Gray level transformation in spatial domain.
5. Perform the Image Transformation in frequency domain using transforms.
6. Create an algorithm to segment an image using edge detection, line detection and boundary detection.
7. Perform the Morphological Operations of digital image using Dilation, Erosion and Opening, Closing.
8. Feature extraction in medical images
9. Medical Image Compression techniques.
10. Medical image fusion.

TOTAL: 30 PERIODS

U19BM704 ARTIFICIAL INTELLIGENCE IN MEDICINE LABORATORY **L T P C**
0 0 2 1

COURSE OUTCOMES

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

- Design heuristics and apply different search techniques in game playing and problem solving
- Effectively communicate and disseminate knowledge in AI domain in the context of biomedical applications.
- Apply knowledge representation and natural Language processing concepts in implementing medical data processing.

CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes (Po's) and Programme Specific Outcome (PSO's)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	2	3	3	-
CO2	3	3	3	3	3	-	-	-	-	-	-	2	3	3	-
CO3	3	3	3	3	3	-	-	-	-	-	-	2	3	3	-

LIST OF EXPERIMENTS:

1. Implement state space search using A* Algorithm
2. Hill climbing algorithm and Genetic Algorithm
3. Adversarial search and Game Playing.
4. Creating rule base and infer the proof using First order Predicate logic.
5. Solving n-Queen's problem.
6. Solving travelling salesman problem
7. ECG signal datasets preparation for AI workflows
8. ECG Classification using ML
9. ECG Classification Using LSTM
10. ECG Classification using Transfer Learning
11. Study of Disease detection with computer vision

TOTAL: 30 PERIODS

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VIII Regulations 2019
Branch: Biomedical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Practical							
1	U19BM801	Project Work	0	0	24	12	360
					Total Credits	**12**	

Approved By

Chairman, Biomedical Engineering BoS
Dr.S.Prabakar

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/ Biomedical Engineering, Eighth Semester BE BME Students and Staff, COE