

SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

B.E-Biomedical Engineering

CURRICULUM and SYLLABI

[For students admitted in 2021-2022]

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	Total Contact Hours
Theory								
1	U19ENG101B	English For Engineers - I	1	0	2	2	HS	45 (15L+30P)
2	U19MAT102B	Linear Algebra and Multivariable Calculus	3	1	0	4	BS	60
3	U19PHY103E	Engineering Physics	4	0	0	4	BS	60
4	U19CHE104G	Engineering Chemistry	3	0	0	3	BS	45
5	U19PPR105	Problem Solving using Python Programming	3	0	0	3	ES	45
6	U19BEE106B	Basic Electrical and Electronics Engineering	3	0	0	3	PC	45
Practical								
7	U19PPL111	Python Programming Laboratory	0	0	2	1	ES	30
8	U19BEEL113B	Basic Electrical and Electronics Engineering Laboratory	0	0	2	1	PC	30
9	U19GE101	Basic Aptitude - I	0	0	2	0	EEC	30
Total Credits						21		
Optional Language Elective*								
10	U19OLE1101	French	0	0	2	1	HS	30
11	U19OLE1102	German						30
12	U19OLE1103	Japanese						30

*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, Bio Medical Engineering BoS	Member Secretary, Academic Council	Chairperson, Academic Council & Principal
Dr. M. Renuga	Dr. S. Prabakar	Dr. R. Shivakumar	Dr. S. R. R. Senthil Kumar

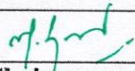
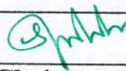
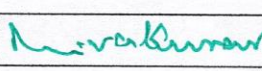
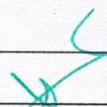
Copy to:-HOD/ Biomedical Engineering, First Semester BE BME Students and Staff, COE

Sona College of Technology, Salem – 636 005
(An Autonomous Institution)
Courses of Study for BE / B Tech Semester II under Regulations 2019 (CBCS)
Branch: Biomedical Engineering

S. No	Course Code	Course Title	L	T	P	C	Category	Total Contact Hours
Theory								
1	U19ENG201B	English for Engineers -II	2	0	0	2	HSMC	30
2	U19MAT202C	Transforms and Differential Equations	3	1	0	4	BSC	60
3	U19CHE204D	Biochemistry	2	0	0	2	BSC	30
4	U19EGR206A	Engineering Graphics	2	0	2	3	ESC	60 (30L+30P)
5	U19BME201	Biology for Engineers	3	0	0	3	PCC	45
6	U19EC202	Circuit Theory	3	0	0	3	PCC	45
Practical								
7	U19WPL212	Workshop Practice	0	0	2	1	ESC	30
8	U19PCL208B	Physics and Chemistry Laboratory	0	0	4	2	BSC	60
9	U19GE201	Basic Aptitude – II	0	0	2	0	EEC	30
Total Credits						20		
Optional Language Elective*								
10	U19OLE1201	French	0	0	2	1	HSMC	30
11	U19OLE1202	German						
12	U19OLE1203	Japanese						

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

Approved by

			
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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	Total Contact Hours
Theory							
1	U19MAT301B	Probability and Statistics	3	1	0	4	60
2	U19BM301	Electronic Devices and Circuits	3	0	0	3	45
3	U19EC301	Signals and Systems	3	1	0	4	60
4	U19BM302	Anatomy and Human Physiology	3	0	0	3	45
5	U19CS307	Programming in C	3	0	0	3	45
6	U19GE303	Mandatory Course: Essence of Indian Traditional Knowledge	2	0	0	0	30
Practical							
7	U19BM303	Electronic Devices and Circuits Laboratory	0	0	2	1	30
8	U19BM304	Anatomy and Human Physiology Laboratory	0	0	2	1	30
9	U19CS308	C Programming Laboratory	0	0	2	1	30
10	U19GE301	Soft Skills and Aptitude – I	0	0	2	1	30
Total Credits						21	

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, 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 Regulations 2019
Branch: Biomedical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19BM401	Analog and Digital Integrated Circuits	3	0	0	3	45
2	U19BM402	Biomedical Instrumentation	3	0	0	3	45
3	U19BM403	Control System for Biomedical Engineering	3	0	0	3	45
4	U19BM404	Biomaterials	3	0	0	3	45
5	U19CS406	Data Structures	3	0	0	3	45
6	U19GE402	Mandatory Course: Environment and Climate Science	2	0	0	0	30
Practical							
7	U19BM405	Analog and Digital Integrated Circuits Laboratory	0	0	2	1	30
8	U19BM406	Biomedical Instrumentation Laboratory	0	0	2	1	30
9	U19CS407	Data Structures Laboratory	0	0	2	1	30
10	U19GE401	Soft Skills and Aptitude-II	0	0	2	1	30
Total Credits						19	

Approved By

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Chairperson, Academic Council & Principal
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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	U19BM502 ✓	Pathology and Microbiology ✓	3	0	0	3	45 ✓
3	U19BM503 ✓	Biomechanics ✓	3	0	0	3	45 ✓
4	U19EC510 ✓	Digital Signal Processing ✓	3	0	0	3	45 ✓
5	U19EC511 ✓	Microprocessors and Embedded System Design	3	0	0	3	45
6	NOC23-BT67 ✓	NPTEL-Animal Physiology ✓	3	0	0	3	45 ✓
	NOC23-GE28 ✓	NPTEL-Research Methods in Health Promotion ✓					
	NOC23-BT55 ✓	NPTEL-Wildlife Ecology ✓					
Practical							
7	U19EC512 ✓	Digital Signal Processing Laboratory ✓	0	0	2	1	30 ✓
8	U19EC513 ✓	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 ✓	390

Approved By


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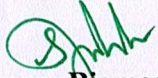
HOD/ Biomedical Engineering, Fifth Semester BE BME Students and Staff, COE

BME
VI

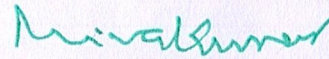
Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VI Regulations 2019
Branch: Biomedical Engineering

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	U19BM910	Professional Elective- Medical Device Design	3	0	0	3	45
5	U19BM911	Professional Elective- Hospital Planning and Management	3	0	0	3	45
	U19BM2011	Professional Elective- Medical Waste Management					
Open Elective							
6	U19CS1001	Big Data Analytics	3	0	0	3	45
	U19CS1002	Cloud Computing					
	U19CS1003	Internet of Things					
	U19EE1002	Energy Conservation and Management					
	U19EE1004	Renewable Energy Systems					
	U19FT1001	Fundamentals of Fashion Design					
	U19FT1002	Garment Manufacturing Technology					
	U19MC1003	Smart Automation					
	U19MC1004	Fundamentals of Robotics					
	U19ME1002	Industrial Safety					
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	390

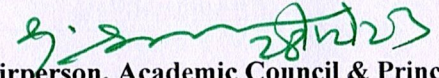
Approved By



Chairman, Biomedical Engineering BoS
Dr.S.Prabakar



Member Secretary, Academic Council
Dr.R.Shivakumar 26/12/23



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

Copy to:-

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

SONA COLLEGE OF TECHNOLOGY, SALEM-5

DEPARTMENT OF BIOMEDICAL ENGINEERING

LIST OF PROFESSIONAL ELECTIVES

B.E/B.TECH UNDER REGULATION 2019

Department:- BME

S.No	Course Code	Course Name	L	T	P	C
1	U19BM901	Hospital Management	3	0	0	3
2	U19BM902	Medical physics				
3	U19BM903	Medical Optics				
4	U19BM904	Biometric systems technology				
5	U19BM905	Bio MEMS				
6	U19BM906	Medical Ethics and Standards				
7	U19BM907	Biomedical waste Management				
8	U19BM908	Assist Devices				
9	U19BM909	Rehabilitation Engineering				
10	U19BM910	Medical Device Design	3	0	0	3
11	U19BM911	Hospital Planning and Management	3	0	0	3

SONA COLLEGE OF TECHNOLOGY, SALEM-5

DEPARTMENT OF BIOMEDICAL ENGINEERING

LIST OF PROFESSIONAL ELECTIVES FOR HONOURS DEGREE

Date: 08.05.2023

S.No	Vertical 1: BIO ENGINEERING	Vertical 2: HEALTHCARE MANAGEMENT INFORMATION SYSTEM	Vertical 3: MEDICAL DEVICE INNOVATION AND DEVELOPMENT	Vertical 4: BIOSIGNAL AND MEDICAL IMAGE TECHNOLOGIES	Vertical 5: HEALTHCARE TECHNOLOGY	Vertical 6: SPECIALIZED MEDICAL EQUIPMENT
1	Medical Physics	Clinical Engineering	Foundation Skills in integrated product development	Bio Signal Processing	Bio-Micro Electro Mechanical Systems	Intensive and Critical Care Equipment
2	Biomedical Optics and Photonics	Hospital Planning and Management	Research Methodology and IPR for Biomedical Engineers	Speech and Audio Signal Processing	Biomedical Nanotechnology	Eye and Dental Care Equipment
3	Principles of Tissue Engineering	Quality Management and Quality control for Medical Devices	Medical Device Design	Brain-Computer Interface and Applications	Wearable Healthcare Devices	Biomedicine for Sports
4	Basic Life Support and first Aid	Economics and Management for Engineers	Medical Device Innovation and Entrepreneurship	Pattern Recognition and Optimization Techniques	Telehealth Technology	Medical Textiles
5	Rehabilitation Engineering Techniques	Clinical safety and Standards	Physiological Modeling	Medical Image Analysis	Internet of Medical Things	Devices for Heritage Medicine
6	Artificial Organs and Implants	Medical Waste Management	Rapid Prototyping	Augmented Reality and Virtual Reality in Healthcare	Robotics in Medicine	Ergonomics & Haptics
7	Biometric System Technology	Computational Tools for Biomedical Engineering	Trouble Shooting of Medical Instruments	Medical Informatics	Biomimetics	Advancements in Medical Technology
8	Forensic Science In Healthcare	Fundamentals Of Medical Coding	Fundamentals of Healthcare Analytics	Principles of Communication Engineering	Bio-Virtual Instrumentation	Veterinary Medical Equipment

SONA COLLEGE OF TECHNOLOGY, SALEM-5

Department of Biomedical Engineering

Honours Degree- Verticals & Courses

(Offered to UG students admitted during AY 2021- 2022 onwards, Regulation 2019)

Vertical 1: BIO ENGINEERING

S.No	Course Code	Course Name	L	T	P	C
1	U19BM902	Medical Physics	3	0	0	3
2	U19BM2001	Biomedical Optics and Photonics	3	0	0	3
3	U19BM2002	Principles of Tissue Engineering	3	0	0	3
4	U19BM2003	Basic Life Support and first Aid	3	0	0	3
5	U19BM2004	Rehabilitation Engineering Techniques	3	0	0	3
6	U19BM2005	Artificial Organs and Implants	3	0	0	3
7	U19BM904	Biometric System Technology	3	0	0	3
8	U19BM2006	Forensic Science In Healthcare	3	0	0	3

Vertical 2: HEALTHCARE MANAGEMENT INFORMATION SYSTEM

S.No	Course Code	Course Name	L	T	P	C
1	U19BM2007	Clinical Engineering	3	0	0	3
2	U19BM911	Hospital Planning and Management	3	0	0	3
3	U19BM2008	Quality Management and Quality control for Medical Devices	3	0	0	3
4	U19BM2009	Economics and Management for Engineers	3	0	0	3
5	U19BM2010	Clinical safety and Standards	3	0	0	3
6	U19BM2011	Medical Waste Management	3	0	0	3
7	U19BM2012	Computational Tools for Biomedical Engineering	3	0	0	3
8	U19BM2013	Fundamentals Of Medical Coding	3	0	0	3

Vertical 3: MEDICAL DEVICE INNOVATION AND DEVELOPMENT

S.No	Course Code	Course Name	L	T	P	C
1	U19BM2014	Foundation Skills in integrated product development	3	0	0	3
2	U19BM2015	Research Methodology and IPR for Biomedical Engineers	3	0	0	3
3	U19BM910	Medical Device Design	3	0	0	3
4	U19BM2016	Medical Device Innovation and Entrepreneurship	3	0	0	3
5	U19BM2017	Physiological Modeling	3	0	0	3
6	U19BM2018	Rapid Prototyping	3	0	0	3
7	U19BM2019	Trouble Shooting of Medical Instruments	3	0	0	3
8	U19BM2020	Fundamentals of Healthcare Analytics	3	0	0	3

Vertical 4: BIOSIGNAL AND MEDICAL IMAGE TECHNOLOGIES

S.No	Course Code	Course Name	L	T	P	C
1	U19BM2021	Bio Signal Processing	3	0	0	3
2	U19BM2022	Speech and Audio Signal Processing	3	0	0	3
3	U19BM2023	Brain-Computer Interface and Applications	3	0	0	3
4	U19BM2024	Pattern Recognition and Optimization Techniques	3	0	0	3
5	U19BM2025	Medical Image Analysis	3	0	0	3
6	U19BM2026	Augmented Reality and Virtual Reality in Healthcare	3	0	0	3
7	U19BM2027	Medical Informatics	3	0	0	3
8	U19BM2028	Principles of Communication Engineering	3	0	0	3

Vertical 5: HEALTHCARE TECHNOLOGY

S.No	Course Code	Course Name	L	T	P	C
1	U19BM2029	Bio-Micro Electro Mechanical Systems	3	0	0	3
2	U19BM2030	Biomedical Nanotechnology	3	0	0	3
3	U19BM2031	Wearable Healthcare Devices	3	0	0	3
4	U19BM2032	Telehealth Technology	3	0	0	3
5	U19BM2033	Internet of Medical Things	3	0	0	3
6	U19BM2034	Robotics in Medicine	3	0	0	3
7	U19BM2035	Biomimetics	3	0	0	3
8	U19BM2036	Bio-Virtual Instrumentation	3	0	0	3

Vertical 6: SPECIALIZED MEDICAL EQUIPMENT

S.No	Course Code	Course Name	L	T	P	C
1	U19BM2037	Intensive and Critical Care Equipment	3	0	0	3
2	U19BM2038	Eye and Dental Care Equipment	3	0	0	3
3	U19BM2039	Biomedicine for Sports	3	0	0	3
4	U19BM2040	Medical Textiles	3	0	0	3
5	U19BM2041	Devices for Heritage Medicine	3	0	0	3
6	U19BM2042	Ergonomics & Haptics	3	0	0	3
7	U19BM2043	Advancements in Medical Technology	3	0	0	3
8	U19BM2044	Veterinary Medical Equipment	3	0	0	3

SONA COLLEGE OF TECHNOLOGY, SALEM-5

Department of Biomedical Engineering

Minor Degree- Verticals & Courses

(Offered to UG students admitted during AY 2021- 2022 onwards, Regulation 2019)

Minor Vertical: Healthcare Technology and Management

S.No	Course Code	Course Name	L	T	P	C
1	U19BME201	Biology for Engineers	3	0	0	3
2	U19BM1002	Basic Life Support	3	0	0	3
3	U19BM2045	Fundamentals Of Medical Equipment	3	0	0	3
4	U19BM1001	Hospital Management	3	0	0	3
5	U19BM907	Biomedical Waste Management	3	0	0	3
6	U19BM2046	Patient Safety, Standards And Ethics	3	0	0	3
7	U19BM2047	Home Medicare Technology	3	0	0	3
8	U19BM2048	Advancements In Medical Technology	3	0	0	3

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	Total Contact Hours
Theory								
1	U19ENG101B	English For Engineers - I	1	0	2	2	HS	45 (15L+30P)
2	U19MAT102B	Linear Algebra and Multivariable Calculus	3	1	0	4	BS	60
3	U19PHY103E	Engineering Physics	4	0	0	4	BS	60
4	U19CHE104G	Engineering Chemistry	3	0	0	3	BS	45
5	U19PPR105	Problem Solving using Python Programming	3	0	0	3	ES	45
6	U19BEE106B	Basic Electrical and Electronics Engineering	3	0	0	3	PC	45
Practical								
7	U19PPL111	Python Programming Laboratory	0	0	2	1	ES	30
8	U19BEEL113B	Basic Electrical and Electronics Engineering Laboratory	0	0	2	1	PC	30
9	U19GE101	Basic Aptitude - I	0	0	2	0	EEC	30
Total Credits						21		
Optional Language Elective*								
10	U19OLE1101	French	0	0	2	1	HS	30
11	U19OLE1102	German						30
12	U19OLE1103	Japanese						30

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

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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.

S.No	Course outcomes	Programme outcomes												Pso1	Pso2
		1	2	3	4	5	6	7	8	9	10	11	12		
1	Frame sentences correctly with accuracy	2	1	1	1	1	2	3	2	2	3	3	3	3	3
2	Write emails and formal letters	3	2	2	3	3	3	3	2	3	3	3	3	3	3
3	Speak effectively in real time and business situations	3	3	2	3	3	3	3	2	3	3	3	3	3	3
4	Write email, formal letters and descriptions of graphics	1	1	1	2	2	1	2	2	1	3	1	1	1	1
5	Develop skills for writing reports and proposals, and for general purpose and technical writing.	2	1	1	3	2	2	3	3	3	3	2	3	3	3

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.

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)												PSO1	PSO2
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		
CO1	3	3		3									2	3
CO2	3	3		3									2	3
CO3	3	3		3									2	3
CO4	3	3		3									2	3
CO5	3	3		3									2	3

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 parallelepiped.

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 LT P C
3 1 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.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO – 2	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO – 3	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO – 4	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO - 5	3	2	-	-	-	-	-	-	-	-	2	2	-	3

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 (CO₂ 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 – Magnetostriction 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

- CO1** Analyze the impurities of water, their removal methods and explain the conditioning methods for industrial uses.
- CO2** Outline the principles and applications of electrochemistry to engineering and technology.
- CO3** Analyze the types of corrosion and describe the methods of corrosion control.
- CO4** Discuss the principle and applications of surface chemistry and catalysis in engineering and technology.
- CO5** Describe the basics of nano chemistry, synthesis, properties and applications of nano materials in engineering and technology.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2												2
CO-2	3	2												2
CO-3	3	3												2
CO-4	3	3												2
CO-5	3	3												2

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 (15th 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

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

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	PSO3
CO1	3	3	3	3	3	3	1	1	2	2	1	3	2	3	3
CO2	3	3	3	3	3	2	1	1	1	1	1	3	1	3	3
CO3	3	3	3	3	3	3	2	1	1	1	1	3	1	3	3
CO4	3	3	3	3	3	2	2	1	1	2	1	3	1	3	3
CO5	3	3	3	3	3	3	3	1	1	1	1	3	2	3	3

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

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	PSO1	PSO2
CO1	1	3	1	1	2	3	2	2		1	2	3	3	2
CO2	1	1	2	2	1	3	2	1		3	1	3	1	
CO3	1	3	2	3	2	3	2	2		3	2	3	3	2
CO4	1	2	2	3	2	3	2	1		3	2	3	3	2
CO5	1	2	2	3	2	3	2	1		3	2	3	3	2

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.

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

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	3	2	1	0	1	2	2	1	2	3	3	3
CO2	3	3	3	3	2	2	0	1	2	2	1	2	3	3	3
CO3	3	3	3	3	2	2	0	1	2	2	1	3	3	3	3

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.

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	2	3	3	3	2	2	2	1	2	2	3	3	2
CO2	3	3	3	3	3	2	3	2	2	2	3	3	3	3
CO3	3	3	3	3	3	2	3	2	1	2	3	3	3	3

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 circuits.
7. V-I characteristics analysis of PN junction diode.
8. V-I characteristics analysis of Zener diode.
9. Biasing characteristics analysis of BJT using CB, CE and CC Configuration.
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

CO1: Solve fundamental problems in specific areas of quantitative aptitude

CO2: Solve basic problems in stated areas of logical reasoning

CO3: Demonstrate rudimentary verbal aptitude skills in English with regard to specific topics

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	2	2	2	1	3	3	3	3	1	1	3	2	2
CO 2	3	3	1	1	2	3	2	3	3	2	2	3	3	3
CO 3	1	2	1	2	1	1	1	3	3	3	1	3	3	3

1. Quantitative Aptitude and Logical Reasoning

Solving simple problems with reference to the following topics:

- Numbers – HCF & LCM
- Decimal fractions
- Square roots & cube roots
- Surds & Indices
- Logarithms
- Percentage
- Averages
- Coding and Decoding & Visual language

2. Verbal Aptitude

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

- Synonyms
- Antonyms
- Verbal analogy
- Editing passages
- Sentence filler words

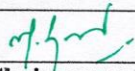
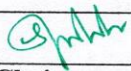
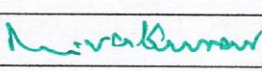
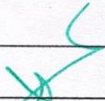
TOTAL: 24 hours

Sona College of Technology, Salem – 636 005
(An Autonomous Institution)
Courses of Study for BE / B Tech Semester II under Regulations 2019 (CBCS)
Branch: Biomedical Engineering

S. No	Course Code	Course Title	L	T	P	C	Category	Total Contact Hours
Theory								
1	U19ENG201B	English for Engineers -II	2	0	0	2	HSMC	30
2	U19MAT202C	Transforms and Differential Equations	3	1	0	4	BSC	60
3	U19CHE204D	Biochemistry	2	0	0	2	BSC	30
4	U19EGR206A	Engineering Graphics	2	0	2	3	ESC	60 (30L+30P)
5	U19BME201	Biology for Engineers	3	0	0	3	PCC	45
6	U19EC202	Circuit Theory	3	0	0	3	PCC	45
Practical								
7	U19WPL212	Workshop Practice	0	0	2	1	ESC	30
8	U19PCL208B	Physics and Chemistry Laboratory	0	0	4	2	BSC	60
9	U19GE201	Basic Aptitude – II	0	0	2	0	EEC	30
Total Credits						20		
Optional Language Elective*								
10	U19OLE1201	French	0	0	2	1	HSMC	30
11	U19OLE1202	German						
12	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. S. Prabakar	Dr. R. Shivakumar	Dr. S. R. R. Senthil Kumar

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

U19ENG201B- English for Engineers – II

First year II semester

BME

Course Outcome: At the end of 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.

	COURSE OUTCOMES	PROGRAMME OUTCOMES												Pso 1	Pso 2
		1	2	3	4	5	6	7	8	9	10	11	12		
1	Frame sentences correctly, both in written and spoken forms of language with accuracy and fluency	2	1	2	3	2	3	3	3	3	3	3	3	3	3
2	Develop and demonstrate listening skills for academic and professional purposes	2	2	2	3	2	3	3	3	3	3	3	3	3	3
3	Draw conclusions on explicit and implicit oral information	3	2	2	3	2	3	3	3	3	3	3	3	3	3
4	Develop effective reading skills and reinforce language skills required for using grammar and building vocabulary	3	3	2	3	2	3	3	3	3	3	3	3	3	3
5	Read for gathering and understanding information, following directions and giving responses.	3	3	2	3	2	3	3	3	3	3	3	3	3	3

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, grammatical structures
- Short reading passages for sentence matching exercises, picking out specific information in a short text

TOTAL: 30 hours

B. E. / BIOMEDICAL ENGINEERING

SEMESTER – II	TRANSFORMS AND DIFFERENTIAL EQUATIONS	L	T	P	C
UI9MAT202C		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.

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
CO1	3	3		3								2	3	
CO2	3	3		3								2	3	
CO3	3	3		3								2	3	
CO4	3	3		3								2	3	
CO5	3	3		3								2	3	

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.

Theory: **45 Hours**

Tutorial: **15 Hours**

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.

REFERENCE BOOKS:

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.



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COURSE CODE U19CHE204D
COURSE NAME BIOCHEMISTRY

L T P C
 2 0 0 2

Course outcome:

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

- CO1** Outline the fundamentals of biochemistry.
- CO2** Analyze the classification of carbohydrates and their properties and applications.
- CO3** Discuss the classification of lipids and their biological importance.
- CO4** Demonstrate the structure and properties of nucleic acid and protein.
- CO5** Describe the classification and the biological clinical applications of enzymes.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2												3
CO - 2	3	2												3
CO - 3	3	2												3
CO - 4	3	2												3
CO - 5	3	2												3

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, Chargoff's 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.

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

- CO1** Predict the construction of various curves in civil elevation, plan and machine components.
- CO2** Analyze the principles of projection of various planes by different angle to project points, lines and planes.
- CO3** Draw the principles of projection of simple solid by the axis is inclined to one reference plane by change of position method.
- CO4** Understand the interior details of complex components, machineries by sectioning the solid body. Study the development of surfaces for prisms and pyramids.
- CO5** Draw the projection of three dimensional objects representation of machine structure and explain standards of orthographic views by different methods.

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	1	1	1	1	3	2	2	3	2	2
CO 2	3	2	2	1	2	1	1	1	3	2	2	3	2	2
CO 3	3	2	2	1	2	1	1	1	3	2	2	3	2	2
CO 4	3	2	2	1	2	1	1	1	3	2	2	3	2	2
CO 5	3	2	2	1	1	1	1	1	3	2	2	3	2	2

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
BME

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.

		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	PSO1	PSO 2	PSO 3
CO1	3	3	1									2	1	1	
CO2	3	3	1									2	1	1	
CO3	3	3	1									2	1	1	
CO4	3	3	1									2	1	1	
CO5	3	3	1									2	1	1	

UNIT I - CELL: THE BASIC UNIT OF LIFE

9

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

9

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

9

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

9

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 9

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.

REFERENCE BOOKS

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

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.

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	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	3	3	2	1	3	1	1	-	-	1	1	2	2
CO 2	3	3	3	2	1	3	1	1	-	-	1	1	2	2
CO 3	3	3	3	2	1	3	1	1	-	-	1	1	2	2
CO 4	3	3	3	2	1	3	1	1	-	-	1	1	2	2
CO 5	3	3	3	2	1	3	1	1	-	-	1	1	2	2

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, Shyammoan 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															
After successful completion of this course, the students should be able to															
CO1:	Apply the principles of Optics, Electricity and Elasticity to determine the Engineering properties of materials.														
CO2:	Identify hardness and suggest the quality of water suitable for domestic purpose and analyze the concentration of carbonate, bicarbonate and hydroxide present in the given sample of water.														
CO3:	Determine the thickness and resistivity of the given copper turn used for house hold applications and determine the amount of pH of house hold water sample and suggest the remedial measures.														
Pre-requisite: Capable of using Screw gauge, Vernier calliper, Travelling microscope, Spectrometer, able to handle burette and pipette															
CO/PO, PSO Mapping															
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)															
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	
CO1	3			1		1					1			2	
CO2	3			1		1					1			2	
CO3	3			1		1					1			2	
Course Assessment methods															
Direct												Indirect			
Mean of 1 st half of Experiment (10)						Quiz on 2 nd half (5)						Course end survey			
Quiz on 1 st half (5)						Internal test II (10)									
Internal test I (10)						RTPS (10)									
Mean of 2 nd half of Experiment (10)						End semester Examination (40)									
List of Experiments (Physics part)															
1	Determination of the thickness of a thin wire by forming interference fringes using air wedge apparatus.														
2	Determination of dispersive power of the prism for various pairs of colors in the mercury spectrum using a spectrometer.														
3	Determination of laser wavelength, particle size of lycopodium powder, acceptance angle and														

	numerical aperture of an optical fibre using diode laser.
4	Determination of specific resistance of a given wire using Carey Foster's bridge.
5	Determination of band gap of the given semiconductor diode.
6	Determination of velocity of ultrasonic waves and compressibility of the given liquid using ultrasonic interferometer.
7	Determination of wavelength of the prominent colors in the mercury spectrum using a spectrometer.
8	Determination of the Young's modulus of the given material by non-uniform bending method.
9	Determination of coefficient of viscosity of the given liquid by Poiseuille's method.
10	Determination of rigidity modulus of the material using torsion pendulum.
List of Experiments (Chemistry part)	
11	Estimation of hardness of water sample by EDTA method.
12	Estimation of alkalinity of water sample by indicator method.
13	Estimation of copper in brass by EDTA method.
14	Estimation of HCl by pH metry.
15	Determination of iron content in water by spectrophotometric method.
16	Estimation of HCl by conductometry. (HCl vs NaOH)
17	Estimation of mixture of acids by conductometry. (HCl + CH ₃ COOH vs NaOH)
18	Estimation of ferrous ion by potentiometric titration.
19	Determination of Molecular weight of a polymer by viscosity measurements.
20	Estimation of chromium in waste water.
	Total Hours: 60 Hrs.

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	Total Contact Hours
Theory							
1	U19MAT301B	Probability and Statistics	3	1	0	4	60
2	U19BM301	Electronic Devices and Circuits	3	0	0	3	45
3	U19EC301	Signals and Systems	3	1	0	4	60
4	U19BM302	Anatomy and Human Physiology	3	0	0	3	45
5	U19CS307	Programming in C	3	0	0	3	45
6	U19GE303	Mandatory Course: Essence of Indian Traditional Knowledge	2	0	0	0	30
Practical							
7	U19BM303	Electronic Devices and Circuits Laboratory	0	0	2	1	30
8	U19BM304	Anatomy and Human Physiology Laboratory	0	0	2	1	30
9	U19CS308	C Programming Laboratory	0	0	2	1	30
10	U19GE301	Soft Skills and Aptitude – I	0	0	2	1	30
Total Credits						21	

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, Third Semester BE BME Students and Staff, COE

COURSE OUTCOMES

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

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

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	1	1	1	1	1	-	-	-	-	-	-	-	2	1	-
CO2	2	1	1	1	1	-	-	-	-	-	-	-	2	1	-
CO3	2	1	1	1	1	-	-	-	-	-	-	-	2	1	-
CO4	2	1	1	1	1	-	-	-	-	-	-	-	2	1	-
CO5	2	1	1	1	1	-	-	-	-	-	-	-	2	1	-

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.

TOTAL : 45Hours**TEXTBOOKS:**

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

COURSE OUTCOMES

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

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

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	3	2	1	2	1	-	-		1	2	1	3	3	-
CO2	3	2	2	1	-	1	-	2		1	2	1	3	3	-
CO3	3	3	1	1	2	1	2	2		1	2	1	3	3	-
CO4	3	3	2	2	-	1	-	2		1	2	1	3	3	-
CO5	3	3	2	1	2	1	2	2		1	2	1	3	3	-

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS**12**

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.

UNIT II LINEAR TIME- INVARIANT SYSTEMS**12**

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.

UNIT III ANALYSIS OF CT SIGNALS USING FOURIER SERIES & FOURIER TRANSFORM **12**

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.

UNIT IV ANALYSIS OF SIGNALS AND SYSTEMS USING LAPLACE TRANSFORM **12**

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.

UNIT V ANALYSIS OF SIGNALS AND SYSTEMS USING Z-TRANSFORM **12**

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.

TOTAL : 60 Hours

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

COURSE OUTCOMES

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

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

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	1	1	-	-	-	-	-	-	-	-	-	-	1	2	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	1	2	-
CO3	1	2	-	1	-	-	-	-	-	-	-	-	1	2	-
CO4	2	1	1	1	1	-	-	-	-	-	-	-	1	2	-
CO5	1	1	-	1	-	-	-	-	-	-	-	-	-	-	-

UNIT I ORGANIZATION OF HUMAN BODY**9**

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.

UNIT II RESPIRATORY SYSTEM AND URINARY SYSTEM**9**

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.

UNIT III BLOOD AND CARDIOVASCULAR SYSTEM**9**

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.

UNIT IV SKELETAL AND SPECIAL SENSORY SYSTEM**9**

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 vision – EOG – Physiology of hearing mechanism – hearing loss – audiograms – hearing tests – taste and smell sensors.

UNIT V NERVOUS SYSTEM**9**

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.

Total : 45 Hours**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.

COURSE OUTCOMES

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

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

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	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	1	1	2	1	1	2	3	3	1
CO2	3	3	3	3	2	3	1	1	2	1	1	2	3	3	1
CO3	3	3	3	3	2	3	1	1	2	1	1	2	3	3	1
CO4	3	3	3	3	2	3	1	1	2	1	1	2	3	3	-
CO5	3	3	3	3	2	3	1	1	2	1	1	2	3	3	-

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.

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

Total : 45 Hours

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.

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

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	1	1	1	1	1	-	-	-	-	-	-	-	2	1	1
CO2	2	1	1	1	1	-	-	-	-	-	-	-	2	1	1
CO3	2	1	1	1	1	-	-	-	-	-	-	-	2	1	1

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.

TOTAL: 30 Hours

COURSE OUTCOMES

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

- Estimation and quantification of biomolecules.
- Separation of macromolecules.
- Interpreting the metabolic changes in pathological conditions.

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	1	1	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	1	1	1	1	-	-	-	-	-	-	-	-	1	1	-
CO3	1	1	1	-	-	-	-	-	-	-	-	-	1	1	-

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.

TOTAL : 30 Hours

COURSE OUTCOMES:

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

1. Design and develop simple programs using branching, looping statements
2. Develop programs using functions, arrays, structures and string handling
3. Write programs using pointers and dynamic memory allocation and file handling

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
CO 1	3	3	3	3	2	3	-	-	3	1	2	2	3	3	-
CO 2	3	3	3	3	2	3	-	-	3	1	2	2	3	3	-
CO 3	3	3	3	3	2	3	-	-	3	1	2	2	3	3	-

LIST OF EXPERIMENTS:

1. Programs using Input, Output and assignment statements.
2. Programs using Branching statements
3. Programs using Looping statements
4. Programs using Functions
5. Programs using Arrays
6. Programs using Structures
7. Programs using Strings
8. Programs using Pointers (both data pointers and function pointers)
9. Programs using dynamic memory allocation
10. Programs using Recursion
11. 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: <ol style="list-style-type: none"> Attitude building Dealing with criticism Innovation and creativity Problem solving and decision making Public speaking Group discussions 					
2. Quantitative Aptitude and Logical Reasoning	Solving problems with reference to the following topics: <ol style="list-style-type: none"> Vedic Maths: Fast arithmetic, multiplications technique, Criss cross, Base technique, Square root, Cube root, Surds, Indices, Simplification. Numbers: Types, Power cycle, Divisibility, Prime factors & multiples, HCF & LCM, Remainder theorem, Unit digit, highest power. Averages: Basics of averages and weighted average. Percentages: Basics of percentage and Successive percentages. Ratio and proportion: Basics of R &P, Alligations, Mixture and Partnership. Profit ,Loss and Discount: Basic & Advanced PLD Data Interpretation: Tables, Bar diagram, Venn diagram, Line graphs, Pie charts, Caselets, Mixed varieties, Network diagram and other forms of data interpretation. 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: <ol style="list-style-type: none"> Verbal analogy Tenses Prepositions Reading comprehension Choosing correct / incorrect sentences Describing pictures Error spotting 					

S. Ant

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

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B. E / BIOMEDICAL ENGINEERING

SEMESTER – III	PROBABILITY AND STATISTICS	L	T	P	C
UI9MAT301B		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.

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
CO1	3	3		3								2	3	
CO2	3	3		3								2	3	
CO3	3	3		3								2	3	
CO4	3	3		3								2	3	
CO5	3	3		3								2	3	

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.

20. 05. 2020

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UNIT – V TESTING OF SIGNIFICANCE

12

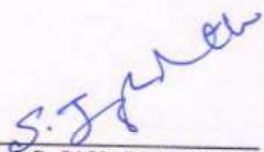
Sampling distributions - Testing of hypothesis for mean, standard deviation, variance, proportion and differences using normal and t distributions - χ^2 - tests for independence of attributes and goodness of fit and F distribution.

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

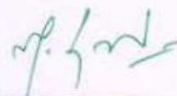
1. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons Publishers, 11th Edition, Reprint, 2019.
2. T. Veerarajan, "Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks", McGraw Hill Publishers, 4th Edition, 7th Reprint, 2018.

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.



Prof. S. JAYABHARATHI
Head / Department of Mathematics
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Dr. M. RENUGA
BoS - Chairperson
Science and Humanities
Sona College of Technology
Salem – 636 005

20. 05. 2020

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U19GE303 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE 2000

Course Outcomes

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

1. Analyze the basics of Indian traditional knowledge in modern scientific perspectives.
2. Explain the basics of Vedic science and its applications in modern days.
3. Discuss the introduction and objectives of modern science.
4. Describe the contribution of Noble laureates for India's achievements in Science and Technology.
5. Analyze the various traditional practices for holistic health care of human beings.

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
CO1	2	2	2	-	-	2	-	-	-	-	-	-	-	2
CO2	2	2	2	-	-	2	-	-	-	-	-	-	-	2
CO3	3	2	2	-	-	2	-	-	-	-	-	-	-	2
CO4	3	2	2	-	-	2	-	-	-	-	-	-	-	2
CO5	2	2	2	-	-	2	-	-	-	-	-	-	-	2

Unit I

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

6

Unit II

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

6

UNIT – III- Modern Science

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

6

UNIT – IV Technology

- 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

6

29.08.2022

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UNIT – V- Yoga and Holistic Health Care

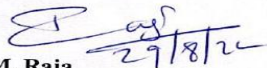
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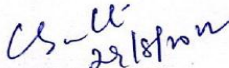
- Fundamentals of yoga and holistic health
- Human biology
- Diet and nutrition
- Life management
- Contemporary yogic models – case study


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, Vidyavidhi Prakasham, Delhi, 2016.
4. Roshan Dalal The Vedas: An Introduction to Hinduism's Sacred Texts, Penguin Books 2014. ISBN13: 9780143066385
5. Raja Ram Mohan Roy, Vedic Physics, Mount Meru Publication ISBN : 9781988207049

Total: 30 hours


M. Raja
Course Coordinator / Sciences


Dr. C. Shanthi
HOD / Sciences


Dr. M. Renuga
Chairperson BOS,
Science and Humanities

29.08.2022

B.E. / B.Tech. Regulations 2019

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19BM401	Analog and Digital Integrated Circuits	3	0	0	3	45
2	U19BM402	Biomedical Instrumentation	3	0	0	3	45
3	U19BM403	Control System for Biomedical Engineering	3	0	0	3	45
4	U19BM404	Biomaterials	3	0	0	3	45
5	U19CS406	Data Structures	3	0	0	3	45
6	U19GE402	Mandatory Course: Environment and Climate Science	2	0	0	0	30
Practical							
7	U19BM405	Analog and Digital Integrated Circuits Laboratory	0	0	2	1	30
8	U19BM406	Biomedical Instrumentation Laboratory	0	0	2	1	30
9	U19CS407	Data Structures Laboratory	0	0	2	1	30
10	U19GE401	Soft Skills and Aptitude-II	0	0	2	1	30
Total Credits						19	

Approved By

Chairperson, 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, Fourth Semester BE BME Students and Staff, COE

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.

CO/PO, PSO Mapping															
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
Cos	Programme Outcomes (Po's) and Programme Specific Outcome (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	3	1	-	-	3	-	-
CO2	3	3	3	3	-	-	-	-	3	1	-	-	3	-	-
CO3	3	3	3	3	-	-	-	-	3	1	-	-	3	-	-
CO4	3	3	3	3	-	-	3	-	-	-	-	-	3	-	-
CO5	3	3	3	3	-	-	3	-	-	-	-	-	3	-	-

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, Differentiators and Integrators, Non-linear applications - Comparators, Schmitt Trigger.

UNIT II ACTIVE FILTERS AND DATA CONVERTERS

9

Introduction to Active Filters, LPF, HPF, Band pass, Band reject, 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.

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, 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.

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.

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	-	-	-	3	2	-	-	-	2	2	2	3	3	3
CO2	3	-	-	-	3	2	-	-	-	2	2	2	3	3	3
CO3	3	-	-	-	3	2	-	-	-	2	2	2	3	3	3
CO4	3	-	-	-	3	2	-	-	-	2	2	2	3	3	3
CO5	3	-	-	-	3	2	-	-	-	2	2	2	3	3	3

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.

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.

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	3	2	-	-	-	-	-	-	-	-	-	2	2	1
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	2	1
CO3	3	3	2	2	-	-	-	-	1	-	-	1	2	2	1
CO4	3	3	2	2	-	-	-	-	-	-	-	-	2	2	1
CO5	3	3	2	2	-	-	-	-	-	-	-	-	2	2	1

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 stability criterion, Constant M and N circles.

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.

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 Yanzhan 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.

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

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

TOTAL: 45 PERIODS

TEXT BOOK:

1. Biomaterials- Basic Theory with Engineering Applications C.Mauli Agarwal, Joo L.Ong, Mark R. Appleford, Gopinath Mani. Cambridge 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.

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

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.

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	3	3	3					3	1			3	1	
CO2	3	3	3	3					3	1			3	1	
CO3	3	3	3	3					3	1			3	1	

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

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.

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	-	-	-	3	2	-	-	-	2	2	2	3	3	3
CO2	3	-	-	-	3	2	-	-	-	2	2	2	3	3	3
CO3	3	-	-	-	3	2	-	-	-	2	2	2	3	3	3

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

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

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	3	3	3	3	3	2	2	1	2	1	2	3	3	2
CO2	3	3	3	3	3	3	2	2	1	2	1	2	3	3	2
CO3	3	3	3	3	3	3	2	2	2	2	2	2	3	3	2

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 Techniques

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:	
	<ul style="list-style-type: none"> 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:	
	<ul style="list-style-type: none"> 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. g. Binary Number System.- Binary to decimal, Octal, Hexadecimal 	
3. Verbal Aptitude	Demonstrating English language skills with reference to the following topics:	
	<ul style="list-style-type: none"> a. Critical reasoning b. Theme detection c. Verbal analogy d. Prepositions e. Articles f. Cloze test g. Company specific aptitude questions 	

S. Anita
06/01/2023

Dr.S.Anita

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

MANDATORY COURSE

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.

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..

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

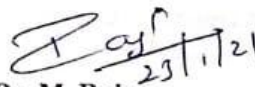
Fungal diseases in forests and agricultural crops due to climatic fluctuations - Growing energy needs - effect of climate change due to non-renewable energy resources. Renewable energy resources in the prevention of climatic changes- Effect of climatic changes in ground water table, garments, monuments,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

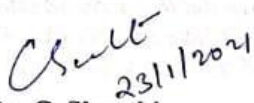
TOTAL: 30 HOURS**Text Books:**

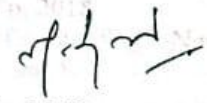
1. Miller, T.G. Jr., "Environmental Science", Wadsworth Pub. Co. 2018
2. Anubha Kaushik and Kaushik, "Environmental Science and Engineering" New Age International Publication, 4th Multicolour Edition, New Delhi, 2014.

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.


Dr. M. Raja
 Course Coordinator / Sciences


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	U19BM502 ✓	Pathology and Microbiology ✓	3	0	0	3	45 ✓
3	U19BM503 ✓	Biomechanics ✓	3	0	0	3	45 ✓
4	U19EC510 ✓	Digital Signal Processing ✓	3	0	0	3	45 ✓
5	U19EC511 ✓	Microprocessors and Embedded System Design	3	0	0	3	45
6	NOC23-BT67 ✓	NPTEL-Animal Physiology ✓	3	0	0	3	45 ✓
	NOC23-GE28 ✓	NPTEL-Research Methods in Health Promotion ✓					
	NOC23-BT55 ✓	NPTEL-Wildlife Ecology ✓					
Practical							
7	U19EC512 ✓	Digital Signal Processing Laboratory ✓	0	0	2	1	30 ✓
8	U19EC513 ✓	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 ✓	390

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, Fifth Semester BE BME Students and Staff, COE

COURSE OUTCOMES

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

- Elucidate the working and recording setup of all basic cardiac equipment.
- Explicate the working and recording of all basic neurological equipment.
- Interpret the recording of diagnostic and therapeutic equipment related to EMG.
- Explain about measurements of parameters related to respiratory system.
- 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	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO2	2	1	-	1	-	-	-	-	-	-	-	-	2	2	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-	2	2	-
CO4	3	2	-	1	-	-	-	-	-	-	-	-	2	2	-
CO5	2	2	-	1	-	-	-	-	-	-	-	-	2	2	-

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 BOOKS:

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.

REFERENCE BOOKS:

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 Measurementl, 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.



Dr.S.PRABAKAR, M.E.,Ph.D.,
Professor and Head
Department of Biomedical Engineering
Sona College of Technology, Salem.

COURSE OUTCOMES

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

- Describe DFT , FFT and to perform its computations
- Design FIR digital filters using various techniques
- Design IIR digital filters using different techniques.
- Analyse the finite word length effects in signal processing
- 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	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO2	3	3	3	3	3	1	-	-	-	-	2	2	3	3	1
CO3	3	3	3	3	3	1	-	-	-	-	2	2	3	3	1
CO4	3	3	2	3	3	1	-	-	-	-	2	2	3	3	1
CO5	3	1	2	1	3	1	-	-	-	-	2	2	3	3	1

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

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

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

TEXTBOOKS:

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

REFERENCE BOOKS:

1. Allan V.Openheim, Ronald W.Shafer & 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.

Dr.S.PRABAKAR, M.E.,Ph.D.,
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Sona College of Technology Salem.⁵

COURSE OUTCOMES

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

- Elucidate the basic nature of disease processes
- Classify diseases and apply knowledge of pathology's role in the diagnosis, staging and management of disease
- Depict theory and practical skills in microscopy and their handling techniques and staining procedures
- Distinguish common infectious agents and the diseases that they cause
- 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	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	1	1	-	-	-	-	-	-	-	-	-	-	1	1	1
CO3	1	2	-	1	-	-	-	-	-	-	-	-	1	1	1
CO4	2	1	1	1	1	-	-	-	-	-	-	-	1	1	1
CO5	1	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

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.

9

UNIT V IMMUNOPATHOLOGY

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 BOOKS:

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, 7th Edition, WB Saunders Co., 2005.
3. Ananthanarayanan and Panicker, Microbiology, 10th Edition, Orient blackswan, 2017

REFERENCE BOOKS:

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



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COURSE OUTCOMES

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

- Illustrate the principles of mechanics
- Infer the basics of bio fluid mechanics
- Utilize the mechanical properties of musculoskeletal elements
- Examine the biomechanics of joints and implants
- 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	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	3	2	1	-	-	-	-	-	-	3	1	1
CO2	3	3	3	3	3	1	-	-	-	-	-	-	3	2	1
CO3	2	3	3	3	3	1	-	-	-	-	-	-	3	2	1
CO4	3	3	3	3	3	1	-	-	-	-	-	-	3	2	1
CO5	3	3	3	3	3	1	-	-	-	-	-	-	3	2	1

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 BOOKS:

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

REFERENCE BOOKS:

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. Mansfield, 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, Biofluid Mechanics: The Human Circulation, Taylor and Francis, 2007

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COURSE OUTCOMES

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

- Develop assembly language program to solve mathematical problems using ALP programs.
- Understand the architecture and addressing modes, of Intel 8051 microcontroller.
- Design the embedded system application using 8051 microcontrollers.
- Analyze the hardware and software components of embedded system and its design process.
- Develop a real time application 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	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	3	3	2	-	-	1	1	2	1	3	3	-
CO2	1	2	2	3	2	1	-	-	1	1	2	1	3	2	-
CO3	2	2	3	2	3	1	-	-	1	1	1	1	3	3	-
CO4	2	2	2	3	2	3	-	-	1	1	2	1	3	2	-
CO5	2	3	3	3	3	3	-	-	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 – Signal
–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.

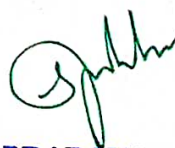
TOTAL: 45 HOURS

TEXT BOOKS:

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.

REFERENCE BOOKS:

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. Kenneth J Ayala, “The 8051 Microcontroller Architecture Programming and Application”, Edition3, Penram International Publishers (India), New Delhi, 2007.
4. Ramesh S Gaonkar, “Microprocessor Architecture, Programming and application with 8085”, 4th Edition, Penram International Publishing, New Delhi, 2002.
5. M. Rafi Quazzaman, “Microprocessors Theory and Applications: Intel and Motorola”, Prentice Hall of India, Pvt. Ltd., New Delhi, 2003.



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COURSE OUTCOMES

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

- Perform convolution, sampling and FFT operations on signals using MATLAB and DSP Processor
- Design FIR and IIR filters using MATLAB and DSP Processor
- 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	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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 HOURS


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COURSE OUTCOMES

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


- Develop and implement the arithmetic and logical operations using assembly language for 8086 microprocessors
- Develop and implement the interfacing of peripheral with 8051 microcontroller using embedded 'C' programs
- 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	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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:

1. Experiments based on 8086 microprocessor developed using assembly language
2. 8 bit / 16 bit addition, subtraction, multiplication, division using 8086
3. Logical operations, sorting of numbers, string manipulation using 8086
4. Experiments based on 89C5X microcontroller developed using Embedded 'C' environment
5. Timers, Serial port and Parallel I/O port access using 89C5X
6. Interfacing of LED, Key switches using 89C5X.
7. Interfacing of 7 Segment display using 89C5X.
8. Experiments based on Arduino board (UNO, Nano, Node MCU) interfacing
9. Serial data communication using Arduino.
10. Interfacing LED, Key switch, relay, and buzzer.
11. Interfacing Potentiometer, Thermistor, LDR.
12. Interfacing servo motors.
13. I2C devices.
14. IR sensors.
15. Measurement of Bio medical signals.
16. Interfacing WiFi and Blue tooth modules.
17. Data monitoring in cloud using IOT

TOTAL: 30 HOURS


Dr. S. PRABAKAR, M.E., Ph.D.,
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COURSE OUTCOMES

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

- Illustrate the pathological state of different clinical conditions
- Describe the staining characteristics of bacteria and differentiate these bacteria according to microscopic morphologies
- 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	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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. Differential count of Blood cells using Leishman's stain
3. Abnormal forms of RBC
4. Haematology slides of anaemia and leukaemia
5. Study of bone marrow charts
6. Histopathological examination of benign and malignant tumours (demonstration)
7. Handling of Microscopes: calibration of Microscopes
8. Test for motility (Hanging drop method)
9. Simple stain test
10. Gram stain test
11. AFB stain test
12. Capsule stain test
13. Sterilization Techniques.
14. Preparation of Culture media for microorganisms.
15. Enumeration of microorganisms



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TOTAL: 30 HOURS

V. Jem

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. Display effective language knowledge to construct sentences with subject verb agreement and select the best alternative for the underlined parts of the sentences, and fill in the blanks in the given passages with suitable forms of words and their synonyms.						
1.SOFT SKILLS	Demonstrating soft-skill capabilities with reference to the following topics: <ol style="list-style-type: none"> Career planning Resume writing Group discussion Teamwork Leadership skills Interview skills Mock interviews Mock GDs 					
2.QUANTITATIVE APTITUDE AND LOGICAL REASONING	Solving problems with reference to the following topics : <ol style="list-style-type: none"> Geometry: 2D, 3D, Coordinate Geometry, and Height & Distance. Permutation&Combinations:Principles of counting, Circular Arrangements and Derangements. Probability: Addition & Multiplication Theorems, Conditional Probability and Bayes Theorem. Statistics : Mean Median, Mode, Range and Standard Deviation. Interest Calculation :Simple Interest and Compound Interest Crypto arithmetic: Addition and Multiplication based problem. Logical Reasoning :Blood Relations, Directions Test, Series, Odd man out, Analogy, Coding & Decoding, Problems and Input – Output Reasoning. Statement & Assumptions, Statements & Arguments, Inference. Company Specific Pattern :Infosys and TCS company specific problems 					
3. VERBAL APTITUDE	Demonstrating English language skills with reference to the following topics: <ol style="list-style-type: none"> Subject verb agreement Selecting the best alternative for the stated parts of given sentences Reading comprehension Contextual synonyms Sentence fillers Writing a story for a given picture Company specific aptitude questions 					

S. Anita
8/6/2023

Dr.S.Anita

Head/Training

Dr. S. ANITA

Professor and Head

Department of Training,

SONA COLLEGE OF TECHNOLOGY,

SALEM-636 005.

Syllabi for

**B.E/B.Tech Honours (Specialization in the
same Discipline)**

B.E/B.Tech Honours

B.E/B.Tech Minor

courses

U19BM2038		EYE AND DENTAL CARE EQUIPMENT											L	T	P	C
													3	0	0	3
COURSE OUTCOMES																
On successful completion of this course, the student will be able to																
	•	Understand the physiology behind ocular and oral biological structures.														
	•	Illustrate the importance and working principle of ophthalmic instruments.														
	•	Conclude the Engineering principles involved in Ophthalmology.														
	•	Discuss about Dental radiology and its applications														
	•	Explain about the various biomaterials used in Dental field.														
CO/PO, PSO Mapping																
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak																
Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)																
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	2	2	2	1	1	-	-	-	-	-	2	2	2	1	
CO2	3	2	2	2	1	1	-	-	-	-	-	2	2	2	1	
CO3	3	2	2	2	1	1	-	-	-	-	-	2	2	2	1	
CO4	3	2	2	2	1	1	-	-	-	-	-	2	2	2	1	
CO5	3	2	2	2	1	1	-	-	-	-	-	2	2	2	1	
UNIT I INTRODUCTION TO OPHTHALMOLOGY AND ORAL BIOLOGY 9																
Anatomy and physiology of ocular structures and visual pathways - Optics and image formation in the retina - Pressure control mechanism of the eye - Ocular blood supply - Nervous control of the eye - Oculomotor control - Common pathologies of the eye and visual system - Anatomy and physiology of oral cavity- Tooth types and functions.																
UNIT II OPHTHALMIC INSTRUMENTS 9																
Lensometer, Lens gauge-Tonometer-Placido disc – Ketherometer- Specular Microscopy - Exophthalmometer - Non Contact Tonometer- Slit Lamp- Photo-slit lamp- Ophthalmoscope, Fundus Camera- Contrast sensitivity tests - Glare acuity tests - Color vision tests - Dark adaptometer- Retinoscopy- Gonioscopy-Pachometry-A -Scan Biometry - Heidelberg Retina-tomography HRT –II - Nerve fiber analyzer - Frequency doubling perimeter.																
UNIT III OPHTHALMIC ENGINEERING 9																
Lasers in Ophthalmic Engineering- Fundamentals and types of Lasers- Lasers for Ophthalmic Surgery , Lasers in ophthalmic measurement instrumentation – Optoelectronics- Fundamentals of Optoelectronics, Optical fiber and Optoelectronic Technology for Ophthalmic practices- Biomaterials for Ophthalmic Applications- Different class of materials used for Eye Care- AI for Ophthalmic practices.																

UNIT IV	DENTAL RADIOLOGY	9
Introduction to dental radiology- Dental X ray unit- X ray room, X ray unit control panel, Dental X ray film, dental X-ray working principle- Applications of Bite-wing X ray, Periapical X ray, occlusal X ray and Panoramic X-rays-Tomograms-Cephalometric projections, Sialography-Extra oral projections in dentistry		
UNIT V	DENTAL MATERIALS	9
Introduction to dental materials-physical and mechanical properties-Tooth composition- Tooth mechanical properties - Impression materials- Bases, liners for cavities- Varnishes for cavities – Fillings- Restorative materials- Materials for deep cavities- Metals in dentistry-dental ceramics-dental implants – Dental Engine.		
TOTAL : 45 Hours		
TEXTBOOKS:		
1.	Olaf E. Langland ,Robert P. Langlais , John Preece,“Principles of Dental Imaging”, Wolters Kluwer, 2nd edition,2002.	
2.	Sujata V Bhat, “Biomaterials”, Narosa publishing house, 2nd edition, 2010.	
3.	Helena Jelinkova, “Lasers for medical applications: Diagnostics, Therapy and Surgery”, Woodhead Publishing, 1st edition, 2013.	
REFERENCES:		
1.	K.Nicopoulou-Karayianni, A.G.Mitsea, K.Horner.,“Dental diagnostic radiology in the forensic sciences: sciences: two case presentations”, J Forensic Odontostomatol 2007;25:12-6.	
2.	Stuart C. White and Michael J. Pharoah., “Oral radiology- principles and interpretation”, Elsevier publications. Parts I and II. Chapters 1-16, 7th edition, 2014.	

COORDINATOR

K. Manikandan

Aplomb

S. Prabahar

HOD-BME

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U19BM2037	INTENSIVE AND CRITICAL CARE EQUIPMENT	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

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

- Understand the fundamental principles, functions, and components of various types of ICU Equipment
- Illustrate the importance and working principle of critical care equipment.
- Explain the usage and applications of operation theatre equipment.
- Classify the different types of centralized systems used in hospitals
- Categorize the basic concepts of patient safety and protection equipment used for safety measures in hospitals.

CO/PO, PSO Mapping

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

Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

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

UNIT I INTENSIVE CARE UNIT EQUIPMENT 9

Suction apparatus-Different types; Sterilizers- Chemical, Radiation, Steam for small and large units. ICU ventilators. Automated drug delivery systems - Infusion pumps, components of drug infusion system, closed loop control infusion system, implantable infusion system. BMD Measurements – SXA – DXA - Quantitative ultrasound bone densitometer.

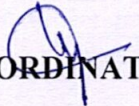
UNIT II CRITICAL CARE EQUIPMENT 9

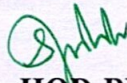
Defibrillators, Hemodialysis Machine, Different types of Dialyzers, Membranes, Machine controls and measurements. Heart Lung Machine, different types of oxygenators, peristaltic pumps, Incubators.

UNIT III OPERATION THEATRE EQUIPMENT 9

Craniotomy, Electrosurgical Machines (ESU), Electrosurgical analyzers, surgical aspirator, Instruments for operation. Anesthesia Machine, Humidification, Sterilization aspects, Boyle's apparatus. Endoscopy – Laparoscopy - Cryogenic Equipment - Anesthesia gas, Anesthesia gas monitor - surgical microscope.

UNIT IV	CENTRALISED SYSTEMS	9
Centralized Oxygen, Nitrogen, Air supply & Suction. Centralized Air Conditioning, Operation Theatre table & Lighting.		
UNIT V	PATIENT SAFETY	9
Patient electrical safety, Types of hazards, Natural protective mechanisms against electricity, Leakage current, Inspection of grounding and patient isolation, Hazards in operation rooms, ICCU and IMCUs, Optocouplers and Pulse transformers.		
TOTAL : 45 Hours		
TEXTBOOKS:		
1.	Khandpur. R.S., "Handbook of Biomedical Instrumentation". Second Edition. Tata McGrawHill Pub. Co., Ltd. 2003.	
2.	Leslie Cromwell, "Biomedical Instrumentation and Measurement", Pearson Education, New Delhi, 2007.	
REFERENCES:		
1.	John G. Webster, "Medical Instrumentation Application and Design", 4th edition, Wiley India Pvt Ltd, New Delhi, 2015.	
2.	Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson education, 2012.	
3.	L.A Geddes and L.E. Baker, "Principles of Applied Biomedical Instrumentation", 3rd Edition, 2008.	
4.	Antony Y.K. Chan, "Biomedical Device Technology, Principles and design", Charles Thomas Publisher Ltd, Illinois, USA, 2008.	


COORDINATOR
 K. Manikandan
 APLBME


HOD-BME
Dr. S. PRABAKAR, M.E., Ph.D.,
 Professor and Head
 Department of Biomedical Engineering
 Sona College of Technology, Salem-5

Minor

ADS

COURSE OUTCOME:

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

1. Learn the foundations of data science and the primary areas of this discipline's research.
2. Demonstrate skill in Python sequence data structures, including strings, arrays, lists, tuples, sets, and dictionaries.
3. Apply aggregation functions such as finding the minimum, maximum, and mean values of arrays.
4. Apply various operations and transformations on data using Pandas methods and functions.
5. Analyse the need for data pre-processing and Web scrapping 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
CO1	3	2								2	2	1	1	1
CO2	3	2	1							2	1	2	2	2
CO3	3	3	1	1	1						1		2	3
CO4	3	3	2	2	2						1		3	2
CO5	3	3	2	3	3						2	2	2	3

UNIT I INTRODUCTION DATA SCIENCE AND PYTHON 9

What is data? what is data science? - Fundamentals of data science - Data science life cycle - Why data science is important? - Applications of data science -Basics of data: categories of data- Sources of data- data processing -Why Python is necessary for data science? - Jupyter/pycharm/spyder or any other python tool set up and installation.

UNIT II BASICS OF PYTHON AND DATA STRUCTURES 9

Data types - operators – variables – expressions - control structures using sample dataset-objects and functions -Python sequence data structures including String, Array, List, Tuple, Set, and Dictionary.

UNIT III INTRODUCTION TO NUMPY 9

Understanding Data Types in Python -The Basics of NumPy Arrays-Computation on NumPy Arrays: Universal Functions -Aggregations: Min, Max, and Everything In Between - Computation on Arrays: Broadcasting -Comparisons, Masks, and Boolean Logic- Fancy Indexing -Sorting Arrays-Structured Data: NumPy's Structured Arrays

UNIT IV DATA MANIPULATION WITH PANDAS 10

Introducing Pandas Objects - Data Indexing and Selection - Operating on Data in Pandas - Handling Missing Data - Hierarchical Indexing -Combining Datasets: Concat and Append - Combining Datasets: Merge and Join- Aggregation and Grouping - Pivot Tables - Vectorized String Operations - Working with Time Series -High-Performance Pandas: eval () and query()

Handwritten signatures in blue ink.

Handwritten signature in green ink.
DR. J. AKILANDESWARI
 PROFESSOR & HEAD
 Department of Information Technology
 SONA COLLEGE OF TECHNOLOGY
 SALEM - 636 005

Data pre-processing: data loading - dealing with missing values and outliers - data wrangling - filtering data - Data Normalization - Data Formatting -data cleaning - Web scraping with beautiful soup.

THEORY – 45 HRS

PRACTIAL: 30 HRS

TOTAL: 75 HOURS

LAB EXERCISES:

1. Write a python program to perform following operations.
 - a. Create a list, insert elements into the list and sort it in ascending order.
 - b. Create a dictionary of 10 elements, change/delete the values of few keys and display the dictionary before and after the updates.
 - c. Create a tuple and a list. Convert the list to tuple and display the elements of both. Write the program to remove the duplicate element of the list.
2. Write a python program to perform following task using NumPy
 - a. Develop a program to learn concept of array and NumPy module.
 - b. Convert a list of numeric value into a one-dimensional NumPy array. And perform all operations on that array.
 - c. Find the union of two arrays. Union will return the unique, sorted array of values that are in either of the two input arrays.
3. Perform the following task using pandas
 - a. Convert a NumPy array to a Pandas series. Also write a Pandas program to calculate the frequency counts of each unique value of a given series.
 - b. Read a dataset from diamonds DataFrame and modify the default columns values and print the first 6 rows. Also find the number of rows and columns and data type of each column of diamonds DataFrame.
4. Write a program to perform all basic data pre-processing steps on the given data set.
5. Write a program to perform exploratory data analysis on the given dataset.

TEXTBOOKS:

1. Python for data science for dummies 2nd Edition, John Paul Mueller, Luca Massaron, and Wiley.(Unit- 1,4,5)
2. Vasiliev, Y. (2022). Python for Data Science: A Hands-On Introduction. United Kingdom: No Starch Press. (Unit- 1,3,4)
3. Thareja, R. (2019). Python Programming: Using Problem Solving Approach. India: Oxford University Press. (Unit- 2)

REFERENCE BOOKS:

1. Pandas for everyone: Python Data Analysis, Daniel Y. Chen, Pearson
2. Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Davy Cielen, Arno D.B. Meysman, et al., Manning
3. Applied Data Science with Python and Jupyter: Use powerful industry-standard tools to unlock new, actionable insights from your data.




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COURSE OUTCOMES

At the end of the course, student will able to

1. Explain the life cycle of data analytics project
2. Apply Exploratory Data Analysis over the dataset
3. Explore data pre-processing and feature selection techniques over a dataset
4. Apply association rule mining to find the frequent item set in business data repository
5. Build different type of regression models for different business use cases

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
CO1	2	2	2	2	2				2	2				2
CO2	3	2	2	2	2									3
CO3	3	2	2	2	2									3
CO4	3	3	3	3	3								2	3
CO5	3	3	3	3	3								2	3

UNIT I INTRODUCTION

9

Need for data science – benefits and uses – facets of data – Data Analytics Lifecycle: Data Analytics Lifecycle Overview - Discovery – Data Preparation – Model Planning –Model Building – Communicate Results

UNIT II EXPLORATORY DATA ANALYTICS

9

Exploratory Data Analysis: Visualization before Analysis, Dirty Data, Examining Single and Multiple Variable, Data Exploration- Statistical Methods for Evaluation: Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, Type I and Type II errors, Powers and Sample Size, ANOVA

UNIT III DATA PRE-PROCESSING AND FEATURE SELECTION

9

Data cleaning - Data integration - Data Reduction - Data Transformation and Data Discretization, Feature Generation and Feature Selection, Feature Selection algorithms: Filters-Wrappers, and Embedded

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 Department of Information Technology
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UNIT IV DATA ANALYTICS METHOD – ASSOCIATION RULE MINING 9

Association Rules: Apriori Algorithm, Evaluation of Candidate rules, Application of Association Rules, Frequent Pattern Growth Algorithm, Validation and Testing, Rule based Classifiers – Use case: Grocery Stores, Recommendation System

UNIT V REGRESSION MODELS 9

Regression Models – Use of Regression Analysis – Types of Regressions: Linear Regression, Logistic Regression, Polynomial Regression, Stepwise Regression, Ridge Regression, Lasso Regression, and ElasticNet Regression- Selection of Right Regression Model –Use Case: Sales Forecasting, Credit Card industry

TOTAL: 45 HOURS

TEXT BOOKS

1. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics: Discovering, Analysing, Visualizing, and Presenting Data ”, Wiely 2015

REFERENCES

1. David Cielén, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2. Jiawei Han, Micheline Kamber and Jian Pei ,”Data Mining: Concepts and Techniques”, 3rd Edition , Morgan Kaufmann,2011
3. Jay Liebowitz, “Big Data and Business Analytics”, CRC Press, 2013
4. Cathy O'Neil and Rachel Schutt, “Doing Data Science”. O'Reilly, 2014.

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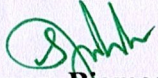
Handwritten signature in green ink.
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BME
VI

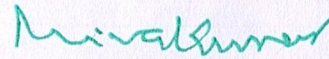
Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VI Regulations 2019
Branch: Biomedical Engineering

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	U19BM910	Professional Elective- Medical Device Design	3	0	0	3	45
5	U19BM911	Professional Elective- Hospital Planning and Management	3	0	0	3	45
	U19BM2011	Professional Elective- Medical Waste Management					
Open Elective							
6	U19CS1001	Big Data Analytics	3	0	0	3	45
	U19CS1002	Cloud Computing					
	U19CS1003	Internet of Things					
	U19EE1002	Energy Conservation and Management					
	U19EE1004	Renewable Energy Systems					
	U19FT1001	Fundamentals of Fashion Design					
	U19FT1002	Garment Manufacturing Technology					
	U19MC1003	Smart Automation					
	U19MC1004	Fundamentals of Robotics					
	U19ME1002	Industrial Safety					
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	390

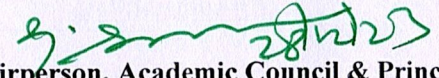
Approved By



Chairman, Biomedical Engineering BoS
Dr.S.Prabakar



Member Secretary, Academic Council
Dr.R.Shivakumar 26/12/23




Chairperson, Academic Council & Principal
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																
CO1	•	Classify the various equipment used in ICU														
CO2	•	Illustrate the types of diathermies and its applications														
CO3	•	Infer the basics of critical care equipment and its application in medicine														
CO4	•	Explain the various extracorporeal and special diagnostic devices used in hospitals														
CO5	•	Summarize the importance of patient safety against electrical hazard														
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 Outcomes (PSO's)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	2	2	1	-	-	-	-	-	-	-	1	3	2	-	
CO2	3	2	2	1	-	-	-	-	-	-	-	1	3	2	-	
CO3	3	2	2	1	-	-	-	-	-	-	-	1	3	2	-	
CO4	3	2	2	1	-	-	-	-	-	-	-	1	3	2	-	
CO5	2	2	2	-	-	3	-	-	-	-	-	1	2	2	2	
UNIT I PATIENT MONITORING AND BIOTELEMETRY 9																
Patient monitoring systems, ICU/CCU Equipment, bed side monitors, Infusion pumps, Central console 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, Oscopes.																

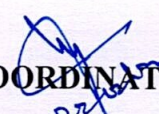
UNIT IV	DENTAL EQUIPMENT	9
Need for Dental care-Dental Patient Chairs, Operatory Cabinetry, Delivery Systems, Dental Operatory Lights, X-ray Imaging Equipment, Sterilization Equipment, Handpieces, Utility Equipment, Specialized equipment's –Intraoral Cameras, introduction to Chairside CAD/CAM Systems, 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 Hours		
TEXTBOOKS:		
1.	John G. Webster, Medical Instrumentation Application and Design, Wiley India Pvt. Ltd, New Delhi, 4 th edition, 2015	
2.	Joseph J. Carr and John M. Brown, Introduction to Biomedical Equipment Technology, Pearson education, 2012.	
REFERENCES:		
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, Merrill 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.	



COORDINATOR
K.MANIKANDAN
Asst. Prof /BME


CHAIRMAN
BoS-BME
Dr.S.PRABAKAR, M.E.,Ph.D.,
Professor and Head
Department of Biomedical Engineering
Sona College of Technology, Salem-5

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																
CO1	•	Describe the working principle of X-ray machine and its application.														
CO2	•	Illustrate the principle of computed tomography.														
CO3	•	Interpret the technique used for visualizing various sections of the body using MRI														
CO4	•	List the applications of radio nuclide imaging.														
CO5	•	Explain the methods of radiation safety.														
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 Outcomes (PSO's)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	1	1	1	3	-	1	-	-	1	-	1	2	2	-	
CO2	3	2	1	1	3	-	1	-	-	1	-	1	2	2	-	
CO3	3	2	1	1	3	-	1	-	-	1	-	1	2	2	-	
CO4	3	1	1	1	3	-	1	-	-	1	-	1	2	2	-	
CO5	3	1	1	1	3	2	1	-	-	1	-	1	2	2	2	
UNIT I																
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.																
UNIT II																
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.																
UNIT III																
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																

UNIT IV	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.		
UNIT V	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 : 45 Hours		
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 Edition 2009.	
REFERENCES:		
1.	Steve Webb, The Physics of Medical Imaging, Adam Hilger, Philadelphia, 1988	
2.	Gopal B.Saha, Physics and Radio biology of Nuclear Medicine, Springer, Third edition, 2006.	
3.	B.H.Brown, PV Lawford, RH Small wood, DRHose, DC Barber, Medical physics and biomedical Engineering, -CRC Press, 1999.	
4.	Myer Kutz, Standard hand book of Biomedical Engineering and design, McGrawHill, 2003.	


COORDINATOR
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 Asst. Prof /BME


CHAIRMAN
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 Professor and Head
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 Sona College of Technology, Salem-5

U19BM603		BIOSENSORS AND TRANSDUCERS											L	T	P	C
													3	0	0	3
COURSE OUTCOMES																
On successful completion of this course, the student will be able to																
CO1	●	Identify and classify the various methods of measurement systems														
CO2	●	Explain the Principles of Sensors and Transducers.														
CO3	●	Comprehend the modes of operation of Photoelectric and Piezoelectric Transducers														
CO4	●	State the principle and components of Biosensors.														
CO5	●	Explain the principles of Biochemical sensors.														
CO/PO, PSO Mapping																
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak																
Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)																
CO's		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3	2	2	-	-	-	-	-	-	1	-	1	2	1	-
CO2		3	2	2	-	-	-	-	-	-	1	-	1	2	1	-
CO3		3	2	2	-	-	-	-	-	-	1	-	1	2	1	-
CO4		3	2	2	-	-	-	-	-	-	1	-	1	2	1	-
CO5		3	2	2	-	-	-	-	-	-	1	-	1	2	1	-
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 Hours		
TEXTBOOKS:		
1.	A.K.Sawhney, "Electrical & Electronics Measurement and Instrumentation", 10th edition, Dhanpat Rai & Co, New Delhi, 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 Wiley and Sons, Third Edition, Reprint 2008.	
5.	Albert D. Helfrick and William D.Cooper. "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.	

COORDINATOR
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Asst. Prof /BME

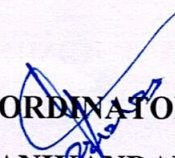
CHAIRMAN


BoS-BME

Dr.S.PRABAKAR, M.E., Ph.D.,
Professor and Head
Department of Biomedical Engineering
Sona College of Technology, Salem-5

U19BM911		HOSPITAL PLANNING AND MANAGEMENT											L	T	P	C
													3	0	0	3
COURSE OUTCOMES																
On successful completion of this course, the student will be able to																
CO1	●	Identify the Principles of Hospital Planning and Management														
CO2	●	Summarize the functional hospital organization and administrative services														
CO3	●	Discuss about Human Management in Hospitals and training of healthcare workers														
CO4	●	Explain various supportive services in the hospitals.														
CO5	●	Elaborate the ways of equipment maintenance in hospitals.														
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 Outcomes (PSO's)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	2	1	1	-	-	2	1	2	2	1	2	1	-	2	1	
CO2	2	1	1	-	-	2	1	2	3	1	2	1	-	2	1	
CO3	2	1	1	-	-	2	1	2	3	1	1	1	-	2	1	
CO4	2	1	1	-	-	2	1	2	2	1	1	1	-	2	1	
CO5	2	1	1	-	-	2	1	2	2	1	1	1	-	2	1	
UNIT I	OVERVIEW OF HOSPITAL PLANNING															9
The role of hospitals in Healthcare -, Hospital Planning and Design, -Guiding principles in Planning - Regionalization of hospital services – Equipment Planning- Functional Planning -Financial Planning– Climatic consideration in design -Distinction between Hospital and Industry, Different Departments of clinical services.																
UNIT II	FUNCTIONAL HOSPITAL ORGANIZATION AND ADMINISTRATIVE SERVICES															9
Distinction between Hospital and Industry– Public relations in hospitals, Ethical and Legal aspects of Hospital Administration, Disaster Management, Quality Assurance through record, review and Medical audit, Evaluation of Hospital Services- Clinical Information Systems Medical Transcription, Medical Records Department – Central Sterilization and Supply Department – Pharmacy– Food Services - Laundry Services- Challenges in Hospital Administration.																
UNIT III	HOSPITAL MANAGEMENT AND TRAINING															9
Effective Hospital Management- Materials Management- Manpower planning- Organizing- Directing and Leading- Controlling- Training of healthcare workers – Waste transport staff, Operators of treatment plants - Immunization of healthcare workers – Management of occupational blood exposure, Hepatitis A and B, Prophylaxis, HIV PEP, HCV, H1N1- Infection control practices																

UNIT IV	CLINICAL SUPPORTIVE SERVICES	9
Radiology and Imaging Services- Laboratory Services- Operation Theatre Suite- Central Sterile Supply Department (CSSD)- Outpatient Services- Intensive Care Unit- The Nursing Unit and Nursing Services- Pharmacy.		
UNIT V	EQUIPMENT MAINTENANCE MANAGEMENT	9
Organizing Maintenance Operations- Paper Work Control, Maintenance Job Planning, Maintenance Work Measurement and Standards- Preventive Maintenance- Computerized Maintenance Management System (CMMS), Maintenance Budgeting and Forecasting- Maintenance Training- Contract Maintenance.		
TOTAL : 45 Hours		
TEXTBOOKS:		
1.	Sakharkar B. M., Principles of Hospital Administration and Planning, Second Edition, Jaypee Brothers, 2009.	
2.	Sharma D. K. Goyal R. C., Hospital Administration and Human Resource Management, PHI Learning Private Limited, 2017.	
3.	G.D.Kunders, "Hospitals – Facilities Planning and Management", TMH, New Delhi – 5th edition Reprint 2007.	
REFERENCES:		
1.	Lawrence F. Wolper, Health Care Administration, Managing Organized Delivery System, Fifth Edition, Jones and Bartlett Publishers, 2011.	
2.	Madhuri Sharma, Hospital Waste Management and its monitoring, Jaypee, 2017	

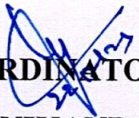
COORDINATOR

K.MANIKANDAN
 Asst. Prof /BME


CHAIRMAN

BoS-BME

Dr.S.PRABAKAR, M.E., Ph.D.,
 Professor and Head
 Department of Biomedical Engineering
 Sona College of Technology, Salem-5

U19BM910		MEDICAL DEVICE DESIGN											L	T	P	C
													3	0	0	3
COURSE OUTCOMES																
On successful completion of this course, the student will be able to																
CO1	•	Classify the medical devices standards and requirements.														
CO2	•	Summaries the concept of medical device development.														
CO3	•	Explain the engineering design and project metrics.														
CO4	•	Demonstrate the testing and validation of medical equipment.														
CO5	•	Explain the various design transfer and manufacturing methods														
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 Outcomes (PSO's)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	2	2	1	2	1	1	-	-	1	-	1	2	1	-	
CO2	3	2	2	1	2	1	1	-	-	1	-	1	2	1	-	
CO3	3	2	2	1	2	1	1	-	-	1	-	1	2	1	-	
CO4	3	2	2	1	2	1	1	-	-	1	-	1	2	1	-	
CO5	3	2	2	1	2	1	1	-	-	1	-	1	2	2	-	
UNIT I																
MEDICAL DEVICES STANDARDS AND REQUIREMENTS															9	
FDA, Medical devices classification, Medical Devices Directive Process – Harmonized Standards, ISO13485, ISO 14971, IEC60601-1, IEC 62304. Reliability, Concept of failure, Product Design and Development Process.																
UNIT II																
CONCEPT DEVELOPMENT															9	
Product Definition Process - Quality Function Deployment-Human Factors-Business Proposal. Safety and Risk Management - Tools, Documents and Deliverables.																
UNIT III																
DESIGN ENGINEERING															9	
Hardware Design, Hardware Risk Analysis, Design and Project Metrics, Design for Six Sigma, Software Design, Software Coding, Software Risk Analysis, Software Metrics.																
UNIT IV																
TESTING AND VALIDATION															9	
Basis and Types of Testing, Hardware Verification and Data Analysis, Software Verification and Data Analysis.																

UNIT V	DESIGN TRANSFER AND MANUFACTURING	9
Transfer to Manufacturing, Hardware Manufacturing, Software Manufacturing, Configuration Management, Intellectual Property-Copy Rights-Trademarks-Trade Secrets.		
TOTAL : 45 Hours		
TEXTBOOKS:		
1.	Peter Ogradnik, Medical Device Design Innovation from Concept to Market, Elsevier, 2013.	
2.	Richard C. Fries and Marcel Dekker AG, Handbook of Medical Device Design, 2 nd edition, 2005.	
REFERENCES:		
1.	Jagdish Chaturvedi, Inventing medical devices: A perspective from India, Create Space Independent Publishing Platform , 1 st edition, 2015.	
2.	Theodore R. Kucklick , The Medical Device R&D Handbook, Second Edition, CRC Press, 2012.	
3.	Gail Baura, Medical Device Technologies: A Systems Based Overview Using Engineering, Elsevier science, 2012.	
4.	Matthew B. Weinger, Michael E, Wiklund, Daryle J. Gardner-Bonneau, Handbook of Humanfactors in Medical Device Design, Taylor and Francis group, 2010.	

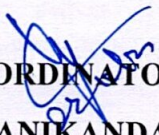

COORDINATOR
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 Asst. Prof /BME



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Dr.S.PRABAKAR, M.E., Ph.D.,
 Professor and Head
 Department of Biomedical Engineering
 Sona College of Technology, Salem-5

U19BM2011		MEDICAL WASTE MANAGEMENT											L	T	P	C
													3	0	0	3
COURSE OUTCOMES																
On successful completion of this course, the student will be able to																
CO1	•	Summarize the types of Medical waste.														
CO2	•	Explain the guidelines for handling Biomedical Waste.														
CO3	•	Describe the various medical waste segregation methods.														
CO4	•	Categorize the types of treating and disposing methods of Medical wastes.														
CO5	•	Enumerate various safety and regulatory guidelines in Medical waste management.														
CO/PO, PSO Mapping																
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak																
Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)																
CO's		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1	1	-	-	-	2	3	1	-	1	-	1	-	-	2
CO2		1	1	-	-	-	2	3	1	-	1	-	1	-	-	2
CO3		1	1	-	-	-	2	3	1	-	1	-	1	-	-	2
CO4		1	1	-	-	-	2	3	1	-	1	-	1	-	-	2
CO5		1	1	-	-	-	2	3	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: Biomedical waste handling rules, CPCB guidelines, BARC guidelines - Radioactive waste disposal – WHO guidelines – Waste 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 - Biomedical symbol, microwave, 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 equipment usage - Occupational health programmers - Safety, Budget allocation, Record Maintenance, 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 Hours		
TEXTBOOKS:		
1.	Tweedy, James T., Healthcare Hazard Control and Safety Management-CRC Press, Taylor and Franci, 2014.	
2.	Anantpreet Singh, Sukhjit Kaur, Biomedical Waste Disposal, Jaypee Brothers Medical Publishers (P) Ltd. 2012.	
3.	Mohd. Faisal Khan, Hospital Waste Management: Principle and Guidelines, Kanishka Publishers, 2010.	
REFERENCES:		
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 Managementl, 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 Mediactal Publishers, 2007.	
5.	Mohammad Mohsin, Hospital: Waste Management, VDM Publishing, 2010.	

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 Sona College of Technology, Salem-5

U19BM604 ✓

DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY

L	T	P	C
0	0	2	1

COURSE OUTCOMES

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

- | | | |
|-----|---|--|
| CO1 | • | Measure the different bioelectrical signals. |
| CO2 | • | Analyze the various physiological signals using telemetry. |
| CO3 | • | Demonstrate various diagnostic and therapeutic techniques. |

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 Outcomes (PSO's)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	1	1	2	2	3	2	-
CO2	3	3	2	2	2	-	-	-	1	1	2	2	3	2	-
CO3	3	3	2	2	2	-	-	-	1	1	2	2	3	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 Hours

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Dr. S. PRABAKAR, M.E., Ph.D.,

Professor and Head

Department of Biomedical Engineering

Sona College of Technology, Salem-5

U19BM605		BIOSENSORS ^{AND} TRANSDUCERS LABORATORY											L	T	P	C
													0	0	2	1
COURSE OUTCOMES																
On successful completion of this course, the student will be able to																
CO1	•	Evaluate the performance of temperature, pressure, displacement & torque - measurement using relevant sensors/transducers.														
CO2	•	Demonstrate the characteristics of an LDR, load cell & pH electrodes.														
CO3	•	Analyze the characteristics of Biosensors and transducers.														
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 Outcomes (PSO's)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	3	2	2	2	-	-	-	1	1	2	2	3	2	-	
CO2	3	3	2	2	2	-	-	-	1	1	2	2	3	2	-	
CO3	3	3	2	2	2	-	-	-	1	1	2	2	3	2	-	
List of Experiments:																
<ol style="list-style-type: none"> 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 																
Total : 30 Hours																



COORDINATOR

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Sona College of Technology, Salem-5

22.12.2023

Regulation - 2019

Semester –VI	U19GE601: SOFT SKILLS AND APTITUDE – IV (Common to all dept except Civil)	L	T	P	C	Marks
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					

30 Hours

S. Anita
18/12/2023

Dr.S.Anita
Professor and Head
Department of Training
Dr. S. ANITA
Professor and Head
Department of Training,
SONA COLLEGE OF TECHNOLOGY,
SALEM-636 005.

COURSE OUTCOMES:**At the end of the course the students will be able to**

- Compare and analyze different types of digital data characteristics of Big Data
- Implement programs using Hadoop open source software framework
- Design and develop programs using NoSQL Databases like Mongo DB and Cassandra
- Apply MapReduce programming for various big data based problems
- Implement programs using Hive and Pig Databases

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	2	1	2	1	2	0	1	0	2	1	2	2	2
CO2	2	1	2	2	3	2	0	1	1	2	2	2	2	2
CO3	2	1	2	3	3	2	1	1	1	2	3	2	2	3
CO4	3	1	2	3	3	2	0	1	0	2	3	2	2	3
CO5	2	2	3	3	3	1	0	1	0	2	3	2	3	3

UNIT I INTRODUCTION TO BIG DATA**9**

Types of Digital Data: Classification of Digital Data Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, Characteristics of Big Data ,Traditional Business Intelligence (BI) versus Big Data, A Typical Data Warehouse Environment , A Typical Hadoop Environment.

UNIT II BIG DATA ANALYTICS**9**

Introduction -Big Data Analytics, Classification of Analytics, Challenges in Big Data, Technologies to handle Challenges Posed by Big Data- Data Science- Data Scientist, Terminologies Used in Big Data Environments, Basically Available Soft State Eventual Consistency (BASE), Few Top Analytics Tools.

UNIT III HADOOP**9**

Introduction Hadoop, RDBMS versus Hadoop, Distributed Computing Challenges ,History of Hadoop , Hadoop Overview, Use Case of Hadoop ,Hadoop Distributors ,HDFS (Hadoop Distributed File System),Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator),Interacting with Hadoop Ecosystem, MapReduce Programming -Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression

UNIT IV NO SQL DATABASES

9

Cassandra :Apache Cassandra - An Introduction , Features of Cassandra, CQL Data types, CQLSH, Keyspaces, CRUD (Create, Read, Update and Delete) Operations, Collections, Using a Counter, Time to Live (TTL), Alter Commands, Import and Export, Querying System Tables, Practice Examples- MongoDB, Terms Used in RDBMS and MongoDB, Data Types in MongoDB , MongoDB Query Language

UNIT V HIVE AND PIG

9

Hive: Introduction to Hive, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, SerDe, User-defined Function(UDF).

Pig: Introduction to Pig, The Anatomy of Pig, Pig on Hadoop , Pig Philosophy, Use Case for Pig: ETL Processing, Pig Latin Overview , Data Types in Pig ,Running Pig , Execution Modes of Pig ,HDFS Commands ,Relational Operators ,Eval Function ,Complex Data Types ,Piggy Bank, User-Defined Functions (UDF) ,Parameter Substitution , Diagnostic Operator , Word Count Example using Pig,Pig versus Hive


Total: 45 hours

TEXT BOOKS:

1. **Big Data and Analytics**, Seema Acharya, Subhashini Chellappan, Infosys Limited, Publication: Wiley India Private Limited,1st Edition 2015(Chapters 1,2,3,4,5,6,7,8,9,10)

REFERENCE BOOKS:

1. **Hadoop in Practice**, Alex Holmes, Manning Publications Co., September 2014, Second Edition.
2. **Programming Pig**, Alan Gates, O'Reilly, Kindle Publication.
3. **Programming Hive**, Dean Wampler, O'Reilly, Kindle Publication.


Dr. B. SATHIYABHAMA, B.E., M.Tech., Ph.D.
PROFESSOR & HEAD,
Dept. of Computer Science and Engineering
SONA COLLEGE OF TECHNOLOGY
SALEM - 636 005

COURSE OUTCOMES:

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

1. Provide an overview of cloud computing
2. Explain the various tasks in developing cloud services
3. Analyze the provision of cloud computing services to different users
4. Configure the various cloud services according to the environment.
5. Analyze various ways to collaborate online

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
CO1	2	1	1	2	1	2	0	1	0	2	1	2	2	2
CO2	2	1	2	3	3	2	0	1	1	2	2	3	3	3
CO3	2	1	3	3	3	2	0	1	0	3	3	2	3	3
CO4	2	1	2	3	3	2	0	1	0	2	3	3	3	3
CO5	2	2	3	3	3	1	0	1	0	2	3	2	3	3

UNIT I Understanding Cloud Computing**6**

Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

UNIT II Developing Cloud Services**10**

Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon – Google App Engine – IBM Clouds

UNIT III Cloud Computing for Everyone**10**

Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation

UNIT IV Using Cloud Services**10**

Collaborating on Calendars, Schedules and Task Management – Exploring Online Calendar Applications- Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Spread sheets- Collaborating on Databases – Storing and Sharing Files

Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services –
Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware –
Collaborating via Blogs and Wikis

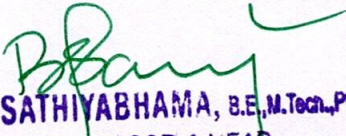
Total:45 hours

TEXT BOOK:

1. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.

REFERENCE BOOK:

1. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.


Dr. B. SATHIYABHAMA, B.E., M.Tech., Ph.D.
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PREAMBLE

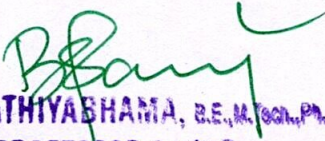
The "Internet of Things" (IoT) is the network of physical objects or "things" embedded with sensors, actuators, software, electronics and network connectivity to enable it to achieve greater value and service by exchanging data between the physical world and computer systems over existing network infrastructure. By connecting everyday real world objects such as transports, buildings and industrial equipments, IoT guarantees to revolutionize how we live and work. In the year 2020, it is estimated that approximately 30 billion devices will be connected in IoT. IoT will drive new consumer and business behavior that will demand increasingly intelligent industry solutions. It can also help various industries like agriculture, health services, energy, security, disaster management etc., which need to automate solutions to problems faced through remotely connected devices.

The Internet of Things involves three distinct stages:

1. The sensors which collect data (including identification and addressing the sensor/device)
2. An application which collects and analyzes this data for further consolidation
3. Decision making and the transmission of data to the decision-making server. Analytical engines, actuators and Big data may be used for the decision making process.

After completing the course the students will attain the following,

- Ability to build real time IoT applications by interfacing the sensors with minimal programming.
- Ability to associate sensor networks and communication modules for building IoT systems.


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Dept. of Computer Science and Engineering
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SALEM-636 005

COURSE OUTCOMES:**At the end of the course the students will be able to**

- Recall characteristics, physical and logical designs, domains.
- Differentiate IoT and M2M and explain IoT design methodology.
- Describe the various IoT components.
- Design a portable IoT system using Arduino/Raspberry Pi.
- Discuss the various applications of IoT.

UNIT I FUNDAMENTALS OF IOT 9

Introduction-Definition and Characteristics of IoT- Physical design- IoT Protocols-Logical design - IoT communication models, Iot Communication APIs- Enabling technologies - Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates - Domain specific IoTs.

UNIT II M2M AND IOT DESIGN METHODOLOGY 9

IoT and M2M- difference between IoT and M2M - Software defined networks, network function virtualization- Needs- IoT design methodology

UNIT III IOT COMPONENTS 9

Sensors and actuators - Communication modules - Zigbee- RFID-Wi-Fi-Power sources.

UNIT IV BUILDING IOT WITH HARDWARE PLATFORMS 9

Platform - Arduino/Raspberry Pi- Physical devices - Interfaces - Programming - APIs/Packages

UNIT V CASE STUDY 9

Various Real time applications of IoT- Home automation-Automatic lighting-Home intrusion detection- Cities-Smart parking-Environment-Weather monitoring system- Agriculture-Smart irrigation.

TOTAL: 45 PERIODS**TEXT BOOK:**

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.

REFERENCES:

1. Manoel Carlos Ramon, —Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers!, Apress, 2014.
2. Marco Schwartz, —Internet of Things with the Arduino Yun!, Packt Publishing, 2014.
3. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, Wiley Publications, 2012.
4. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key applications and Protocols”, Wiley Publications 2nd edition , 2013.

COURSE OUTCOMES

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

1. Assess role of energy in global economic development.
2. Explain methodology of energy audit and concept of instruments used.
3. Discuss various lamps and design energy efficient illumination schemes.
4. Apply energy conservation concepts in buildings.
5. Identify the energy conserving opportunities in utilities.

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
CO1	2	2	3	3	3		2			2	3	3	3	2
CO2	2	2	3	3	3				2			3	3	2
CO3	2	2	3	3	3	3			3			3	3	2
CO4	2	2	3	3	3	2		3				3	3	2
CO5	2	2	3	3	3		3			3		3	3	2

UNIT- I ENERGY SCENARIO AND BASICS

9

Classification of Energy – Purchasing Power Parity – Energy Security – Strategy to meet future energy requirements – Objectives and features for electricity act 2003 – Energy efficiency standards and labeling – Study of Global and Indian primary energy reserves – Study of energy scenario for India – Energy and environment – Global environmental issues – Types of Energy – Electrical and Thermal energy basics – Energy units and conversions.

UNIT- II ENERGY MANAGEMENT AND AUDIT

9

Definition and objectives of energy management and audit – Need for energy audit – Types of energy audit – Methodology for conducting detailed energy audit – ENCON opportunities and measures – Energy audit report. Energy costs – Benchmarking – Energy performance – Fuel and Energy substitution – Instruments and metering for energy audit – Basic principles, components of material and energy balance – Sankey diagram – Financial analysis terms – Payback period, ROI, NPV, IRR.

UNIT- III LIGHTING SYSTEMS

9

Introduction – Terms in Lighting and Illumination – Light sources - Lamp types – Arc Lamps, Vapour lamps = Incandescent lamp, Fluorescent lamp = Energy saving lamps = CFL, LED = Lighting design for interiors – Indoor and outdoor lighting schemes – Energy saving opportunities – Energy efficient lighting controls.

UNIT- IV ENERGY CONSERVATION IN BUILDINGS

9

Energy conservation building code (ECBC) – Compliance approaches – ECBC guidelines on Building envelope, HVAC system, Service hot water, Water pumps – Energy consumption in Escalators and Elevators – Building Energy Management Systems – Star ratings – Energy Efficiency Measures in AC and Lighting system.

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23.12.23
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UNIT-V ENERGY EFFICIENT OPPORTUNITIES IN UTILITIES

9

Introduction to Compressed air system components – Heat transfer loops in refrigeration systems – Standards and labelling of room air conditioners – Introduction to Fans, Blowers and Compressors – Types of pumps, Pump curves – Efficient operation of pumps – Components of cooling towers and its efficient operation - Introduction to DG set system.

Energy Efficiency and energy savings in Compressed Air System, HVAC system, Fans and Blowers, Pumping system, Cooling towers, and DG sets.


Lecture: 45; Tutorial: 00; Total: 45

TEXT BOOKS:

1. "General Aspects of Energy Management and Energy Audit", Bureau of Energy Efficiency, Fourth Edition, 2015.
2. "Energy Efficiency in Electrical Utilities", Bureau of Energy Efficiency, Fourth Edition, 2015.

REFERENCE BOOKS:

1. Chakrabarti A, "Energy Engineering and Management", PHI, 2011.
2. Murphy W R, McKay G, "Energy management", Elsevier, 2009.
3. Rajput R K, "Utilization of Electrical Power", Lakshmi Publications, 2006.


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COURSE OUTCOMES

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

1. Describe the power demand scenario in world level and impact of various renewable energy sources in satisfying power demand.
2. Explain the principle of operation and the application of solar system.
3. Outline in the components and to find the suitability based on the performance of wind energy and Conversion system, biomass energy system
4. Describe the principle of operation and the application of geo thermal power tidal power generation scheme, wave energy and OTEC scheme.
5. Illustrate the emerging energy generation systems of MHD, Thermal and fuel cells 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)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2					2		2	3	3	3
CO2	3	3	3	2	1	3	3	1	2		3	3	3	3
CO3	3	3	3	2	2	3	3	1	2		3	3	3	3
CO4	3	3	3	2	2	3	3	1	2		3	3	3	3
CO5	3	3	3	2	2	3	3	1	2		3	3	3	3

UNIT I INTRODUCTION

9

World energy futures–Energy sources and their availability – Energy cycle of the earth – environmental aspects of energyutilization – Energy plantation- Renewable energy resources and their importance- Prospects of Renewable energy sources.

UNIT II SOLARENERGY SYSTEMS

9

Introduction –Solar radiation and measurements-Solar energy collectors-solar energy storage systems- Solar pond and applications- Applications of solar energy: solar pumping, solar cooking, solar distillation and solar greenhouse.

UNIT III WIND AND BIOMASS ENERGYSYSTEMS

9

Introduction – Wind Energy conversion- Wind speed and power relation – Power extracted from wind – wind distributionand wind speed predictions – types of Wind power systems.

Bio mass conversion technologies-Biogas generation-Types of biogas plants-Bio gas from plant wastes- Utilization of Bio gas and applications.

UNIT IV GEOTHERMAL, TIDAL AND OCEAN ENERGY SYSTEMS

9

Geothermal energy – Estimates of Geothermal power- site selection for geothermal power plant- Applications of Geothermal energy.

Origin of tides – Basic principle of Tidal power- Operation of a Tidal power plant. Ocean Thermal Energy conversion system- Open and closed OTEC cycles- Prospects of ocean thermal energy conversion in India.

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UNIT V EMERGING ENERGY SYSTEMS

Magneto Hydro Dynamic (MHD) Power Generation- MHD systems and its operation. Thermo Electric power generation- Basic principle- Thermo electric power generator.

Thermonuclear fusion energy-Nuclear fusion and reactions- Advantages. Fuel cell- classification of fuel cells- Fuel cell based electrical power generation scheme- Applications.

Lecture: 45; Tutorial: 0; Total: 45 Hours

TEXT BOOKS:

1. Rai, G.D., "Non-Conventional Energy Sources", Khanna Publishers, Sixth Edition 2017.
2. Khan, B.H, Non- Conventional Energy Resources", Mc. Graw Hill Education Ltd, third reprint 2017.

REFERENCE BOOK

1. Rao S. Paruklekar, B.B, "Energy Technology – Non Conventional, Renewable and Conventional", Khanna Publishers, 1994.
2. F.Kreith and J.F.Kreider, "Principles of Solar Engineering", McGraw Hill.
3. T.N.Veziroglu, "Alternative Energy Sources", Vol 5 and 6, McGraw Hill.
4. Mukund R.Patel, "Wind and Solar Power Systems", CRC Press LLC.

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COURSE OUTCOMES

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

1. Define and discuss the fashion and related terms and reason for change in fashion and the classification
2. Describe clothing and its purpose, Role of clothing and its status.
3. Describe the selection of clothing for various age groups, Fashion apparel and wardrobe planning.
4. Explain the elements and principles of the design, with the effects in the apparel
5. Bounce out the theme and development of portfolio.

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	PO12	PSO1	PSO2	PSO3
CO1	3	3	3							3	3	3	3	3
CO2	3	3	3									3	3	3
CO3	3	3	3								3	3	3	3
CO4	3	3	3								3	3	3	3
CO5	3	3	3							3	3	3	3	3

UNIT I Introduction to Fashion 9
Origin of fashion - terms and definitions - reasons for change in fashion - classification of fashion – Style, Classic, FAD, Trend – theories of fashion – movement of fashion - fashion cycle.

UNIT II Introduction to Clothing 9
Understanding clothing - Purpose of clothing: protection, modesty, attraction etc - Importance of clothing - Clothing Culture, Men and Women clothing and ornamentation - Role and status of clothing - Clothing according to climatic conditions – factors to be considered in the selection of clothing

UNIT III Selection of clothes 9
Clothes for children, middle-aged and adults. Types of clothes according to different types of human figure, Different materials for different clothes, Fabrics and colours suitable for different garments.

Planning for clothing needs: Formal clothing, Clothes for parties, Clothes for sports, Casual Clothes for casualwear. **Wardrobe Planning:** Wardrobe for men and women

UNIT IV Elements and Principles of Design 9

22.12.2023

Regulations-2019


Dr. D. RAJA, M.Tech., Ph.D.,
Professor & Head
Department of Fashion Technology
Sona College of Technology
Salem - 636 005. Tamil Nadu

Elements of Design: Introduction on basics Elements of design - Silhouette, Details, Texture, Color, Lines,

Principle of design: Introduction to principles of Elements of design - Proportion, Balance, Rhythm, Center of Interest, Harmony

UNIT 5 Design and Development

9

Boards: Mood board, fabric board, colour board, accessory board. Fashion illustration – head theories, Illustration techniques – strokes, hatching, shading; Colouring techniques – Medias for colouring. Portfolio presentation – styles of presentation - Fashion shows.

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TOTAL: 45 hours

TEXT BOOKS

1. Munslow, Janine, McKelvey, Kathryn “**Fashion Design Process Innovation and Practice**”, 2nd Edition, wiley, 2012.
2. Nicola White, Ian Griffiths, “**The Fashion Business Theory, Practice, Image**”, Berg, 2000.

REFERENCE

1. Sumathi, G. J. **Elements of fashion and apparel design**. New Age International, 2007.
2. Kathryn McKelvey “**Fashion Source Book**” Balckwell Publishing New Delhi.
3. Mills, Jane, and Janet K. Smith. **Design concepts**. Fairchild Books, 1985.
4. Rasband J. **Wardrobe strategies for women**. Fairchild Publications; 2002.
5. Jarnow JA, Judelle B, Guerreiro M. **Inside the fashion business**. Wiley; 1981.

COURSE OUTCOMES

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

1. Explain the basics of garment technology.
2. Explain in detail about the various seams, stitches, needle type, sewing thread and types of sewing machines.
3. Explain in detail about the various garment accessories.
4. Explain the sewing quality parameters and method of garment laundering.
5. Discuss the quality standards of apparel industry and finishing of garments.

CO/PO, PSO Mapping														
<i>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</i>														
COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2						3	3	2
CO2	3	3	3	3	3	3	1					3	3	2
CO3	2	3	3	3	3	3	3					3	3	3
CO4	3	3	3	3	3	3	3	3				3	3	2
CO5	2	3	2	3	3		3	2				3	3	2

UNIT-I Basics of apparel industry - lay out, process sequence 9

Introduction: Apparel industry in world, types of workers in apparel industry, typical layout of apparel industry.

Garment Production Sequence: Fabric selection, pattern making, grading, marker planning, spreading, cutting and sewing, finishing and packing.

UNIT II Seams, Stitches, Needle and Sewing Threads, Types of sewing Machines 9

Seam and Stitches: Classification of seams and stitches, single needle lock stitch machine, parts and functions.

Needle and Sewing Thread: Needle, functions, special needles, needle size, numbering, needlepoint, sewing thread construction, material, thread size, sewing thread packages.

Basics of sewing machines: Single needle Lock stitch, Double needle lock stitch, Over lock, Flat lock, Feed of the arm, Button Attaching, Button hole machine.

Unit III Garment Accessories 9

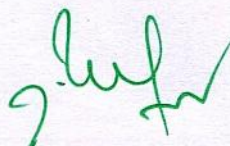
Garment add-on: Labels, linings, interlinings, wadding, lace, braid, elastic, hook and loop fastening, shoulder pads, eyelets and laces, zip fasteners, buttons, Tapes, Tags.

UNIT IV Overview of garment making and care labelling of garment 9

Sewing Process: Garment basic components and assembly process.

Alternative sewing process: Fusing, welding, adhesive, seamless garments, moulding, robotics in sewing.

Basic sizes of mens wear, women's wear, childrens wear and its description.



Types of labels: Size label, brand label, wash care label, designer label.

UNIT V Defects in garment, pressing and Packing

9

Defects: Common defects in woven fabric, knitted fabric and garment.

Garment pressing: Pressing types and pressing equipments.

Packing: Types of packing and different types of packing materials.

TEXT BOOKS

1. Rajkishore Nayak Rajiv Padhye, "**Garment Manufacturing Technology**", woodhead publication, 2015.
2. Ganesan, P., Gopalakrishnan, D., Karthik, T, "**Apparel manufacturing technology**", CRC Publication, 2016.
3. Gerry Cooklin, Steven George Hayes, John McLoughlin, Dorothy Fairclough. "**Cooklin's Garment Technology for Fashion Designers**", John Wiley & Sons, 2011.

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REFERENCE

1. EIRI Consultants and Engineers, "**Hand book of garment manufacturing technology**", 2017.
2. Janace E. Bubonia, "**Apparel production terms and processes**", 2017.
3. Harold Carr, Barbara Latham, "**The Technology of Clothing Manufacture**", Wiley, 1994.

0.12

MCT
VI

Department of Mechatronics Engineering

Open Elective

U19MC1003	SMART AUTOMATION	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Understand the basic automation concepts
CO2:	Identify the components for automation
CO3:	Know the home and smart city automation concepts
CO4:	Apply the concepts of automation in agriculture
CO5:	Suggest solutions for automation and control applications in textile and medical industry

Pre-requisite

NIL

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			3		3	3
CO2	2	3	3		3		3		3			2	2	3
CO3	3	3	3		3		2				2		3	3
CO4	3	2	3		2					3			3	2
CO5	3	3	3		2			2				2	3	3

Course Assessment methods

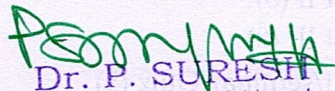
Direct	Indirect
Internal test I (8) Internal test II (8) Internal test III (8) Assignment/seminar/Quiz (5)	Online test (6) Attendance (5) End semester Examination (60) Course end survey

Unit 01: BASICS OF AUTOMATION

9 Hours

Introduction – Drawbacks of manual process – Need of automation in current era – Advantages of automation system – Industry 1.0 to 4.0 – Automation required areas: Heavy Industries – Home – Agriculture – Health care – Defence – Automotive Industries

Unit 02: COMPONENTS FOR AUTOMATION			9 Hours
Sensing: Sensors – Transducers – transduction principle: resistive, Inductive and capacitive type – sensors for detecting temperature, pressure, flow and objects – Decision making: Diode – Transistor – Microprocessor and microcontroller, Raspberry Pi- Relay and PLC – Actuation: Hydraulic and pneumatic cylinders, stepper and servo motors – Lights and buzzers – Analog valves – Bluetooth, Zigbee and Wifi for communication.			
Unit 03: HOME AND SMART CITY AUTOMATION			9 Hours
Need of Home automation – Home automation using IoT – Automated gate unlock system – smart domestic appliances – Wifi camera – object detection (dark mode) – biometric based door opening system - Smart Building using IoT – Automatic Solar Tracker - GPS & GSM based Tracker – Automated Street Lighting - Automated Railway Crossing – Smart Traffic Lighting System.			
Unit 04: AGRICULTURE AUTOMATION			9 Hours
Standards for agriculture – Need for agriculture digitalization – Dielectric Soil Moisture Sensors – Weather sensors – Measurement of leaf health, chlorophyll detection, crop mapping, fertilizing, seeding and weeding machine, ripeness level detection, fruit picking robot, smart sorting system.			
Unit 05: MEDICAL AND TEXTILE AUTOMATION			9 Hours
Types of medical robots – State of art of robotics in the field of healthcare – Assistive robots – Types of assistive robots – Yarn clearer controls – Knotter /splicer carriage controls – Pre-set length/full cone monitors – Warping machine monitors and controls – Humidification system			
Theory: 45 Hrs	Tutorial: --	Practical: --	Total Hours: 45 Hrs
TEXT BOOKS			
1.	D. Patranabis, "Sensors and Transducers", PHI Learning pvt ltd., 2004		
2.	Dwight Spivey, "Home Automation For Dummies", Wiley, 2015		
REFERENCES			
1.	Diego Galar, Pascual Pasquale and Daponte Uday Kumar, "Handbook of Industry 4.0 and SMART Systems", CRC Press, 2021		
2.	Shimon Y. Nof, "Springer Handbook of Automation", Springer, 2009		
3.	Pradeep Tomar and Gurjit Kaur, "Artificial Intelligence and IoT-Based Technologies for Sustainable Farming and Smart Agriculture", IGI Global, 2021		
4.	Ramesh C. Poonia, Xiao-Zhi Gao, Linesh Raja, Sugam Sharma and Sonali Vyas, "Smart Farming Technologies for Sustainable Agricultural Development", IGI Global, 2018		
5.	Achim Schweikard, Floris Ernst, "Medical Robotics", Springer, 2015		
6.	George stylios, "Textile objective measurement and automation in garment manufacture", E.Horwood, 1991.		

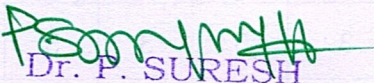

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Department of Mechatronics Engineering

Open Elective

U19MC1004		FUNDAMENTALS OF ROBOTICS								L	T	P	C	
										3	0	0	3	
Course Outcomes														
After successful completion of this course, the students should be able to														
CO1:	Understand the basic robotic concepts													
CO2:	Select the suitable drive system for robot application													
CO3:	Select the suitable sensors and grippers for the respective application													
CO4:	Develop VAL Programming for simple applications													
CO5:	Illustrate the robotic application in various sectors													
Pre-requisite														
NIL														
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
CO1	3		2			3	2		3		3	3	3	3
CO2	2	2	2		3				3		2	3	2	3
CO3	3	2	2		3				3		2	3	3	3
CO4	3	3	3	3	3				3		2	3	3	2
CO5	3	3	3	3	3	3	3		3			2	3	3
Course Assessment methods														
Direct							Indirect							
Internal test I (8) Internal test II (8) Internal test III (8) Assignment/seminar/Quiz (5)							Online test (6) Attendance (5) End semester Examination (60) Course end survey							
Unit 01: INTRODUCTION TO ROBOTICS												9 Hours		
Introduction to Robotics – History of Robotics – Laws of Robotics - Anatomy of a Robot – Classification of Robots – Robot Configurations - Robot subsystems: Motion subsystem, Recognition subsystem, Control subsystem – Robot Links – Joints in robot –Robot Specifications.														

Unit 02: ROBOT MOTIONS AND DRIVE SYSTEMS			9 Hours
Degrees of freedom – DOF associated with arm and body - DOF associated with wrist –Joint Notation scheme- Robot Kinematics – Robot Drive systems – Hydraulic Actuators – Pneumatic actuators – Electrical actuators: Stepper motors, DC motors, Servomotor.			
Unit 03: ROBOT SENSORS AND END EFFECTORS			9 Hours
Classification of Robotic sensors and their functions – Tactile sensors – Inductive Proximity sensor – Hall effect sensor – Range sensor –Force ant Torque sensors- Types of end effectors – Mechanical grippers – Vacuum cups – Magnetic grippers – Adhesive grippers – Tools as end effectors.			
Unit 04: ROBOT PROGRAMMING			9 Hours
Methods of Robot Programming: Lead through methods, Textual robot Languages – Robot language structure – First generation Languages – Second generation Languages – VAL Programming – Simple Programming examples.			
Unit 05: ROBOT APPLICATIONS			9 Hours
Robotics Applications in Manufacturing: Welding Robot, AGVs– Healthcare: Surgery Robot, Therapeutic Robot – Agriculture: Crop Harvesting & Fruit Picking Robot – Defence & Space: Exoskeleton Robot, Telerobotics.			
Theory: 45 Hrs	Tutorial: --	Practical: --	Total Hours: 45 Hrs
TEXT BOOKS			
1.	M.P.Groover, M.Weiss,R.N. Nagal,N.G.Odrey, "Industrial Robotics - Technology, programming and Applications" Tata McGraw-Hill Publication, 2012.		
REFERENCES			
1.	Richard D.Klafter, "Robotics Engineering" PHI Learning Private Limited, 2009.		
2.	Ganesh S.Hedge, "A text book in Industrial Robotics", Laxmi Publications, 2006.		
3.	S K Saha, "Introduction to Robotics", Tata McGraw-Hill Publication, 2012.		
4.	Sathya Ranjan Deb, "Robotics Technology & flexible Automation" Second edition, Tata McGraw-Hill Publication, 2009.		


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COURSE CODE U19ME1002

L T P C

COURSE NAME INDUSTRIAL SAFETY

3 - - 3

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Summarize various legal provisions available in safety regulation.
- CO2** Analyze industrial environment hygiene and develop precautionary measure to avert occupational diseases.
- CO3** Demonstrate the uses of different grades of fire protection systems related with different classes of fire.
- CO4** Develop Agronomical study of different work environment in industries.
- CO5** Discuss the importance of safety training and its impact on shop floor of factories.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	-	-	-	1	3	3	3	2	2	3	3	2	2
CO - 2	3	2	2	1	3	3	3	3	2	2	-	2	2	3
CO - 3	2	3	2	3	3	3	3	3	3	3	3	2	2	3
CO - 4	2	1	3	3	3	3	2	3	1	2	-	2	3	3
CO - 5	1	3	3	3	-	3	-	3	3	3	2	3	2	2

Unit I BASICS OF SAFETY ENGINEERING & ACTS

L 9 T 0

Evolution of modern safety concept –safety performance monitoring. Acts – factories act – 1948 – Statutory authorities – inspecting staff – Tamilnadu Factories Rules 1950 under Safety and health – environment act – 1986 – Air act 1981, water act 1974 – other acts. Safety in industries – General safety concepts, machine guarding, hazards in metal removing process, welding process, cold and hot working process.

Unit II OCCUPATIONAL HEALTH AND INDUSTRIAL HYGIENE

L 9 T 0

(Basic concepts, related hazards and exposure limits)

Physical Hazards – Noise, heat, radiation, vibration, recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases. Biological and Ergonomical Hazards-Basic concepts. Occupational Health-Concept and spectrum of health – functional units and activities of occupational health services, pre-employment and post-employment medical examinations – occupational related diseases, levels of prevention of diseases, notifiable occupational diseases. Hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, Preliminary Hazard Analysis (PHA), human error analysis, hazard operability studies (HAZOP), safety warning systems.

Unit III FIRE ENGINEERING AND EXPLOSIVE CONTROL

L 9 T 0

Fire properties of solid, liquid and gases – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E – types of fire extinguishers – Principles of explosion – Explosion Protection – Electrical Safety. Electrical Hazards – Primary and Secondary hazards – concept of earthing – protection systems – fuses, circuit breakers and over load relays – first aid cardiopulmonary resuscitation techniques.

Unit IV ERGONOMICS

L 9 T 0

Introduction to ergonomics: The focus of ergonomics, ergonomics and its areas of application in the work system, modern ergonomics, and future directions for ergonomics. Anatomy, Posture and Body Mechanics: anatomy of the spine and pelvis related to posture, posture stability and posture adaptation, low back pain, risk factors for musculoskeletal disorders in the workplace, effectiveness and cost effectiveness. Anthropometry and its uses in ergonomics, Applications of human factors engineering, man as a sensor, man as information processor, man as controller – Ergonomics in IT industries.

Unit V SAFETY EDUCATION AND TRAINING

L 9 T 0


Importance of training – identification of training needs – training methods – programs, seminars, conferences, competitions – motivation – communication – role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety Training.

Total Number of hours: 45**Learning Resources****Text Books**

1. Krishnan N.V., "Safety Management in Industry", Jaico Publishing House, Bombay, 1997.
2. Hand book of "Occupational Safety and Health", National Safety Council, Chicago, 1982.

Reference Books

1. Derek, James, "Fire Prevention Hand Book", Butter Worths and Company, London, 1986.
2. Guidelines for Hazard Evaluation Procedures Centre for Chemical Process Safety, AICHE 1992.
3. The factories Act 1948, Madras Book Agency, Chennai, 2000.
4. Introduction to Ergonomics, R.S. Bridger, Taylor & Francis.



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Syllabi for

**B.E/B.Tech Honours (Specialization in the
same Discipline)**

B.E/B.Tech Honours

B.E/B.Tech Minor

courses

U19BM2039		BIOMEDICINE FOR SPORTS											L	T	P	C
													3	0	0	3
COURSE OUTCOMES																
On successful completion of this course, the student will be able to																
	•	Understand the Kinetics and Kinematics of muscle action in sports and exercise.														
	•	Explain about the various equipment and its functions used in muscle strengthening and fitness activity.														
	•	Summarize the importance of biomechanics in yoga and devices used in yogic practices.														
	•	Analyze injury level to identify trends, patterns, and areas of concern for targeted prevention efforts.														
	•	Apply novel approaches to injury prevention, with recent advancements of sports medicine.														
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 Outcomes (PSO's)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	2	2	1	1	-	-	-	-	-	-	2	2	2	1	
CO2	3	2	2	1	1	-	-	-	-	-	-	2	2	2	1	
CO3	3	2	2	1	1	-	-	-	-	-	-	2	2	2	1	
CO4	3	2	2	1	1	-	-	-	-	-	-	2	2	2	1	
CO5	3	2	2	1	1	-	-	-	-	-	-	2	2	2	1	
UNIT I	MUSCLE ACTION IN SPORT AND EXERCISE - BIOMECHANICAL VIEW															9
Neural Contributions to Changes in Muscle Strength - Mechanical Properties and Performance in Skeletal Muscles - Eccentric Muscle Action in Sport and Exercise - Stretch-Shortening Cycle of Muscle Function - Biomechanical Foundations of Strength and Power Training- The Dynamics of Running – Resistive and Propulsive Forces in Swimming- Aerial Movement- Principles of Throwing - The Flight of Sports Projectiles - Javelin Throwing- Hitting and Kicking.																
UNIT II	FITNESS AND MUSCLE STRENGTHENING EQUIPMENT															9
Introduction to fitness and muscle strengthening exercises- benefits of muscle strengthening- role of Biomechanics in fitness programming- fitness and muscle strengthening equipment types and benefits - treadmill, acupressure twister, cycling machine, hand and finger grip strengthener, fitness jog pad, multi-level back stretcher.																
UNIT III	BIOMECHANICS OF YOGA & DEVICES															9
Introduction- Definition of Yoga- Types of Yoga - Ashtanga yoga as 8 stages of Yoga - the Physiology of Respiration- Thoracic Breathing - Paradoxical Breathing - Supine Abdominal Breathing - Abdominal Breathing in Sitting Postures - Diaphragmatic Breathing - Analysis of Yogic postures – Standing, sitting, Prone, Supine, Lying Prone, Inverted Postures - The effect of Pranayama- devices used in yoga practice- yoga mat, yoga block, yoga straps, resistance bands, yoga wheel, foam roller, massage gun, aerial swings.																

UNIT IV	INJURY PREVENTION AND REHABILITATION	9
Mechanisms of Musculoskeletal Injury - Musculoskeletal Loading during Landing – Sport related Spinal Injuries and their Prevention - Neuromechanics of the Initial Phase of Eccentric Contraction- Induced Muscle Injury- Special Olympic Sports - Manual Wheelchair Propulsion- Sports after Amputation- Biomechanics of Dance Biomechanics of Martial arts		
UNIT V	RECENT TRENDS IN SPORTS MEDICINES	9
Wearable devices for fitness and sports- Smart Football Tracker, Smart Socks, smart Yoga Pants- wearable devices for cricket- bed swing and speed measuring device, wearable neuromodulation device- wearable sport technology for basketball players- basketball precision motion sensor, shot tracker, Wearable Jump Monitor, RFID tracking chips.		
TOTAL : 45 Hours		
TEXTBOOKS:		
1.	McGinnis, Peter M, “Biomechanics of Sport and Exercise, Human Kinetics”, 2005.	
2.	Paul Grimshaw et al., “Sports & Exercise Biomechanics”, Taylor & Francis Group, (2007).	
3.	Sahay G.S, “HathaYoga Pradeepika of Svatmarama”, MDNIY Publication, 2013.	
REFERENCES:		
1.	Gharote, M.M, “Therapeutic references in Traditional Yoga Texts”, The Lonavla Institute, Lonavla, 2010.	
2.	Susan J. Hall, “Basic Biomechanics”, McGraw Hill Education, 2004.	
3.	Roger Bartlett, “ Introduction to Sports Biomechanics Analyzing Human Movement Patterns”, Routledge, 2007.	


COORDINATOR

K. Navilakandan

Aplam H


HOD-BME

Dr. S. PRABAKAR, M.E., Ph.D.,

Professor and Head

Department of Biomedical Engineering

Sona College of Technology, Salem-5

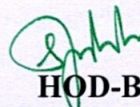
U19BM2040		MEDICAL TEXTILES											L	T	P	C
													3	0	0	3
COURSE OUTCOMES																
On successful completion of this course, the student will be able to																
	<ul style="list-style-type: none"> Understand the basics and classifications of medical textiles. 															
	<ul style="list-style-type: none"> Explain about the types of biomaterials used in medical textile manufacturing. 															
	<ul style="list-style-type: none"> Summarize the applications of medical textiles across a multitude of healthcare domains. 															
	<ul style="list-style-type: none"> Analyze the diverse types of intelligent textile applied in the healthcare. 															
	<ul style="list-style-type: none"> Apply the recent technology in manufacturing medical textiles. 															
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 Outcomes (PSO's)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	1	2	-	-	-	-	-	-	-	-	1	2	1	1	
CO2	3	1	2	-	-	-	-	-	-	-	-	1	2	1	1	
CO3	2	2	2	-	-	-	-	-	-	-	-	2	2	1	1	
CO4	2	2	2	-	-	-	-	-	-	-	-	2	2	1	1	
CO5	3	2	2	-	-	-	-	-	-	-	-	2	2	1	1	
UNIT I MEDICAL TEXTILES – AN OVERVIEW																
9																
Introduction to healthcare and medical textile devices-Medical Textiles – basics, fibres used, classification- Textile fibres and yarn – introduction, classification, chemical and physical properties-Manufacturing process – fibre and yarn-International standards-Fabric structures- Woven, Knitted, non-woven fabrics -Finishing, coating and coloration of Technical textiles – basics- Medical textiles in infection control.																
UNIT II MATERIALS FOR MEDICAL TEXTILES																
9																
Introduction to materials- role of textile structures and biomaterials in healthcare- Classification of biomaterials – metallic, ceramic- Polymers in biomedical use – natural and synthetic, biodegradable synthetic polymers- Biodegradable nanospheres- Polymer sterilization- Electro conductive polymeric fibers- Bio textile product development- Production of bio textile under GMP conditions- Bandaging, pressure garments and wound care materials – basic manufacturing process and evaluation methods- Specially designed adhesive and non-adhesive patches for post-operative surgical application.																
UNIT III MEDICAL TEXTILES APPLICATIONS																
9																
Textiles in drug delivery- Antimicrobial textiles- Chitosan based gels and hydro gels in biomedical and pharmaceutical sciences- Intelligent garments for pre-hospital emergency care-smart medical textiles in rehabilitation, monitoring pregnancy, heart patients, and children in hospital- Wearable assistants for mobile health monitoring.																

UNIT IV	SMART MEDICAL TEXTILES	9
Biomedical sensing- Films, coatings, adhesives, polymers and stimuli responsive materials- Smart polymers for Biotechnology and Protective clothing- Intelligent chemical indicators- Implantable sensors for long-term monitoring- Application of phase change and shape memory materials in medical textiles- Micro electro mechanical system (MEMS) based medical textiles.		
UNIT V	TECHNOLOGIES AND INSTRUMENTS USED IN MEDICAL TEXTILES	9
Electro spinning- Plasma technology- Micro/Nano encapsulation- thin film technology- Ultrasonic sealing- Laser technology- Molecular Imprinting technology- Modeling methods of physiological system for medical textiles – basics- Instruments for the evaluation of medical textile products - implantable devices, wound and surgical dressings, health care and hygiene products-3D textile structures- Medical textile standards.		
TOTAL : 45 Hours		
TEXTBOOKS:		
1.	Anand, S.C., Traftab, M.M., and Rajendran, S. (2010), “Medical Textiles & Biomaterial for Healthcare”, Woodhead publishing Ltd, UK	
2.	Sujata V.B, (2002), “Biomaterials”, Narosa Publishing House, New Delhi	
REFERENCES:		
1.	Anand, S.C, Kennedy, J.F, Miraftab, M and Rajendran S. (2010), “Medical and healthcare textiles”, 6th edition. Woodhead publishing Ltd, UK	
2.	Horrocks, A.R and Anand S.C, (2000), “Handbook of Technical Textiles”, Woodhead publishing Ltd, UK.	

COORDINATOR

K. Navikandan

Dr. Prabhakar



HOD-BME

Dr.S.PRABAKAR, M.E.,Ph.D.,

Professor and Head

Department of Biomedical Engineering

Sona College of Technology, Salem-5

U19BME201		BIOLOGY FOR ENGINEERS											L	T	P	C
													3	0	0	3
COURSE OUTCOMES																
On successful completion of this course, the student will be able to																
	•	Analyze the cell growth and structure.														
	•	Classify various nomenclatures of Enzymes.														
	•	Compare different cycles of Metabolism.														
	•	Analyze the human activity with the Genetic nature.														
	•	Design the various industrial applications.														
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 Outcomes (PSO's)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	3	1	-	-	-	-	-	-	-	-	2	1	1	-	
CO2	3	3	1	-	-	-	-	-	-	-	-	2	1	1	-	
CO3	3	3	1	-	-	-	-	-	-	-	-	2	1	1	-	
CO4	3	3	1	-	-	-	-	-	-	-	-	2	1	1	-	
CO5	3	3	1	-	-	-	-	-	-	-	-	2	1	1	-	
UNIT I	CELL: THE BASIC UNIT OF LIFE															9
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															9
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															9
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															9
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															9
Microorganisms- Growth Kinetics- Culture Media- Sterilization- Microscopy- applications of Microbiology- Immunology and Immunity- Cancer Biology- Stem Cell.																

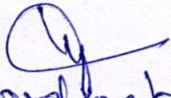
TOTAL: 45 Hours

TEXTBOOKS:

- | | |
|----|--|
| 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. |


Co ordinator
K. Manikandan
AP/BME


CHAIRMAN

BOS-BME


Dr. S. PRABAKAR, M.E., Ph.D.,
Professor and Head
Department of Biomedical Engineering
Sona College of Technology, Salem-5


U19BM1002		BASIC LIFE SUPPORT											L	T	P	C
													3	0	0	3
COURSE OUTCOMES																
On successful completion of this course, the student will be able to																
	•	Analyze Various BLS and First Aid Techniques														
	•	Understand the Essentials of Anatomy and Physiology														
	•	Analyze Various BLS techniques for adults														
	•	Analyze Various BLS techniques for children and infants														
	•	Apply Respiratory techniques and AED in critical conditions														
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 Outcomes (PSO's)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	-	-	-	-	3	1	1	1	-	-	1	-	-	-	
CO2	3	-	-	-	-	1	2	1	-	-	-	1	1	-	-	
CO3	3	-	-	-	-	1	1	1	1	-	-	1	-	-	-	
CO4	3	-	-	-	-	3	2	1	-	-	-	1	-	-	1	
CO5	3	-	-	-	-	2	1	1	1	-	-	1	1	-	1	
UNIT I	INTRODUCTION TO BASIC LIFE SUPPORT															9
General Concepts of Basic Life Support (BLS) Chain of survival. BLS Algorithm, First Aid: Basic First Aid techniques- first aid kit, Law, Resuscitation, Top to Toe Assessment, Hygiene and Hand Washing																
UNIT II	ESSENTIALS OF ANATOMY AND PHYSIOLOGY OF HUMAN BODY															9
Levels of Organization-Chemicals-Cells-Tissues-Organs-Organ Systems. Metabolism and Homeostasis, Terminology and General Plan of the Body-Case Studies.																
UNIT III	ADULT BASIC LIFE SUPPORT															9
BLS for adults: Adult BLS Algorithm, CPR, One Rescuer and Two Rescuer BLS for Adults- Adult Mouth-to-Mask Ventilation, Adult Bag-Mask Ventilation, Self-Assessment for Adult BLS																
UNIT IV	AUTOMATED EXTERNAL DEFIBRILLATOR AND FOREIGN BODY AIRWAY OBSTRUCTION															9
BLS for children: BLS Algorithm children, One Rescuer and Two Rescuer BLS for children, Child Ventilation. BLS for Infants: One Rescuer and Two Rescuer BLS for infants-Case Studies.																
UNIT V	AUTOMATED EXTERNAL DEFIBRILLATOR AND FOREIGN BODY AIRWAY OBSTRUCTION															9
AED for Adults, AED for Children and Infant, Self-Assessment for AED, FBAO- Respiration, Difficult Breathing, Drowning, Strangulation and Hanging, Chocking, Suffocation - Airway Management-Chest Discomforts-Case Studies.																

TOTAL: 45 Hours

REFERENCES:

1.	Dr. Karl Disque, Basic Life Support Provider Handbook, Satori Continuum Publishing, USA, 2021.
2.	INDIAN FIRST AID MANUAL, 7th Edition, St. John Ambulance Association (India) Indian Red Cross Society National Headquarters, New Delhi, 2016
3.	Basic Life Support Training Manual, 1st Edition, Published by in Medical Development Division, Ministry of Health Malaysia, Malaysia in December 2017
4.	Valerie C. Scanlon, Tina Sanders, Essentials of Anatomy and Physiology, 5th Edition, F. A. Davis Company


Coordinator
K. Manikandan
AP/BME


CHAIRMAN
BOS-BME

Dr. S. PRABAKAR, M.E., Ph.D.,
Professor and Head
Department of Biomedical Engineering
Sona College of Technology, Salem-5

COURSE OUTCOMES

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

1. Classify different types of learning and apply linear regression
2. Illustrate the concepts of logistic regression and implement the same with python.
3. Apply the concepts of Neural networks and support vector machines
4. Evaluate the hypothesis based on factors like bias and variance
5. Demonstrate the concepts of clustering, dimensionality reduction and anomaly detection.

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
CO1	3	3	1	1	1				1	1		1	2	2
CO2	3	3	3	3	3				1	1		1	2	2
CO3	3	3	3	3	3				1	1		1	2	2
CO4	3	3	3	1	1				1	1		1	2	2
CO5	3	3	1	1	1				1	1		1	2	2

UNIT I INTRODUCTION AND LINEAR REGRESSION**9**

Introduction to Artificial Intelligence - What is machine learning? – Supervised Learning – unsupervised learning – Linear Regression – cost function – gradient descent algorithm – normal equation - Gradient descent for multiple variables – feature scaling – learning rate – polynomial regression – normal equation

UNIT II LOGISTIC REGRESSION**9**

Hypothesis representation – decision boundary – nonlinear decision boundaries – cost function – gradient descent – advanced optimizations – multi class classification problems – **Regularization** - Problem of overfitting – cost function optimization for regularization – regularized linear regression – regularization with normal equation - regularized logistic regression

UNIT III NEURAL NETWORKS AND SUPPORT VECTOR MACHINES**9**

Overview and summary – neurons and brain – model representation – artificial neural networks representation – example – multiclass classification – cost function – back propagation algorithm – gradient checking – random initialization – Support vector machines – optimization objective – cost function – large margin intuition – decision boundary – kernels – adapting to nonlinear classifiers- Introduction to Decision Trees – K-NN classifier

UNIT IV ADVICE FOR APPLYING MACHINE LEARNING**9**

Debugging a learning algorithm – evaluating a hypothesis – model selection and training, validation test sets – bias Vs variance – regularization and bias/variance – learning curves machine learning system design

Unsupervised learning – k-means algorithm – optimization objective – choosing number of clusters - Dimensionality reduction – principle component analysis - Anomaly detection – algorithm – developing and evaluating the algorithm – anomaly detection Vs supervised algorithm

THEORY: 45 HRS

PRACTICALS: 30 HRS


TOTAL: 75 HOURS

REFERENCES

1. Stanford's machine learning course presented by Professor Andrew Ng – online resource - <http://www.holehouse.org/mlclass/>
2. James, G., Witten, D., Hastie, T., Tibshirani, R., “An Introduction to Statistical Learning with Applications in R”, Springer, 2013.
3. Tom M. Mitchell, “Machine Learning”, 1st edition, McGraw Hill Education, 2017.
4. Ethem Alpaydın, “Introduction to Machine Learning”, The MIT Press, 2nd edition, 2013.
5. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.
6. Sebastianraschka, “Python Machine Learning”, Packt Publishing Ltd., 2017.

LIST OF EXPERIMENTS

1. Write a program to implement simple linear regression to minimize the cost function.
Sample Exercise: In AB Company, there is a salary distribution table based on Year of experience. *You are a HR officer and you got a candidate with 5 years of experience. Plot the given data. and find the best salary to offer the candidate.*
2. Build a logistic regression model to classify the data in the given dataset.
Sample Exercise: Suppose that you are the administrator of a university department and you want to determine each applicant's chance of admission based on their results on two exams. You have historical data from previous applicants that you can use as a training set. For each training example, you have the applicant's scores on two exams and the admissions decision. Write a program to build a classification model (logistic regression) that estimates the probability of admission based on the exam scores.
3. Write a program to fit a logistic regression model with regularization to avoid overfitting of the given dataset.
4. Load the given dataset, split it into train and test sets, then estimate the mean squared error (MSE) for a linear regression as well as the bias and variance for the model error over 100 bootstrap samples.
5. Apply K means algorithm to cluster a set of data stored in a .CSV file and plot the clusters


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SONA COLLEGE OF TECHNOLOGY
SALEM - 636 005

COURSE OUTCOMES

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

1. Explain the fundamentals of Exploratory Data Analysis.
2. Explore the significance of different data transformation techniques.
3. Implement correlation and time series data analysis.
4. Evaluate different datasets with NumPy and Pandas.
5. Apply data exploration and visualization techniques with Matplotlib on different datasets.

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
CO1	3	3	3	3	3	2			2	2	2	2	2	2
CO2	3	3	3	3	3	2			2	2	2	2	2	2
CO3	3	3	3	3	3	2			2	2	2	2	2	2
CO4	2	3	3	3	3	2			2	2	2	2	3	3
CO5	2	3	3	3	3	2			2	2	2	2	3	3

UNIT I INTRODUCTION TO DATA VISUALIZATION IN EDA 9

Exploratory Data Analysis (EDA) fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA.

UNIT II DATA TRANSFORMATION TECHNIQUES 9

Technical requirements - merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.

UNIT III CORRELATION AND TIME SERIES ANALYSIS 9

Introducing Correlation – Types of analysis – Discuss multivariate analysis using the Titanic dataset – Outline Simpson's paradox – Understand the time series dataset – TSA with open power system data.

UNIT IV BUILDING VISUALIZATIONS 9

Chart your data - Chart design principles, Google sheet charts, Bar and Column charts, Histograms, Pie, Line and Area charts, Data wrapper charts, Annotated charts, Range charts, Scatter and Bubble charts, Tableau public charts, Filtered Line chart – Map your data – Table your data.

UNIT V CODE TEMPLATES AND ADVANCED TOOLS 9

Edit and Host code with GitHub – Chart.js and Highcharts templates – Leaflet map templates – Transform your map data – Geospatial data and GeoJSON, Find GeoJSON Boundary files, Draw and edit GeoJson.io, Edit and join with Mapshaper.

THEORY: 45 HRS

PRACTICALS: 30 HRS

TOTAL: 75 HOURS

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020. (Unit 1, 2 and 3)
2. Jack Dougherty, Ilya Ilyankou, "Hands-On Data Visualization", O'Reilly Media, Apr 2021. (Unit 4 and 5)

REFERENCES:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2018.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.
4. Fabio Nelli, "Python Data Analytics with Pandas, Numpy and Matplotlib", Apress, 2nd Edition, 2018.

LIST OF EXPERIMENTS:

1. Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
2. Perform Time Series Analysis and apply the various visualization techniques.
3. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect and user interaction.
4. Build cartographic visualization for multiple datasets involving various countries of the world, states, and districts in India etc.
5. Perform EDA on Wine Quality Data Set and Map data transformation using advanced tools.



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