VIVEKANANDHA

COLLEGE OF ENGINEERING FOR WOMEN

(An Autonomous Institution Affiliated to Anna University - Chennai

Approved by AICTE - Accredited by NBA New Delhi)

Elayampalayam, Tiruchengode – 637 205, Namakkal District, Tamilnadu.

B.E. BIOMEDICAL ENGINEERING

CURRICULA & SYLLABI

REGULATION 2023

Curriculum and Syllabus (1 & 2 Semester)

(Applicable to the students admitted from the academic year 2023 – 2024 onwards)

CHOICE BASED CREDIT SYSTEM

[CBCS]

COLLEGE VISION

To impart value based education in Engineering and Technology to empower young women to meet the societal exigency with a global outlook.

COLLEGE MISSION

- To provide holistic education through innovative teaching-learning practices
- To instill self confidence among rural students by supplementing with co-curricular and extra-curricular activities
- To inculcate the spirit of innovation through training, research and development
- To provide industrial exposure to meet the global challenges
- To create an environment for continual progress through lifelong learning

DEPARTMENT VISION

To delegate a high-grade woman Biomedical Engineer for contemporary and ethical research for the society in the health care field and to furnish industry oriented enlightenment.

DEPARTMENT MISSION

Department of BME is committed to

- Create a new Technology in the healthcare field, provide to study human anatomy and physiology along with the engineering principles.
- Satisfy the industrial need, necessary trainings provide for the future Biomedical Engineers.
- Impart and improve self-educated skills and entrepreneurship qualities.

B.E. BIOMEDICAL ENGINEERING
Regulation 2023
CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

Graduates of Biomedical Engineering will

PEO 1. Demonstrate their skills in solving challenges in their chosen field through the core foundation and knowledge acquired in engineering and biology.

PEO 2. Exhibit leadership, make decisions with societal and ethical responsibilities, function and communicate effectively in multidisciplinary settings.

PEO 3. Recognize the need for sustaining and expanding their technical competence and engage in learning opportunities throughout their careers.

PROGRAM OUTCOMES (POs):

PO 1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3. **Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

At the end of this program, graduate will be able to:

PSO1. Design and develop diagnostic and therapeutic devices that reduce physician burnout and enhance the quality of life for the end user by applying fundamentals of Biomedical Engineering.

PSO2. To apply software skills in developing algorithms for solving healthcare related problems in various fields of medical sector.

PSO3. To adapt to emerging information and communication technologies (ICT) to innovate ideas and solutions for current societal and scientific issues thereby developing indigenous medical instruments that are on par with the existing technology.

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B. E**	Programme Code	106	Regulation	**2023**
Department	**BIOMEDICAL ENGINEERING**			Semester	**I**

CURRICULUM

(Applicable to the students admitted from the academic year 2023 -2024 onwards)

Course Code	Course Name	Category	Periods/Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
U23MA101	Matrices and Calculus*	BSC	3	1	0	4	40	60	100
U23EN101	English For Communication*	HSMC	3	0	0	3	40	60	100
U23CH101	Engineering Chemistry$	BSC	3	0	0	3	40	60	100
U23CS101	Programming for Problem Solving*	ESC	3	0	0	3	40	60	100
U23TA101	தமிழர்மரபு/Heritage of Tamils*	HSMC	1	0	0	1	40	60	100
THEORY INTEGRATED WITH PRACTICAL									
U23GE101	Engineering Graphics*	ESC	2	0	3	3	50	50	100
PRACTICAL INTEGRATED WITH THEORY									
U23GE102	Design Thinking*	EEC	1	0	2	1	50	50	100
PRACTICAL									
U23CH102	Chemistry Laboratory$	BSC	0	0	2	1	60	40	100
U23CS102	Programming for Problem Solving Laboratory*	ESC	0	0	2	1	60	40	100
MANDATORY COURSES									
-	Induction Programme*	3 Weeks				0	-	-	-
U23MCFY2	Indian Constitution$	MC	2	0	0	0	100	-	100
					Total	**20**	**570**	**430**	**1000**

BSC-Basic Science Courses, ESC-Engineering Science Courses, MC-Mandatory courses, HSMC- Humanities and Social Sciences including management courses, EEC – Employability Enhancement courses, CA-Continuous Assessment, ESE - End Semester Examination.

*Common for all branches

$Common for ECE, EEE & BME

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**106**	Regulation	**2023**
Department	**BIOMEDICAL ENGINEERING**			Semester	**II**

CURRICULUM

(Applicable to the students admitted from the academic year 2023-2024 onwards)

Course Code	Course Name	Category	Periods/ Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
U23MA202	Complex Analysis and Ordinary Differential Equations*	BSC	3	1	0	4	40	60	100
U23PH201	Engineering Physics $^{\$}$	BSC	3	0	0	3	40	60	100
U23GE203	Basic Civil and Mechanical Engineering$^{\#}$	ESC	3	0	0	3	40	60	100
U23TA202	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology*	HSMC	1	0	0	1	40	60	100
THEORY INTEGRATED WITH PRACTICAL									
U23CS203	Python Programming$^{@}$	ESC	3	0	2	4	50	50	100
U23EN202	Professional Communication*	HSMC	2	0	3	3	50	50	100
PRACTICAL									
U23PH202	Physics Laboratory$^{\$}$	BSC	0	0	2	1	60	40	100
U23GE204	Engineering Practices Laboratory*	ESC	0	0	3	1	60	40	100
MANDATORYCOURSES									
U23MCFY1	Environmental Science and Engineering $^{\$}$	MC	2	0	0	0	100	-	100
					Total	**20**	**480**	**420**	**900**

BSC-Basic Science Courses, ESC-Engineering Science Courses, MC-Mandatory courses, HSMC-Humanities and Social Sciences including Management courses, CA- Continuous Assessment, ESE - End Semester Examination.

*Common for all branches

$^{\#}$Common for EEE, ECE, BME & BT

$^{@}$Common for EEE, ECE, BME & BT

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205								
Programme	**B.E.**	Programme Code		**106**	Regulation	**2023**			
Department	**BIOMEDICAL ENGINEERING**				Semester	**III**			
CURRICULUM (Applicable to the students admitted from the academic year 2023 onwards)									
Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
GENERAL THEORY									
U23MA303	Transforms and Partial Differential Equations*	BSC	3	1	0	4	40	60	100
	VQAR	EEC	3	0	0	2	100	-	100
CORE									
U23BM301	Anatomy and Human Physiology	PCC	3	0	0	3	40	60	100
U23BM302	Fundamentals of Circuits and Devices	PCC	3	0	0	3	40	60	100
U23BM303	Advanced Data Structure	PCC	3	0	0	3	40	60	100
THEORY INTEGRATED PRACTICAL									
U23BM304	Biosciences for Medical Engineering	PCC	3	0	1	4	50	50	100
PRACTICAL									
U23BM305	Biosciences Laboratory	PCC	0	0	2	1	40	60	100
U23BM306	Advanced Data Structures Lab	PCC	0	0	2	1	40	60	100
CARRIER TRACK COURSE									
	Personality Development	CTC	1	0	0	1	40	60	100
					Total Credits		**22**	**520**	**380**	**900**

CA - Continuous Assessment, ESE - End Semester Examination, BSC - Basic Science Courses, PCC – Professional Core Courses, TIP-Theory Integrated Practical courses, EEC - Employability Enhancement Courses, CTC- Career Track courses

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205								
Programme	**B.E.**	Programme Code	**106**		Regulation	**2023**			
Department	**BIOMEDICAL ENGINEERING**				Semester	**IV**			
CURRICULUM (Applicable to the students admitted from the academic year 2023 – 2020 onwards)									
Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
GENERAL THEORY									
U23MA408	Probability and Statistics	BSC	3	1	0	4	40	60	100
CORE									
U23BM401	Biomedical Instrumentation	PCC	3	0	0	3	40	60	100
U23BM402	Bio Control Systems	PCC	3	0	0	3	40	60	100
U23BM403	Biosensors and Measurements	PCC	3	0	0	3	40	60	100
THEORY INTEGRATED WITH PRACTICAL									
U23BM404	Analog and Digital Integrated Circuits	PCC	3	0	1	4	40	60	100
	ADDITIONAL LANGUAGE	ADL	2	0	1	2	100	-	100
PRACTICAL									
U23BM405	Biomedical Instrumentation Laboratory	PCC	0	0	2	1	60	40	100
U23BM406	Biosensors and Measurements Laboratory	PCC	0	0	2	1	60	40	100
CARRIER TRACK COURSE									
	Career Track Course-2	CTC	3	0	0	1	100	-	100
					Total Credits	**22**	**520**	**380**	**900**

CA - Continuous Assessment, ESE - End Semester Examination, BSC - Basic Science Courses, PCC – Professional Core Courses , TIP-Theory Integrated Practical courses, EEC - Employability Enhancement Courses, PEC - Professional Elective Courses, OEC-Open Elective Courses, CTC- Career Track Courses.

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205								
Programme	**B.E.**	Programme Code			**106**	Regulation		**2023**	
Department	**BIOMEDICAL ENGINEERING**					Semester		**V**	
CURRICULUM (Applicable to the students admitted from the academic year 2023 onwards)									
Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
CORE									
U23BM501	Diagnostic and Therapeutic Equipment	PCC	3	0	0	3	40	60	100
U23BM502	Communication in Healthcare	PCC	3	0	0	3	40	60	100
U23BM503	Fundamentals of Healthcare Analytics	PCC	3	0	0	3	40	60	100
THEORY INTEGRATED PRACTICAL									
U23BM504	Bio signal Processing	PCC	3	0	1	4	50	50	100
PRACTICAL									
U23BM505	Diagnostic and Therapeutic Equipment Laboratory	PCC	0	0	2	1	60	40	100
U23BM506	Mini Project - I	EEC	0	0	2	1	100	-	100
PROFESSIONAL ELECTIVES									
	Professional Elective –I	PEC	3	0	0	3	40	60	100
OPEN ELECTIVES									
	Open Elective –I	OEC	3	0	0	3	40	60	100
CARRIER TRACK COURSE									
	Career Track Course -3	CTC	3	0	0	1	100	-	100
					Total Credits		**22**	**510**	**390**	**900**

CA - Continuous Assessment, ESE - End Semester Examination, BSC - Basic Science Courses, PCC – Professional Core Courses , TIP-Theory Integrated Practical courses, EEC - Employability Enhancement Courses, PEC - Professional Elective Courses, OEC - Open Elective Courses, CTC - Career Track Courses.

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Programme	**B.E.**	Programme Code		**106**	Regulation	**2023**		
Department	**BIOMEDICAL ENGINEERING**				Semester	**VI**		
CURRICULUM (Applicable to the students admitted from the academic year 2023 onwards)								
Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
THEORY									
U23BM618	Radiological Equipments	PCC	3	0	0	3	40	60	100
U23BM619	Medical Image Processing	PCC	3	0	0	3	40	60	100
U23BM620	Biomechanics and Rehabilitation Engineering	PCC	3	0	0	3	40	60	100
THEORY INTEGRATED PRACTICAL									
U23BM621	Embedded Systems and IoMT	PCC	3	0	1	4	50	50	100
PRACTICAL									
U23BM622	Medical Image Processing Laboratory	PCC	0	0	2	1	60	40	100
U23BM623	Mini Project - II	EEC	0	0	2	1	100	-	100
PROFESSIONAL ELECTIVES									
	Professional Elective-II	PEC	3	0	0	3	40	60	100
OPEN ELECTIVES									
	Open Elective-II	OEC	3	0	0	3	40	60	100
CARRIER TRACK COURSE									
	Career Track Course-4	CTC	3	0	0	1	100	-	100
					Total Credits	**22**	**510**	**390**	**900**

CA - Continuous Assessment, ESE - End Semester Examination, BSC - Basic Science Courses, PCC – Professional Core Courses , TIP-Theory Integrated Practical courses, EEC - Employability Enhancement Courses, PEC - Professional Elective Courses, OEC - Open Elective Courses, CTC - Career Track Courses.

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**106**	Regulation	**2023**
Department	**BIOMEDICAL ENGINEERING**			Semester	**VII**

CURRICULUM

(Applicable to the students admitted from the academic year 2023 onwards)

Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
CORE									
U23BM701	Physiological Modeling	PCC	3	0	0	3	40	60	100
U23BM702	Medical Informatics	PCC	3	0	0	3	40	60	100
PRACTICAL									
U23BM703	Hospital Training and Internship	EEC	0	0	2	1	100	-	100
U23BM704	Project-Phase-I	EEC	0	0	2	2	100	-	100
PROFESSIONAL ELECTIVES									
	Professional Elective-III	PEC	3	0	0	3	40	60	100
	Professional Elective-IV	PEC	3	0	0	3	40	60	100
OPEN ELECTIVES									
	Open Elective-III	OEC	3	0	0	3	40	60	100
CARRIER TRACK COURSE									
	Career Track Course -5	CTC	1	0	0	1	100	-	100
					Total Credits	**19**	**500**	**300**	**800**

CA - Continuous Assessment, ESE - End Semester Examination, BSC - Basic Science Courses, PCC – Professional Core Courses , TIP-Theory Integrated Practical courses, EEC - Employability Enhancement Courses, PEC - Professional Elective Courses, OEC - Open Elective Courses, CTC - Career Track Courses.

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205								
Programme	**B.E.**	Programme Code	**106**		Regulation	**2023**			
Department	**BIOMEDICAL ENGINEERING**				Semester	**VIII**			
CURRICULUM									
Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
	Professional Elective-V	PEC	3	0	0	3	40	60	100
	Professional Elective-VI	PEC	3	0	0	3	40	60	100
PRACTICAL									
U23BM801	Project Phase -II	EEC	0	0	16	8	60	40	100
					Total Credits	**14**	**140**	**160**	**300**

PEC - Professional Elective Courses, EEC - Employability Enhancement Courses, MC- Mandatory courses, CA - Continuous Assessment, ESE - End Semester Examination

Cumulative Course Credit: **161 (2023-2027 Batch)**

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Programme	**B.E./B.Tech**	Programme Code		**106**	Regulation		**2023**	
Department	**BIO MEDICAL ENGINEERING**				Semester		**I**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23MA101	**Matrices and Calculus**	3	1	0	4	40	60	100

Course Objective

The Main Objective of the course is to

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

Course Outcome	At the end of the course the students will be able to	Knowledge level
	CO1: Use the matrix algebra methods for solving practical problems.	K1,K3
	CO2: Apply differential calculus tools in solving various application problems.	K2,K4
	CO3: Able to use differential calculus ideas on several variable functions.	K3,K5
	CO4: Apply different methods of integration in solving practical problems.	K2,K5
	CO5: Apply multiple integral ideas in solving areas, volumes and other practical problems.	K3,K5

Pre-requisites -

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

CO/PSO Mapping

COs	Programme Outcomes (POs)												PSOs		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2		1	1								2		
CO 2	3	3	2		1								2		
CO 3	3		2	1									2		
CO 4	3	2	2	1	1								2		
CO 5	3		1	1	1								2		

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment. 3. End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus			
Unit – I	**MATRICES**	Periods	**12**
Characteristic equation – Eigen values and Eigenvectors of a real matrix– Properties of Eigen values and Eigenvectors – Cayley-Hamilton theorem(excluding proof) – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms. Simple application in encoding message using 2×2 matrix.			
Unit - II	**DIFFERENTIAL CALCULUS**	Periods	**12**
Limit, Continuity, Differentiability, Rules of differentiation, Differentiation of various functions, Rolle's theorem(excluding proof), Mean value theorem(excluding proof), Taylor's theorem(excluding proof), Maxima and Minima. Applications: Newton's law of cooling – Heat flow problems.			
Unit – III	**FUNCTIONS OF SEVERAL VARIABLES**	Periods	**12**
Partial differentiation – Homogeneous functions and Euler's theorem(excluding proof) – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables(excluding proof) – Maxima and minima of functions of two variables. Applications: Lagrange's method of undetermined multipliers.			
Unit - IV	**INTEGRAL CALCULUS**	Periods	**12**
Definite and Indefinite Integrals- Methods of integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions -Reduction formula on $\int_0^{\frac{\pi}{2}} \cos^n x dx, \int_0^{\frac{\pi}{2}} \sin^n x dx$.			
Unit - V	**MUTIPLE INTEGRALS**	Periods	**12**
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.			
		Total Periods	**60**

Text Books	
1.	Stewart, J. Calculus: Early Transcendentals (8th Edition), Cengage Learning, 2015.
2.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
References	
1.	Kreyszig E, Advanced Engineering Mathematics (10th Edition), John Wiley (2015).
2.	Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3.	Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus ", 14th Edition, Pearson India, 2018.
4.	Anton H, Calculus: Early Transcendentals, 10th Edition, Wiley (2016).
5.	B V Ramana, Higher Engineering Mathematics, Tata McGraw Hill Education Pvt Ltd., New Delhi (2016)
E-Resources	
1.	https://freevideolectures.com › All Courses › Calculus › UCLA
2.	www.learnerstv.com/Free-engineering-Video-lectures
3.	www.nptel.ac.in

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Programme	**B.E.**	Programme Code		**106**	Regulation		**2023**	
Department	**BIOMEDICAL ENGINEERING**				Semester		**I**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23EN101	**English for Communication**	3	0	0	3	50	50	100

Course Objective	The Main Objective of the course is to: • Improve the communicative ability of learners. • Make learners read widely in order to practice writing • Make learners develop vocabulary and strengthen grammatical understanding • Assist students in the development of intellectual flexibility, creativity, and cultural literacy so that they may engage in life-long learning. • Identify and begin to apply the language features of academic and professional writing and speaking	
Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Use appropriate vocabulary in a professional context	K1
	CO2: Write appropriately based on the knowledge gained through reading of a variety of materials	K1
	CO3: Use language through their grammatical acquisition	K2
	CO4: Read and infer meanings of technical texts	K2
	CO5: Comprehend and retain the contextual and syntax understanding from reading.	K3
Pre-requisites	Nil	

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													**CO/PSO Mapping**		
COs	Programme Outcomes (POs)												PSOs		
	PO1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO 1						2			3	3		3	2		
CO 2						2			3	3		3	2		
CO 3						2			3	3		3	2		
CO 4						2			3	3		3	2		
CO 5						2			3	3		3	2		

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment 3. End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus			
Unit - I		Periods	**9**
Listening-Introduction to Different Types of Listening, Listening to Casual Conversations, **Speaking-**Introduction to develop the Art of Speaking, Giving Self Introduction, **Reading**–Understanding the Basics of Reading Skills, Reading Instructions and Technical Manuals, **Writing**- Introduction to writing strategies, Writing Definitions, **Focus on Language** - -Technical terms (Jargon), Word Formation with Prefixes and Suffixes, Using Active Voice and Passive Voice, Basic sentence patterns, Tenses (past, present, perfect and continuous tenses).			
Unit - II		Periods	**9**
Listening- Listening to lectures, listening to description of equipment, **Speaking-** Strategies for Developing Conversational Skills, Short Conversations through Role Play Activities, **Reading**– Reading Comprehension, Reading e-mails, Reading Headlines, Predicting the Content, **Writing**- Note making, Writing Descriptions, **Focus on Language**–Collocation, One word substitution, Subject - verb agreement.			
Unit - III		Periods	**9**
Listening- Listening to different kinds of interviews (Face - to - face, radio, TV and telephone interviews), **Speaking-** Describing an Object, Asking Questions, Participating in Discussions **Reading**– Intensive reading, Reading passages for gist. **Writing**- Writing short& lengthy e-mails with emphasis on Brevity, Clarity, Coherence and Cohesion), **Focus on Language**–Sequential Connectives, Impersonal Passive			
Unit - IV		Periods	**9**
Listening-Note Taking, **Speaking-** Improving Fluency through Narration. **Reading**–Reading passages for specific information- Phone messages, Reading and Transferring Information. **Writing**-Informal writing, Writing a Memo, Focus **on Language**–Cause and Effect, Conditional Statements (if - clauses and types), Usage of Modal Verbs.			
Unit - V		Periods	**9**
Listening- Listening to understand Modulation, Listening to Welcome Speeches, **Speaking-** Delivering Welcome Address, Understanding Segmental and Suprasegmental Features-Practicing Stress, Pause and Intonation, **Reading**–Reading for a purpose, Reading Business Documents, Interpreting Charts and Graphs. **Writing**-Describing a Process. **Focus on Language** -Synonyms and Antonyms, Common Errors in English.			
		Total Periods	**45**

Text Books	
1.	Sumant. s, Pereira Joyce, Shameem.M, Selvarajan.R-English Communication Skills,Vijay Nicole imprints Pvt.Ltd, 2015.
2.	Sokkaalingam, S.RM., The Art Of Speaking EnglishVersatile Publishing House,2018.
References	
1.	Dr. Padma Ravindran, Poorvadevi, M. Y. Abdur Razack- English for life, English for work, students Book, Ebek language laboratory pvt ltd, 2011.
2.	Dutt Rajeevan, Prakash. A Course in Communication Skill (Anna University, Coimbatore edition): Cambridge University Press India Pvt.Ltd, 2007.
3.	S.P. Dhanavel, English and Communication Skills for Students of Science and Engineering, Orient Blackswan Pvt, Ltd, 2009.
4.	Technical English – I & II, Sonaversity, Sona College of Technology, Salem, First Edition, 2012.
5.	Meenakshmi Raman and Sangeeta Sharma- 'Technical communication English Skills for Engineers; oxford University Press, 2008.
E-Resources	
1.	http://www.sparknotes.com/lit/the-alchemist/summary.html
2.	https://www.stephencovey.com/7habits/7habits.php
3.	http://en.wikipedia.org/wiki/The_Seven_Habits_of_Highly_Effective_People

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code		**106**	Regulation		**2023**	
Department	**BIOMEDICAL ENGINEERING**				Semester		**I**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CH101	**Engineering Chemistry**	3	0	0	3	50	50	100

Course Objective	The Main Objective of the course is to: • Recognize the basic technology requirements in water treatment • Gain knowledge in basics and preparations, properties and applications of Polymers. • Enrich the Knowledge of the students with the basics of Nano materials, their properties and applications. • Familiarize about the Non renewable, renewable energy and different types of storage devices in the engineering application. • Gain knowledge in destruction and protection of metals for engineering applications.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Implement innovative solutions in wastewater treatment process.	K3
	CO2: Familiarize with the applications of polymers in the field of engineering.	K3
	CO3: Identify the synthesis methods of Nanoparticles and their industrial applications	K2
	CO4: Recognize the renewable, non renewable energy and storage devices for domestic and industrial applications.	K3
	CO5: Categorize the metal corrosion in different environment and find out appropriate control techniques to avoid corrosion.	K3
Pre-requisites	Nil	

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													**CO/PSO Mapping**		
COs	Programme Outcomes (POs)												PSOs		
	PO1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO 1	3	3	3	2	1	2	2	2					1	1	2
CO 2	3	2	2	2		2	2	1					2	2	2
CO 3	3	2	2	3	2	1	2	1					2	1	1
CO 4	3	3	2	2	1	1	3	2					3	2	2
CO 5	3	3	3	2	1	2	2	1					2	1	2

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment 3. End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus			
Unit - I	**WATER TECHNOLOGY**	Periods	**9**
Introduction-Sources and impurities in Water, Soft and Hard water, Water quality parameters, Types of Hardness – Determination of Hardness by EDTA method, Domestic Water Treatment. Boiler Feed Water –Requisites, Problems due to hard water in boilers - Scale and Sludge formation in boilers-Caustic Embrittlement-Boiler corrosion, Treatment of boiler feed Water – Internal conditioning (Carbonate, Phosphate, and Calgon conditioning) External conditioning – Ion exchange process, Zeolite process, Brackish water –Water purification by Reverse osmosis.			
Unit - II	**POLYMER CHEMISTRY**	Periods	**9**
Introduction - Occurrence, definitions – Functionality - Degree of Polymerization, Classification of polymers – structure (Linear, Branched & network polymer structure) block, random & graft copolymers,Tacticity, Tg, molecular weight - number and weight average method. Types of polymerizations: Addition, condensation and copolymerization. Mechanism of polymerization (Free radical). Preparation, properties and applications of PE, PMMA, PC, Nylon6, Nylon 66, Poly urethane, Poly isoprene and vulcanization of rubber, Teflon, PET, and Bakelite.			
Unit - III	**NANO CHEMISTRY**	Periods	**9**
Basics- distinction between molecules, nanoparticles and bulk materials; Size dependent properties. Nanoparticles: nanocluster, nanorod, nanotube (CNT) and nanowires. Synthesis: Top down process- Laser ablation,Spray Pyrolysis, Chemical Vapour deposition, Electro deposition. Bottom up process- Precipitation, Sol-gel, Thermolysis - hydrothermal, solvothermal -Properties and applications of nano materials in medical and electronic devices.			
Unit - IV	**ENERGY RESOURCES AND STORAGE DEVICES**	Periods	**9**
Nonrenewable energy - Nuclear energy, nuclear reaction and its types, nuclear power plant and its working (Light water nuclear power plant & Breeder reactor).Renewable energy and its sources - Solar Energy - Photo voltaic cells, Importance of Solar cells - p-n junctions in Solar cells - Working of Photovoltaic cell, Recent advances in solar cell materials, Wind energy - Types of Wind Power Plants (WPPs), Components and working of WPPs. Batteries and fuel cells: Types of batteries -Alkaline battery, lead storage battery, Ni-Cd battery, lithium battery, Fuel cell - H_2-O_2 fuel cell-applications.			
Unit - V	**CORROSION AND ITS CONTROL**	Periods	**9**
Introduction, Types of corrosion - chemical and electrochemical corrosion, mechanism, Pilling -Bedworth rule, Types of electrochemical corrosion – Galvanic corrosion, Pitting corrosion, Crevice corrosion, Corrosion on wire fence and Pipeline corrosion, Factors influencing rate of corrosion, corrosion control methods – Sacrificial anode and impressed cathodic current. Protective coatings – Paints: constituents and functions, Metallic coatings - steps involved in cleaning the surface for Electroplating, Electroplating (Au), Electro less plating (Ni).			
		Total Periods	**45**

Text Books	
1.	O.G.Palanna, "Engineering Chemistry "Tata Mc GrawHill PVT,Ltd. Second Edition -2017
2.	Dr.S.Mageswari, Dr.K.Balachandran, M.S.Viswaksenan, Engineering Chemistry : First Edition, RK publication, Edition-2022
References	
1.	Engineering Chemistry: Jain & Jain, Dhanpat Rai Publishing Company Edition- 16- 2015.
2.	Arun Bahl, B.S. Bahl, G.D. Tuli, Essentials of Physical Chemistry, Published by S. Chand & Company Ltd, 2014
3.	Engineering Chemistry: Sashi Chawla, Dhanpat Rai & Co (pvt.)Ltd. Edition- 5- 2013.
4.	Dr.S.Vairam ,Dr.Suba Ramesh, Engineering Chemistry: First Edition, Wiley publication,Reprint-2016
E-Resources	
1.	https://www.who.int/water_sanitation_health/dwq/arsenicun6.pdf
2.	https://www.schandpublishing.com/books/tech-professional/applied-science/a-textbook-polymer-chemistry/9788121941129/#.XdZ214MzY2w
3.	https://www.elsevier.com/books/nanochemistry/klabunde/978-0-444-59397-9

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Programme	**B.E.**	Programme Code			Regulation	**2023**		
Department	**BIOMEDICAL ENGINEERING**				Semester	**I**		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CS101	**Programming for Problem Solving**	3	0	0	3	40	60	100

Course Objective	The main objective of this course is to: • Learn the fundamentals of computers,languages, number systems and acquire problem solving skills in C Programming	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Examine number systems and to apply problem solving techniques	K3
	CO2: Learn the basics of C programming with branching and looping statements	K2
	CO3: Experiment the C programs using Arrays andPointers for simple applications	K3
	CO4: Solve C programs with the Functions andStrings	K3
	CO5: ApplyStructures, Union and File concepts to solve simple real world problems	K3

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													**CO/PSO Mapping**	
COs	Programme Outcomes (POs)												PSOs	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**
CO 1	3	2	1	1	2							2	3	3
CO 2	2	1	1		2							2	2	2
CO 3	3	2	1	1	2							2	3	3
CO 4	3	2	1	1	2							2	3	3
CO 5	3	2	1	1	2							2	3	3

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment / Quiz / Seminar 3. End-Semester examination
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**INTRODUCTION TO PROBLEM SOLVING**	Periods	**9**

Basic organization of Computer - Programming languages - Compilers – Interpreter- Flowchart – Pseudocode–Algorithm.

Number Systems – Decimal, Binary, Octal and Hexadecimal conversions

Unit - II	BASICS OF C PROGRAMMING	Periods	9
Introduction to C – Features - Data Types – Constants – Variables - I/O Statement - Operators –Expressions - Decision Making and Branching – Looping Statements - Break, Goto, Continue.			
Unit – III	**ARRAYS AND POINTERS**	Periods	**9**
Arrays: Concepts – Need – one dimensional array – array declaration – features – array initialization - Two-Dimensional Arrays- Multidimensional Arrays. **Pointers**: Introduction, pointer declaration-accessing variable through pointer-Pointers and Arrays, Pointers and strings – Pointers structures- Pointer Arithmetic - Array of Pointers – dynamic memory allocation - malloc, realloc, free.			
Unit - IV	**FUNCTIONS AND STRINGS**	Periods	**9**
Functions: Introduction, function declaration, defining and accessing functions, User-defined Functions-storage classes-function prototypes-parameter passing methods-recursion. **Strings**: Concepts – Strings manipulation - String Input / Output Functions- Strings standard functions - Arrays of Strings.			
Unit – V	**STRUCTURES, UNIONS AND FILE SYSTEMS**	Periods	**9**
Structures: Introduction- nested structures- Arrays of Structures - Structures and Functions - Pointers to Structures – Unions. **File**: opening, defining, closing, File Modes, File Types , Writing contents into a file,Reading file contents, Appending an existing file, File permissions and rights, Changing permissions and rights.			
		Total Periods	**45**

Text Books	
1.	S.Kuppuswami, S.Malliga, C. S. Kanimozhiand K.Kousalya, "Problem Solving and Programming", McGraw Hill, 2019.
2.	E. Balagurusamy, "Programming in ANSI C", 8thEdition, McGraw Hill, 2019.
References	
1.	Herbert Schildt, C: The Complete Reference, McGraw Hill, 4th Edition, 2017
2.	Kernighan BW and Ritchie DM, "The C Programming Language", 2nd Edition, Prentice Hall of India, 2017.
3.	Dr.V.Rameshbabu, Dr.R.Samyutha, M.MuniRathnan, "Computer Programming", VRB Publishers Pvt.Ltd, 2016.
Tools Required	
1.	Codetandra/HackerRank/ HackerEarth / Any online Problem Solving Platforms
E-Resources	
1.	https://www.geeksforgeeks.org/c-language-set-1-introduction/
2.	https://www.programiz.com/c-programming
3.	https://www.cprogramming.com/

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Programme	**B.E.**	Programme Code		**106**	Regulation	**2023**		
Department	**BIOMEDICAL ENGINEERING**				Semester	**I**		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23TN201	**தமிழர் மரபு / Heritage of Tamils**	1	0	0	1	40	60	100

Content of the syllabus

அலகு 1	**மொழி மற்றும் இலக்கியம்**	**நேரம்**	**3**

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் திருக்குறளில் மேலாண்மைக் கருத்துக்கள் தமிழ்க் காப்பியங்கள் தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு 2	**மரபு பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை சிற்பக் கலை**	**நேரம்**	**3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை ஐம்பொன் சிலைகள் பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை. யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவல்களின் பங்கு.

அலகு 3	**நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள**	**நேரம்**	**3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு 4	**தமிழர்களின் திணைக் கோட்பாடுகள**	**நேரம்**	**3**

தமிழகத்தின் தாவரங்களும், விலங்குளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு 5	**இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:**	**நேரம்**	**3**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு- கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

Total Periods	**15**

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Programme	**B.E.**	Programme Code		**106**	Regulation		**2023**	
Department	**BIOMEDICAL ENGINEERING**				Semester		**I**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23TN201	**தமிழர் மரபு/Heritage of Tamils**	1	0	0	1	40	60	100

Content of the syllabus

Unit I	**LANGUAGE AND LITERATURE**	Periods	**3**

Language Families in India - Dravidian Languages - Tamil as a Classical Language - Classical Literature in Tamil - Secular Nature of Sangam Literature - Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Developmentof Modem literature in Tamil- Contribution of Bharathiyar and Bharathidhasan.

Unit Ii	**HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE**	Periods	**3**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

Unit III	**FOLK AND MARTIAL ARTS**	Periods	**3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari,Tiger dance - Sports and Games of Tamils.

Unit IV	**THINAI CONCEPT OF TAMILS**	Periods	**3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

Unit V	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	Periods	**3**

Contribution of amils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India. - Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine - Inscriptions & Manuscripts - Print History of Tamil Books.

Total Periods	**15**

Text-Cum-Reference Books

1.	தமிழக வரலாறு மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித் தமிழ் - முனைவர்இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4.	பொருநை -ஆற்றங்கரை நகரிகம்.(தொல்லியல் துறை வெயளியீடு)
5.	SocialLifeofTamils(Dr.K.K.Pillay)Ajointpubhcat1onofTNTB&ESCandRMRL
6.	Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr.S.V.Subatamarnan, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies}. . .
8.	The Contributions of the Tamils to Indian Culture (Dr.M. Valarmathi) (Published by. International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, TamilNadu) .
10.	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K. P1llay) (Publishedby: The Author)
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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Programme	**B.E**	Programme Code	**106**		Regulation	**2023**		
Department	**Biomedical Engineering**				Semester	**I**		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23GE101	**Engineering Graphics**	2	0	3	3	50	50	100

Course Objective

The main objective of this course is to:

- Develop skills to enhance their ability to know the concept of engineering graphics and to draw the points kept in various positions, lines and planes.
- Project the drawing of various solids.
- Sketch sectioned views of solids.
- Draw the development of surfaces.
- Draw the isometric and orthographic projections for any given object to the required standard.

Course Outcomes	At the end of the course, the student should be able to	Knowledge Level
	CO1: Construct plane curves and develop projection of points , lines and plane surfaces	K2
	CO2: Construct projection of solids with various conditions.	K4
	CO3: Design the section of solids and analyze the true shape of the section	K3
	CO4: Design and develop the different solid surfaces.	K2
	CO5: Construct isometric and orthographic projection of different solids.	K1

Pre - requisites: Nil

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

COs	Programme Outcomes (POs)												**CO/PSO Mapping** PSOs	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**
CO 1	3	2	1	1	2							2	3	3
CO 2	2	1	1		2							2	2	2
CO 3	3	2	1	1	2							2	3	3
CO 4	3	2	1	1	2							2	3	3
CO 5	3	2	1	1	2							2	3	3

Course Assessment Methods

Direct

1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examination

Indirect

1. Course - end survey

Content of the Syllabus			
Concepts & Conventions(Not for Examination)	Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.	**Periods**	**1**
Unit – I	**PROJECTION OF POINTS, LINES AND PLANE SURFACES**	**Periods**	**3+8**
Introduction to Plane curves, Orthographic projection – principles – projection of points, straight lines (only first angle projections) and plane surfaces (polygonal and circular).			
Unit - II	**PROJECTION OF SOLIDS**	**Periods**	**3+8**
Projections of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane.			
Unit - III	**SECTION OF SOLIDS**	**Periods**	**3+8**
Sectioning of solids - 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.			
Unit - IV	**DEVELOPMENT OF SURFACES**	**Periods**	**3+8**
Development of lateral surfaces of simple solids like prisms, pyramids, cylinders and cones – development of simple truncated solids involving prisms, pyramids, cylinders and cones.			
Unit - V	**ISOMETRIC PROJECTIONS, ORTHOGRAPHIC VIEWS FROM PICTORIAL VIEWS**	**Periods**	**5+10**
Isometric Projection and Introduction to AutoCAD / Solid Edge: Principles of isometric projection - Isometric scale -Isometric projections of simple solids like prisms, pyramids, cylinders and cones & orthographic views from pictorial views.			
Demonstration only: **Computer Aided Drafting (Auto CAD / Solid Edge):** Introduction to drafting packages and demonstration of their use.			
		Total Periods	**60**

Text Book:	
1.	Basant Agrawal and C.M Agrawal ,“Engineering Drawing ”,Tata McGraw Hill ,Third Edition,2019
2.	Jain and Gautam ,“Engineering Graphics & Design ”,Khanna Publishing House, 2018
Reference Book :	
1.	Dr.P.Kannan and Dr.J.Bensam Raj, “Engineering Graphics”, JBR Tri Sea Publishers Pvt. Ltd,2018.
2.	K.V Natarajan, "Engineering Drawing and Graphics", M/s. N.Dhanalakshmi, Chennai,2014.
3.	K.Venugopal and V. Prabhu Raja, “Engineering Graphics”New Age International Publishers,2011.
4.	N.S Parthasarathy and Velamurali, “ Engineering Graphics”, Oxford University, New Delhi,2015
5.	Bhatt N.D and Panchal V.M, “Engineering Drawing”, Charotar Publishing House,50th Edition,2010
e-RESOURCES:	
1.	http://nptel.ac.in/courses/105104148, “Engineering Graphics” - Dr. Nihar Ranjan Patra , IIT Kanpur
2.	http://cfd.annauniv.edu/webcontent.htm, “Engineering Graphics” - Dr.Velamurali
3.	http://link.springer.com/ “Engineering Graphics”-Springer Nature.

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205								
Programme	**B.E.**	Programme code	**106**	Regulation	**2023**				
Department	**BIOMEDICAL ENGINEERING**		Semester		**I**				
Course Code	Course name	Periods per week			Credit	Maximum Marks			
		L	T	P	C	CA	ESE	Total	
U23GE102	**Design Thinking**	1	0	2	1	50	50	100	

Course Objective	The student should be made to, • familiarize with design thinking concepts and principles • practice the methods, processes and tools of design thinking. • apply the design thinking approach and have ability to model real world situations.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand and apply the concept of team building activity	K2
	CO2: Understand Design Thinking and apply the design thinking approach to empathize situations in real world	K3
	CO3: Identify various methods of empathy and define the problem	K3
	CO4: Develop creative ideas through design thinking	K4
	CO5: Understand benefits of learning through observation, experience and application	K5
Pre-requisites	-	

	CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak												**CO/PSO Mapping**	
COs	Programme Outcomes (POs)												PSOs	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO 1	2	3	3	3	3	2	2	3	3	3	2	2	3	3
CO 2	3	3	3	3	3	3	3	3	3	3	3	3	2	2
CO 3	3	3	1	2	2	2	2	1	2	1			2	2
CO 4	3	3	3	3	3	2	2	2	2	2	2	1	2	2
CO 5	3	3	3	3	1	2	2	2	1	2	2	1	2	2

Course Assessment Methods

Direct
1. Continuous Assessment Test through activities, assignment & Quiz 2. Models (Chart/paper/3D) 3. Prototype & Presentation
Indirect
1. Course - end survey

Content of the syllabus

SESSION-I	Periods	**6**
Introduction – Team Building - Types – 4 C's of Team Building – Levels of Team Building – Benefits of Team Work – Team Building Activity.		
SESSION II	Periods	**9**
Introduction to Design Thinking – Purpose of Design Thinking – Design Thinking Framework, Empathy and related case studies		

SESSION III	Periods	6
Define : Examine and Reflect on the problem.		
SESSION IV	Periods	**12**
Generating Ideas – Identifying ideas – Bundling the ideas and create concepts – Rapid Prototyping – Idea Refinement.		
SESSION V	Periods	**12**
Importance & testing the design with people - Retest and redefine results		
Total Periods		**45**

Textbooks	
1.	Solving Problems with Design Thinking - Ten Stories of What Works by Jeanne Liedtka 2013.
2.	Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.
3.	Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, 2nd edition, 2011
4.	Design of Business: Why Design Thinking is the Next Competitive Advant age by Roger L. Martin 2009.
5.	Change by Design: How Design thinking transforms organizations and empires Innovation, 2009, Harper Business, Brown,Tim and Berry.
References	
1.	Design thinking toolbox by Michael Lewick, Wily 2020
2.	Design thinking playbook by Michael Lewrick , Wily 2019
3.	Creative Confidence: Unleashing the CreativePotential Within Us All by by Tom 2014
4.	The Design of Everyday Things: by Don Norman 2013
E-Resources	
1.	https://www.collectivecampus.io/blog/6-resources-to-help-you-learn-design-thinking
2.	https://thisisdesignthinking.net/on-design-thinking/design-thinking-resources/
3.	http://hs.griet.ac.in/pdf/studymaterialsgr20/Design%20Thinking%20Lab%202020-21.pdf
4.	https://www.mindtools.com/brainstm.html
5.	https://www.quicksprout.com/. /how-to-reverse-engineer-your-competit
6.	https://www.youtube.com/watch?v=2mjSDIBaUlM
7.	thevirtualinstructor.com/foreshortening.html
Activity Based Learning/Practical Based Learning	
http://dschool.stanford.edu/dgift/	
Online Course	
1.	https://onlinecourses.nptel.ac.in/noc19_mg60/preview
2.	https://www.ibm.com/design/thinking/page/badges/core-skills

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Programme	**B.E.**	Programme Code		**106**	Regulation		**2023**	
Department	**BIOMEDICAL ENGINEERING**				Semester		**I**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CH102	**CHEMISTRY LABORATORY**	0	0	2	1	60	40	100

Course Objective

The Main Objective of the course is to:

- Gather basic simple acid-base reactions and study the mechanism of acid mixture with base.
- Learn pH and potential of hydrogen in a sample solution.
- Study the redox reaction through potential difference.
- Infer iron forms complex with thiocyanate.
- Gather knowledge on hardness producing salts and removal of hardness through estimation.
- Collect data required for dissolved oxygen present in water sample.
- Understand alkalinity and available chlorine present in water sample.

Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Infer knowledge on neutralization reaction between acid, acid mixture with base and identify the concentrations.	K3
	CO2: Identify the concentration of sample using pH.	K3
	CO3: Spot the concentration of sample solution through redox reaction by potentiometric method	K4
	CO4: Estimate Iron by complexation reaction spectrometric ally.	K4
	CO5: Determine hardness and dissolved oxygen present in domestic water supply and Identify alkalinity and available chlorine present in the given sample.	K4

Pre-requisites Nil

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													**CO/PSO Mapping**		
COs	Programme Outcomes (POs)												PSOs		
	PO1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO 1	3	3		2	2	1	1						2	2	2
CO 2	3	3		2	2	2	2						2	1	2
CO 3	3	3		2	2	1							1	2	2
CO 4	3	3	1	2	2	1							2	2	
CO 5	2	3	1	2		2	3						2	2	

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment 3. End-Semester examinations
Indirect
1. Course - end survey

S.No	Name of the Experiment	Course Outcome
1.	Estimation of HCl using NaOH by Conductometric titration	CO1
2.	Estimation of Mixture of acid using NaOH by Conductometric titration.	CO1
3.	Estimation of Barium Chloride using Sodium Sulphate by Conductometric precipitation titration	CO1
4.	Determination of HCl using NaOH by pH metry	CO2
5.	Estimation of Ferrous iron by Potentiometric titration.	CO3
6.	Estimation of Ferric ion by Spectrophotometry	CO4
7.	Determination of Total, Temporary and Permanent hardness of water by EDTA method.	CO5
8.	Estimation of Dissolved Oxygen content in water by Winkler's method	CO5
9.	Estimation of Alkalinity in water sample.	CO5
10.	Estimation of available Chlorine in bleaching powder.	CO5
	Total Periods	**30**

Text Books

1.	Chemistry laboratory I & II by Dr.A.Ravikrishnan,Sri Krishna Pub,Revised Edition-2017
2.	Chemistry laboratory Manual by Dr.Veeraiyan, Revised Edition-2017

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Programme	**B.E.**	Programme Code			Regulation		**2023**	
Department	**BIOMEDICAL ENIGEERING**				Semester		**I**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CS102	**Programming for Problem Solving Laboratory**	0	0	2	1	60	40	100

Course Objective	The main objective of the course is to • Develop simple C programs to illustrate the applications of User Defined and Derived Data Types suchas Arrays, Pointers,Structures,and Functions.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Develop C programs for computer based solution of simple real world problems using Conditional and Looping statements	K3
	CO2: Implement simple C Programs using Stringsand Arrays	K3
	CO3: Implement C program for simple applications using Pointers	K3
	CO4: Write C programs that perform operations on File	K4
	CO5: Demonstrate C Programs using Structures	K3

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

CO/PSO Mapping

COs	Programme Outcomes (POs)												PSOs	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**
CO 1	3	2	1	1	2							2	3	3
CO 2	3	2	1	1	2							2	3	3
CO 3	3	2	1	1	2							2	3	3
CO 4	3	2	1	1	2							2	3	3
CO 5	3	2	1	1	2							2	3	3

Course Assessment Methods

Direct

1. Prelab and post lab test
2. End-Semester examination

Indirect

1. Course - end survey

List of Experiments	**CO's**
1. Write a C program that accepts an employee's ID, total worked hours in a month and the amount he received per hour. Print the ID and salary (with two decimal places) of the employee for a particular month.	CO1
2. Write a program in C to calculate the sum of three numbers with input on one line separated by a comma.	CO1
3. Write a program in C to find the sum of the series [x - x^3 + x^5 + ...].	CO1
4. Write a program in C to find the number and sum of all integers between 100 and 200 which are divisible by 9.	CO1

5.	Write a program in C to count the total number of duplicate elements in an array.	CO2
6.	You are given an input string 'S'. Your task is to find and return all possible permutations of the input string. **Note:** 1. The input string may contain the same characters, so there will also be the same permutations. 2. The order of permutation does not matter. **Sample Input** xyz sample Output xyz, xzy, yxz, yzx, zxy, zyx **Sample Output :** All the possible permutations for string "XYZ" will be "XYZ", "XZY", "YXZ", "YZX", "ZXY" and "ZYX".	CO2
7.	Find the Smallest and Largest Element in an Array **Method 1:** Traverse the array iteratively and keep track of the smallest and largest element until the end of the array. **Method 2:** Traverse the array recursively and keep track of the smallest and largest element until the end of the array. **Method 3:** Sort the array using STL and return the first element as the smallest element and the last element as the largest element. **For example, consider the array.** arr = {1, 2, 3, 4, 5} **Sample output:** Smallest element: 1 Largest element: 5	CO2
8.	Write a C program to find the sum of all the multiples of 3 and 5 below 100using pointers. We have to find the number of numbers which are multiples of both 3 and 5 in the first 100 natural numbers. Multiples of both 3 and 5 in the first 100 natural numbers are the multiples of LCM of 3 and 5. LCM of 3 and 5 =3×5=15 **Sample output:** Multiples of 15 below 100 are 15, 30, 45, 60, 75 and 90.	CO3
9.	Write a C program to count number of characters, words and lines in a text file. Logic to count characters, words and lines in a file in C program. How to count total characters, words and lines in a text file in C programming. **ExampleSource file** I love programming. Working with files in C programming is fun. I am learning C programming at VCEW. **Sample output** Total characters = 100 Total words = 18 Total lines = 3	CO4
10.	Write a C program to implement Student database using Structure **Sample output:** **Enter details of student:** Name :abi RollNo:101	CO5

Percentage :89.7 **Entered details:** Name: abi RollNo: 101 Percentage: 89.70	
Total Periods	**45**
Tools Required	
Codetandra/HackerRank/HackerEarth/ Any online Problem Solving Platforms	
E-Resources	
1.	https://www.programiz.com/c-programming
2.	https://www.cprogramming.com/
3.	https://beginnersbook.com/2015/02/simple-c-programs/

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Programme	**B.E.**	Programme Code			**106**	Regulation		**2023**	
Department	**BIOMEDICAL ENGINEERING**					Semester		**I**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks			
		L	T	P	C	CA	ESE	Total	
U23MCFY2	**Indian Constitution**	2	0	0	0	100	-	100	

Course Objective	The Main Objective of this course is to: • Know about Indian constitution. • Know about central and state government functionalities in India • Know about Indian society.	
Course Outcome	At the end of the course, the student will be able to	Knowledge Level
	CO1: Understand the functions of the Indian government	K1
	CO2: Understand and abide the rules of the Indian constitution	K1
	CO3: Understand and appreciate different culture among the people	K1
	CO4: Understanding human being as a co-existence of the sentient 'I' and the material	K1, K2
	CO5: 'Body' and the needs of Self ('I') and 'Body' and Ability to utilize the professional competence for augmenting universal human order and Ability to identify the scope and characteristics of people-friendly and ecofriendly Production systems	K2
Pre-requisites	---	

CO / PO Mapping (3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**													**CO/PSO Mapping**		
COs	Programme Outcomes (POs)												PSOs		
	PO1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO 1						3		3	2						
CO 2						3		3	3						
CO 3						3		3	2						
CO 4						3		3	3						
CO 5						3		3	3						

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment: Simulation using tool 3. End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**INTRODUCTION**	Periods	**9**

Historical Background – Constituent Assembly of India – Fundamental Rights – Citizenship – Constitutional Remedies for citizens

Unit - II	**STRUCTURE AND FUNCTION OF CENTRAL**	Periods	**9**
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India			
Unit – III	**STRUCTURE AND FUCTION OF STATE**	Periods	**9**
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts			
Unit - IV	**UNIVERSAL HUMAN VALUES**	Periods	**9**
Course Introduction - Need, Basic Guidelines, Content and Process for Value Education			
Unit – V	**OPTOEL UNIVERSAL HUMAN VALUES -** PROFESSIONAL **ETHICS ECTRONICS**	Periods	**9**
Understanding Harmony in the Human Being - Harmony in Myself and society.			
		Total Periods	**45**

Text Books	
1.	Durga Das Basu, "Introduction to the Constitution of India," Prentice Hall of India, New Delhi.
2.	Tanu Shukla, "Human Values and professional Ethics," Cengage publications.
References	
1.	R. C. Agarwal, "Indian Political System," S. Chand and Company, New Delhi, 1997
2.	M. Laksmikanth, "Indian polity," Tata MC Grawhill publications.
3.	R.R Gaur, R Sangal, G P Bagaria, "A foundation course in Human Values and Professional Ethics," Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2
E-Resources	
1.	https://mhrd.gov.in/
2.	https://niti.gov.in/content/niti-aayog-library
3.	www.drishtiias.com/

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Programme	**B.E.**	Programme Code	**106**	Regulation	**2023**		
Department	**BIOMEDICAL ENGINEERING**			Semester	**II**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23MA202	**Complex Analysis and Ordinary Differential Equations**	3	1	0	4	40	60	100

Course Objective	The Main Objective of the course is to • Understand the Analytic functions and Bilinear transformations. • Proficiently understand the Complex Integration. • Demonstrate Vector Differentiation and Integration.. • To know about the Ordinary Differential Equations. • Identify the Laplace Transform of Derivatives and Integrals.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Analyze the construction of analytic functions.	K3, K4
	CO2: Apply the concepts of cauchy's integral theorem and residue theorem in evaluation of complex integrals.	K2, K3
	CO3: Apply Green's , Stoke's and Gauss Divergence theorems.	K1, K5
	CO4: Understand the concepts of solving second order differential equations.	K2, K5
	CO5: Apply the concepts of Laplace transform in solving ODE.	K5, K3
Pre-requisites	-	

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													**CO/PSO Mapping**		
COs	Programme Outcomes (POs)												PSOs		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO 1	3		2	1	1								2		
CO 2	3	2	1	1									2		
CO 3	3	2		1									2		
CO 4	3	2		1	1								2		
CO 5	3	2	1	1									2		

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment. 3. End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus			
Unit – I	**ANALYTIC FUNCTIONS**	Periods	**12**
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions c+z, cz,1/z and Bilinear transformation.			
Unit - II	**COMPLEX INTEGRATION**	Periods	**12**
Problem solving using Cauchy's integral theorem and integral formula- Taylor's and Laurent's expansions- Residues- Cauchy's residue theorem- Application: Contour integration over unit circle.			
Unit – III	**VECTOR DIFFERETIATION & INTEGRATION**	Periods	**12**
Vector Differentiation: Vector and Scalar Functions- Derivatives- Curves, Gradient of a Scalar Field- Directional Derivative -Divergence of a Vector Field - Curl of a Vector Field – Line, Surface and Volume integrals (concepts only), Green's theorem in a plane(excluding proof), Gauss Divergence theorem(excluding proof), Stoke's theorem (Excluding proof).			
Unit - IV	**ORDINARY DIFFERENTIAL EQUATIONS**	Periods	**12**
Second order Linear ordinary differential equations with constant coefficients, Cauchy's - Euler equations (excluding proof)- Legendre's Linear differential equations(excluding proof) - Method of variation of parameters.			
Unit – V	**LAPLACE TRANSFORMS**	Periods	**12**
Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems(excluding proof) -Transforms of derivatives and integrals – Initial and final value theorems(excluding proof) – Inverse transforms – Convolution theorem(excluding proof) – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.			
		Total Periods	**60**

Text Books	
1.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2.	Ravish R Sing , Mukul Bhatt, "Engineering Mathematics", Mc Graw Hill Education Pvt. Ltd-2018
3.	Sivaramakrishna Das. P, Vijayakumari.C, " Engineering Mathematics – II", Pearson India Education Pvt. Ltd-2022.
References	
1.	Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics" , Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
2.	Kreyszig, E., Advanced Engineering Mathematics (10th Edition), John Wiley (2015).
3.	Alan Jefferis , Advanced Engineering Mathematics, Academic Press- New Delhi-2003
4.	Yunus A.Cengel, William J.Palm III," Differential equations for Engineers & Scientists", Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
5.	John Bird, Higher Engineering Mathematics, Anuradha Agencies(2004)
E-Resources	
1.	https://en.wikipedia.org › wiki › Ordinary_differential_equation
2.	www.learnerstv.com/Free-engineering-Video-lectures
3.	www.nptel.ac.in

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Programme	**B.E.**	Programme Code		**106**	Regulation		**2023**		
Department	**Biomedical Engineering**				Semester		**II**		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks			
		L	T	P	C	CA	ESE	Total	
U23PH201	**ENGINEERING PHYSICS**	3	0	0	3	40	60	100	

Course Objective	The student should be made to, • understand the basic concepts of properties of matter • gain knowledge about the conduction properties of metals • identify the different types of crystal structures and crystal growth techniques. Study the production and applications of ultrasonics. • correlate better understanding the carrier concentration and its variations with temperature in a semiconductor. Study the properties of modern engineering materials and its uses • categorize the types of laser and fiber optics	
Course Outcome	At the end of the course, the student will be able to	Knowledge Level
	CO1: understand the elastic properties of the materials	K2
	CO2: gain knowledge about the conduction properties of metals	K3
	CO3: determine packing factor for various unit cells and understand different types of crystal imperfections and learn the engineering, medical applications.	K1
	CO4: discuss the basic idea of semiconducting materials and realize the function of modern engineering materials	K1
	CO5: learn the optical properties of materials and its uses	K3
Pre-requisites	---	

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

COs	Programme Outcomes (POs)												**CO/PSO Mapping** PSOs		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO 1	3	2	3	1	2									2	
CO 2	3	2	3	3	1										
CO 3	3	3		3	1									2	
CO 4	3		2	1	1								3	2	
CO 5	3			1	2	2								2	

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2. Assignments and Mind map 3.End-Semester examinations
Indirect
Course - end survey

Content of the syllabus

Unit – I	PROPERTIES OF MATTER	Periods	9

Elasticity: Types of moduli of elasticity - Stress - Strain Diagram – uses. Young's modulus: Uniform bending (qualitative) Experimental determination by non-uniform bending - Twisting couple on a wire – Application: Torsional pendulum.

Viscosity: Co-efficient of viscosity - Poiseuilles' formula - Experimental determination – uses.

Unit - II	ELECTRICAL PROPERTIES OF METALS	Periods	9

Classical theory: Classical free electron theory of metals- Expressions for electrical conductivity and Thermal Conductivity of metals – Wiedemann-Franz law (Qualitative) - Success and failures.

Quantum theory: de Broglie's hypothesis - Schrodinger's time independent and time dependent wave equations (Qualitative) - Particle in a one-dimensional box - Fermi – Dirac Statistics - Density of energy states (Qualitative).

Unit – III	CRYSTAL PHYSICS AND ULTRASONICS	Periods	9

Crystallography - Unit cell - Crystal systems - Bravais lattices- Lattice planes - Miller indices - Inter-planar spacing in cubic lattice- Calculation of number of atoms per unit cell- Atomic radius – Coordination number- Packing Factor for HCP structures.

Ultrasonics: Introduction - Properties and Generation of Ultrasonics – Magnetostriction and Piezoelectric Oscillator methods – Applications: Sound Navigation and Ranging (SONAR), Non – Destructive Testing (NDT) and Sonogram.

Unit - IV	SEMICONDUCTING & MODERN ENGINEERING MATERIALS	Periods	9

Semiconductors: Elemental and Compound semiconductors - Intrinsic semiconductor: (Qualitative only) – Carrier concentration – Fermi level – Electrical conductivity - Band gap determination. Extrinsic semiconductors: Carrier concentration in n – type and p – type semiconductor (Qualitative) – Variation of Fermi level with temperature. Application; Construction and working of LED.

Metallic glasses: preparation, properties and applications - Shape memory alloys (SMA): Characteristics and applications of NiTi alloy.

Unit – V	LASER AND FIBER OPTICS	Periods	9

Laser: Interactions of Radiations with matters - Characteristics of laser – Derivation of Einstein's A and B coefficients. Types: CO2 laser - Semiconductor laser: Homo junction - Applications.

Optical fiber: Principle of propagation of light through optical fiber - Numerical aperture and acceptance angle (Qualitative) -Types of optical fibers -Fiber optical communication system (block diagram) - Application: Temperature sensor.

Total Periods	**45**

Text Books

1.	R.K. Gaur and Gupta. S.L, Engineering Physics, Dhanpat Rai Publishers, 2017.
2.	S.O Pillai., Solid state physics, New Age International Private Limited.
3.	Dr.P.Mani, "Engineering Physics", Shri Dhanam publisher, Chennai – 600 042

References

1.	B.K. Pandey, S. Chaturvedi. "Engineering Physics", 1st Edition, Cengage Learning India Pvt Ltd, (2012).
2.	Fundamentals Of Physics Extended 8/Ed 8th Edition, David Halliday, Robert ResnickJearl Walker, Wiley India Pvt Ltd, 2008.
3.	Lawrence H.Vanvlack, "Elements of materials Science Engineering, 6th Edition, Pearson Publication.

4.	S.O.Pillai, “Solid State Physics”, New Age International Publishers
5.	Dr.V.Rajendran, “Engineering Physics”, Tata McGraw Hill Education Private Limited, New Delhi
E-Resources	
1.	www.e-booksdirectory.com
2.	Home.iitk.ac.in
3.	physics.cu.ac.bd/

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**106**	Regulation	**2023**		
Department	**BIOMEDICAL ENGINEERING**			Semester	**II**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23GE202	**Basic Civil and Mechanical Engineering**	3	0	0	3	40	60	100

Course Objective

The Main Objective of the course is to:

- Familiarize the materials and measurements used in Civil Engineering.
- Provide the exposure on the fundamental elements of civil engineering components and structures.
- Impart basic knowledge of power plants, pumps & boilers.
- Study the various types of IC engines and understand the features of IC engine.
- Enable the students to distinguish the components and working principle of refrigeration and air conditioning system.

Course Outcome

At the end of the course, the student should be able to,	Knowledge level
CO 1: Explain the usage of civil engineering materials and measure the location of points in surveying	K2
CO 2: Identify the nature of building components, structures and material qualities.	K1
CO 3: Classify the various types of power plant, pump, turbine & boiler	K2
CO 4: Compare spark ignition and compression ignition of two stroke and four stroke engines.	K2
CO 5: Elaborate the working principle of refrigeration and air conditioning system.	K3

Pre-requisites -

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

COs	Programme Outcomes (POs)												PSOs		
	PO1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO 1	3	3	3	2	3	-	-	-	-	-	-	-	3	2	-
CO 2	3	3	3	2	3	-	-	-	-	-	-	-	2	-	-
CO 3	3	2	2	-	2	-	-	-	-	-	-	-	2	3	-
CO 4	3	3	2	-	2	-	-	-	-	-	-	-	2	-	-
CO 5	3	2	2	-	2	-	-	-	-	-	-	-	3	2	-

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment 3. End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus			
Unit – I	**CIVIL ENGINEERING MATERIALS AND SURVEYING**	**Periods**	**9**
Civil Engineering Materials: Bricks – Stones – Sand – Cement – Concrete – Steel sections. **Surveying**: Introduction to Surveying & Leveling.			
Unit - II	**BUILDING COMPONENTS AND STRUCTURES**	**Periods**	**9**
Foundations: Site selection, Foundation – Types – Requirement of good foundations. **Superstructure:** Brick masonry – Stone masonry – Beams – Columns – Lintels – Roofing – Flooring - Plastering.			
Unit - III	**POWER PLANT ENGINEERING**	**Periods**	**9**
Introduction, Classification of Power Plants – Boiler - Working principle of steam, Gas , Diesel , Hydro-electric, Solar, Wind and Nuclear Power plants – Merits and Demerits – Pumps and turbines – Working principle of reciprocating pumps (single acting and double acting) – Centrifugal Pump.			
Unit - IV	**IC ENGINES**	**Periods**	**9**
Introduction to Electric vehicles- Internal combustion engines as automotive power plant – Four stroke and two stroke cycles – Working of SI and CI engines - Comparison of four stroke and two stroke engines.			
Unit - V	**REFRIGERATION AND AIR CONDITIONING SYSTEM**	**Periods**	**9**
Terminology of refrigeration and air conditioning. Principle of vapour compression and vapour absorption refrigeration system – Layout of typical domestic refrigerator – Window and split type room air conditioner.			
		Total Periods	**45**
Text Books			
1.	Dr. P. Kannan, “Basic Mechanical Engineering,” JBR Tri Sea Publishers Pvt. Ltd., 2019.		
2.	Pravin Kumar, “Basic Mechanical Engineering,” Pearson Publishers, New Delhi, 2013.		
References			
1.	Dr. S. Ramachandaran, “Basic Civil and Mechanical Engineering,” Air Walk Publication,2016		
2.	R.Gupta, “Basic Civil Engineering,” RPH Publication, 2016.		
3.	Mrs. V. Valarmathi, Mr. K. Rajasekar & Mr. T. Satheeskumar, “Basic Civil Engineering,” JBR Tri Sea Publishers Pvt. Ltd., 2017.		
4.	G. Shanmugam and M.S Palanichamy, “Basic Civil and Mechanical Engineering,” Tata McGraw Hill Publishing Company Limited, New Delhi,2014		
5.	S.Seetharaman, “Basic Civil Engineering,”Anuradha Agencies,2005		
E-Resources			
1.	https://nptel.ac.in/downloads/105105104/		
2.	https://nptel.ac.in/courses/112107216/		
3.	http://link.springer.com/ “Basic Civil and Mechanical Engineering”-Springer Nature.		

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	B.E/B.Tech.	Programme code		106	Regulation		2023	
Department	**BIO MEDICAL ENGINEERING**			Semester			II	
Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23TA202	**தமிழரும்தொழில்நுட்பமும்/ TAMILS AND TECHNOLOGY**	1	0	0	1	40	60	100
	Content of the syllabus							
அலகு 1	**நெசவுமற்றும்பானைத்தொழில்நுட்பம்**				**Periods**		**3**	
சங்ககாலத்தில்நெசவுத்தொழில் – பானைத்தொழில்நுட்பம் - கருப்புசிவப்புபாண்டங்கள் – பாண்டங்களில்கீறல்குறியீடுகள்.								
அலகு 2	**வடிவமைப்புமற்றும்கட்டிடத்தொழில்நுட்பம்**				**Periods**		**3**	
சங்ககாலத்தில்வடிவமைப்புமற்றும்கட்டுமானங்கள்&சங்ககாலத்தில்வீட்டுப்பொருட்களில்வடிவமைப்பு- சங்ககாலத்தில்கட்டுமானபொருட்களும்நடுகல்லும் – சிலப்பதிகாரத்தில்மேடைஅமைப்புபற்றியவிவரங்கள்–மாமல்லபுரச்சிற்பங்களும் , கோவில்களும் – சோழர்காலத்துப்பெருங்கோயில்கள்மற்றும்பிறவழிபாட்டுத்தலங்கள் – நாயக்கர்காலக்கோயில்கள் - மாதிரிகட்டமைப்புகள்பற்றிஅறிதல், மீனாட்சிஅம்மன்ஆலயம்மற்றும்திருமலைநாயக்கர்மஹால் – செட்டிநாட்டுவீடுகள் – பிரிட்டிஷ்காலத்தில்சென்னையில்இந்தோ-சாரோசெனிக்கட்டிடக்கலை.								
அலகு 3	**உற்பத்தித்தொழில்நுட்பம்**				**Periods**		**3**	
கப்பல்கட்டும்கலை – உலோகவியல் – இரும்புத்தொழிற்சாலை – இரும்பைஉருக்குதல் ,எஃகு – வரலாற்றுச்சான்றுகளாக-செம்புமற்றும்தங்கநாணயங்கள் – நாணயங்கள்அச்சடித்தல் – மணிஉருவாக்கும்தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடிமணிகள் – சுடுமண்மணிகள் – சங்குமணிகள் – எலும்புத்துண்டுகள் – தொல்லியல்சான்றுகள் – சிலப்பதிகாரத்தில்மணிகளின்வகைகள்.								
அலகு 4	**வேளாண்மைமற்றும்நீர்ப்பாசனத்தொழில்நுட்பம்**				**Periods**		**3**	
அணை, ஏரி, குளங்கள் ,மதகு – சோழர்காலக்குமுழித்தூம்பின்முக்கியத்துவம் – கால்நடைபராமரிப்பு – கால்நடைகளுக்காகவடிவமைக்கப்பட்டகிணறுகள் – வேளாண்மைமற்றும்வேளாண்மைச்சார்ந்தசெயல்பாடுகள் – கடல்சார்அறிவு – மீன்வளம் – முத்துமற்றும்முத்துக்குளித்தல் – பெருங்கடல்குறித்தபண்டையஅறிவு – அறிவுசார்சமூகம்.								

அலகு 5	அறிவியல்தமிழ்மற்றும்கணினித்தமிழ்	Periods	3
அறிவியல்தமிழின்வளர்ச்சி - கணினித்தமிழ்வளர்ச்சி - தமிழ்நூல்களைமின்பதிப்புசெய்தல் – தமிழ்மின்பொருட்கள்உருவாக்கம் – தமிழ்இணையக்கல்விக்கழகம் – தமிழ்மின்நூலகம் – இணையத்தில்தமிழ்அகராதிகள் – சொற்க்குவைத்திட்டம்.			
		Total Periods	15

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Programme	**B.E.**	Programme code	**106**	Regulation	**2023**			
Department	**BIO MEDICAL ENGINEERING**		Semester	**II**				
Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23TA202	**TAMILS AND TECHNOLOGY**	1	0	0	1	40	60	100
	Content of the syllabus							
UNIT I	**WEAVING AND CERAMIC TECHNOLOGY**				**Periods**		**3**	
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) –Graffiti on Potteries								
UNIT II	**DESIGN AND CONSTRUCTION TECHNOLOGY**				**Periods**		**3**	
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)-ThirumalaiNayakarMahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.								
UNIT III	**MANUFACTURING TECHNOLOGY**				**Periods**		**3**	
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.								
UNIT IV	**AGRICULTURE AND IRRIGATION TECHNOLOG**				**Periods**		**3**	
Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.								
UNIT V	**SCIENTIFIC TAMIL & TAMIL COMPUTING**				**Periods**		**3**	
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.								
					Total Periods		**15**	

TEXT-CUM-REFERENCE BOOKS

1	தமிழகவரலாறும் – மக்களும்பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2	கணினித்தமிழ் – முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3	கீழடி – வைகைநதிக்கரையில்சங்கநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4	பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்வெளியீடு)
5	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies

7	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9	Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text BookandEducational Services Corporation, Tamil Nadu)
12	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code			**106**	Regulation	**2023**	
Department	**BIOMEDICAL ENGINEERING**					Semester	**II**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CS203	**Python Programming**	3	0	2	4	50	50	100
Course Objective	The student should be made to, • Understand the fundamentals of Python programming • Handle list, tuples, sets and Dictionaries data types • Learn function prototypes and string functions. • Use files and modules for data processing • Understand packages in Python and data visualization							
Course Outcome	At the end of the course, the student should be able to,							Knowledge Level
	CO1: Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.							K3
	CO2: Perform operations on list, tuples, sets and Dictionaries using python.							K3
	CO3: Implement function prototypes and string functions.							K3
	CO4: Apply files and modules and perform operations on CSV files.							K3
	CO5: Perform data visualization and apply Python packages for CSV files							K3
Pre-requisites	Nil							

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak												**CO/PSO Mapping**	
Cos	Programme Outcomes (POs)											PSOs	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**
CO 1	3	2	1	-	1	-	-	-	-	-	-	2	3	2
CO 2	3	3	1	1	2	-	-	-	-	-	-	2	3	2
CO 3	3	3	1	2	2	-	-	-	-	-	-	2	3	2
CO 4	3	3	1	2	2	-	-	-	-	-	-	2	3	2
CO 5	3	3	1	2	2	-	-	-	-	-	-	2	3	2

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignments / Quiz 3. End-Semester examinations
Indirect
1. Course - End survey

Content of the syllabus

Unit – I	**INTRODUCTION TO PYTHON**	Periods	**9**

Introduction to Python, features, installing Python, writing and executing Python program — native data types, comments, constants, variables, operators, expression, conditional statements, control statements, continue, pass, break.

Unit - II	**LISTS, TUPLES, SETS AND DICTIONARIES**	Periods	**9**
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Sets: methods and operators, Dictionaries: operations and methods.			
Unit – III	**FUNCTIONS AND STRINGS**	Periods	**9**
Functions definition, declaration, arguments, parameters – formal and local, parameter passing methods - function prototypes, recursion; Strings: string slices, immutability, string functions and methods, string module, regular expressions.			
Unit - IV	**FILES AND MODULES**	Periods	**9**
Files and exception: Text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, accessing CSV file.			
Unit – V	**PACKAGES AND DATA VISUALIZATION**	Periods	**9**
Text processing, Numerical processing: numpy package – mean, medium and mode, pandas package – vector, dataframe, data visualization: matplotlib, Time operations.			
Total Periods			**45**

Suggested List of Experiments

List of Experiments	**CO's**
1. Write a program to demonstrate different number data types in Python.	CO1
2. Write a program to perform different Arithmetic Operations on numbers in Python.	CO1
3. Write a program to create, append and remove lists and demonstrate the tuples in python.	CO2
4. Write a program to demonstrate working with dictionaries in python.	CO2
5. Write a program to create, concatenate and print a string and accessing sub-string from a given string.	CO3
6. Write a Python function to calculate the factorial of a number (a non-negative integer). The function accepts the number as an argument.	CO3
7. Write a program to compute the number of characters, words and lines in a file.	CO4
8. To write a Python program to find the most frequent words in a text read from a file.	CO4
9. Find mean, median, mode for the given set of numbers in a list.	CO5
10. Draw a horizontal bar chart with Matplotlib	CO5

Lecture 45: Practical 30;Total: 75

Text Books

1.	AnuragGupta,G.P BISWAS ," Python Programming – Problem solving, packages and Libraries, Edition 1, McGraw Hill, 2019
2.	E Balagurusamy, "Problem Solving and Python Programming", Edition1, McGraw Hill, 2018
3.	ReemaThareja, "Python Programming using Problem Solving Approach", OXFORD University Press, 2017.

References

1.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016.
2.	John V Guttag, ―Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press , 2021
3.	Guido van Rossum (Author), The Python Development Team (Author),An Introduction to Python Tutorial and What's New ,2022,Shroff Publishers first edition

E-Resources

1.	http://greenteapress.com/wp/think- python/)
2.	https://www.python.org/about/gettingstarted/

3.	https://beginnersbook.com/2018/03/python-tutorial-learn-programming/
4.	https://www.tutorialspoint.com/python/index.htm
5.	https://www.learnpython.org/
6.	https://www.udemy.com/topic/python/free

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205								
Programme	**B.E.**	Programme code	**106**	Regulation	**2023**				
Department	**BIOMEDICAL ENGINEERING**			Semester	**II**				
Course code	Course name	Periods per week			Credit	Maximum Marks			
		L	T	P	C	CA	ESE	Total	
U23EN202	**Professional Communication**	2	0	3	3	50	50	100	

Objective	The main objective of this course is to: • Providesuitable reading &writing tasks to develop communicative ability for academic and professional progress • Inculcate channelized reading to make learners proficient in the chosen professional writing contexts. • Improve learners' vocabulary and grammar to supplement their language use at professional contexts • Assist students in the development of intellectual flexibility, creativity, and cultural literacy so that they may engage in life-long learning. Identify and begin to apply the language features of academic and professional writing and speaking	
Outcomes	The students who complete this course successfully are expected to:	Knowledge Level
	CO1: Acquire sufficient command over language to speak at an academic or professional context	K1
	CO2: Write technically well at professional contexts through exposing them to similar readings.	K1
	CO3: Use language at length at technical and professional situations through enrichment of vocabulary and strengthening of grammatical knowledge.	K2
	CO4: Ethically gather, understand, evaluate and synthesize information from a variety of written and electronic sources.	K2
	CO5: Be proficient in oral communication and writing.	K3
Pre-requisites	**Nil**	

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1– Weak													**CO/PSO Mapping**		
COs	Programme Outcomes (POs)												PSOs		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO 1						2			3	3		3	2		
CO 2						2			3	3		3	2		
CO 3						2			3	3		3	2		
CO 4						2			3	3		3	2		
CO 5						2			3	3		3	2		

Course Assessment Methods

Direct
1. Continuous Assessment Test I & II 2. Continuous Assessment Test III in the Communication Skills Lab 3. Assignments 4. End-Semester examinations
Indirect
1. Course – end survey

	Content of the syllabus		
Unit - I		Periods	**15**
Listening- Listening forCultural Awareness, Listening to ProfessionalConversations, Talks, Interviews and Lectures **Speaking**- Developing Confidence to get rid of Fear on the Dias, Discussion at a Corporate Context. **Reading**– Inferential Reading, Reading Short Messages and Technical Articles,**Writing**- Introduction to Letter Writing, Writing Formal and Informal Letters, Thanking Letters, Letters Calling for Quotations, Letters Placing an Order, Seeking clarification, Letters of Complaint.**Focus on Language**–Adjectives and Degrees of Comparisons			
Unit - II		Periods	**15**
Listening- Listening to specific information relating to technical content, Listening for statistical information **Speaking-** Expressing opinions, Formal Discussions, Describing Role Play at Business Context and Consolidating Ideas.**Reading**– Reading Technical Articlesin Journals and Comparing Articles. **Writing**- Letter seeking permission to undergo practical training and to undertake project work.**Focus on Language**– Simple, compound and complex sentences and Transformationof Sentences.			
Unit - III		Periods	**15**
Listening- Listening to understand the overall meaning, Listening to Interviews and Presentations.**Speaking-** Giving Instructions and Showing Directions and Rephrasing Instructions.**Reading**– Skimming and Scanning, Reading Job Advertisements. **Writing**- Applying for a Job, Writing a CV. **Group Discussion:** Introduction – Topic Analysis – Thematic Expressions-Objective and content of discussion.			
Unit - IV		Periods	**15**
Listening- Listening and retrieving Information. **Speaking-** Developing fluency and Coherence, Accent Neutralization, Voice Modulation, and Intonation, Improving Voice Quality.**Reading**–Reading and understanding Advertisements. **Writing**- Letters to the Editor, Letter of Complaint, Various kinds of Reports, Permission to go forIndustrial visits.**Presentation skills:** Making Self Introduction effectively-Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Accents analysis – Stylistics.			
Unit - V		Periods	**15**
Listening- Listening to Fragmented Texts and Filling in the Blanks. **Speaking-**Mind Mapping, Developing Coherence and Self-Expression, Making presentations, Paralinguistic and Extra linguistic Features (body language), **Reading**– Predicting content, InterpretingReports. **Writing**- Writing Proposals, Agenda, Minutes of the Meeting.**Soft Skills:** Introduction - Change in Today's Workplace: Soft Skills as a Competitive Weapon - Antiquity of Soft Skills - Classification of Soft skills - Ability to work as a team.			
		Total Periods	**75**

Text books	
1.	Sumant.S,Pereira Joyce, English for Communication, Vijay Nicole Imprints Pvt.Ltd., 2014.
2.	Sokkaalingam, S.RM., The Art Of Speaking EnglishVersatile Publishing House,2018.
Reference books	
1.	Norman Whitby - Business Benchmark Pre-Intermediate to Intermediate, Students Book, Cambridge University Press, 2008. , 1997.
2.	Dutt, Rajeevan, Prakash .A Course in Communication Skills (Anna University, Coimbatore edition) :. Cambridge University Press India Pvt.Ltd, 2007.

3.	Meenakshi Raman and Sangeeta Sharma-'Technical Communication English Skills for Engineers'; Oxford University Press, 2008.
4.	S.P. Dhanavel, English and Communication Skills for Students of Science and Engineering, Orient Blackswan Pvt, Ltd, 2009.
5.	Technical English – I & II, Sonaversity, Sona College of Technology, Salem, First Edition, 2012.
E-Resources	
1.	http://www.kalevleetaru.com/Publish/Book_Review_Who_Moved_My_Cheese.pdf
2.	http://www.bookbrowse.com/reviews/index.cfm/book_number/304/who-moved-my-cheese
3.	http://www.imdb.com/title/tt0482629/plotsummary

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Programme	**B.E.**	Programme Code	**106**	Regulation	**2023**			
Department	**BIOMEDICAL ENGINEERING**			Semester	**II**			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23PH202	**PHYSICS LABORATORY**	0	0	2	1	60	40	100

Course Objective

- Understand elastic behavior of Materials
- Predict viscous force in liquids.
- Gain knowledge in measuring the lowest thickness materials
- Identify wavelengths of prominent lines using polychromatic lamp
- Observe heat conduction in bad conductor
- Understand the principle of interferometer
- Learn about the characteristics of Lasers

Course Outcome	At the end of the course, the student will be able to	Knowledge Level
	CO1: Measure the young"smodulus of the materials, Rigidity modulus – Torsion pendulum	K3
	CO2: Calculate Coefficient of viscosity of liquid and thickness of thin wire using Air wedge	K3
	CO3: Observe and measure the different wavelengths of mercury Spectrum and dispersive power of a prism	K3
	CO4: Illustrate the conductivity of bad conductors. To know how to determine the velocity of ultrasonic waves inliquid	K3
	CO5: To understand the importance of laser beam compared to ordinary light	K2

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													**CO/PSO Mapping**		
COs	Programme Outcomes (POs)												PSOs		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	1											2		
CO 2	3	3	1	2	2								2		
CO 3	3	2			2								3		
CO 4	3	3		1									1		
CO 5	3	1	1		1								2		

Course Assessment Methods

Direct
1. Prelab and post lab test 2. Execution of experiment and Viva-Voce 3. End-Semester examinations
Indirect
Course - end survey

Content of the syllabus		
S.No.	**Experiments**	**CO**
1.	Determination of Young's modulus of the material - Uniform bending method	**CO1**
2.	Determination of Young's modulus of the material - Non uniform bending method	**CO1**
3.	Determination of Rigidity modulus – Torsion pendulum	**CO1**
4.	Determination of Coefficient of viscosity of a liquid – Poiseuille's method	**CO2**
5.	Determination of thickness of a thin material – Air wedge method	**CO2**
6.	Determination of wavelength of mercury spectrum – spectrometer grating	**CO3**
7.	Determination of Dispersive power of a prism – Spectrometer	**CO3**
8.	Determination of thermal conductivity of metallic glass using Lee's Disc Method	**CO4**
9.	Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer	**CO4**
10.	Determination of Wavelength and particle size using Laser	**CO5**
	Total Periods	**30**

Lab Manual	
1.	R. Jayaraman, Engineering Physics Laboratory Manual, Pearson Pub, Edition-2021.
2.	A.K. Katiyar &C.K. Pandey Engineering Physics: Theory and Practical, Wiley Pub,2 nd Edition.

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Programme	**B. E.**	Programme Code		**106**	Regulation		**2023**	
Department	**BIOMEDICAL ENGINEERING**				Semester		**II**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23GE204	**Engineering Practices Laboratory**	0	0	3	1	60	40	100

Course Objective	The Main Objective of this course is to: • Know the plumbing line assemblies. • Weld lap joint, butt joint and T-joint. • Learn the assembling and dismantling methodology of home appliances. • Learn the resistor value identification through colors coated on resistor. • Learn the basics of signal generation in CRO. • Learn the soldering techniques in PCB board for designing the projects.	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Perform basic machining operations and finish the job to the requirements and quantify the accuracy.	K2
	CO2: Make various joints such as cross lap joint and Tee lap joint in the carpentry.	K2
	CO3: Understand the basics of house wiring techniques and the measurements of basic electrical quantities.	K2
	CO4: Understand the resistor value identification through colors coated on resistor.	K2
	CO5: Understand the soldering techniques in PCB board for designing the projects.	K2
Pre - requisites	Nil	

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

COs	Programme Outcomes (POs)												**CO/PSO Mapping** PSOs		
	PO1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO 1	3	2	3	2	2	-	-	-	2	-	-	-	2	3	-
CO 2	3	2	3	2	2	-	-	-	2	-	-	-	2	-	-
CO 3	3	2	2	3	2	2	-	-	2	-	-	-	2	-	-
CO 4	3	2	2	3	2	2	-	-	2	-	-	-	2	3	-
CO 5	3	2	3	3	2	2	-	-	2	-	-	-	2	-	-

Course Assessment Methods

Direct
1. Prelab and post lab test 2. End-Semester examinations
Indirect
1. Course - end survey

Content of the Syllabus

GROUP A **(CIVIL & MECHANICAL ENGINEERING)**	
(CIVIL ENGINEERING PRACTICE)	
1.Plumbing : a) Single Tap G.I / PVC pipe connection involving the fitting like valves, taps & bends. b) Two Tap G.I / PVC pipe connection involving the fitting like valves, taps & bends.	CO2
2.**Carpentry:** a) To make a Cross Lap Joint from the given work piece. b) Preparation of ' T' Lap Joint from the given work piece.	CO2
MECHANICAL ENGINEERING PRACTICE	
3.**Welding:** a) To join the metal plates by a Butt Joint in arc welding machine. b) To join the metal plates by a Lap Joint in arc welding machine.	CO1
4.Basic Machining: a) To perform simple facing & turning operation. b) To perform of step turning operation.	CO1
5.Sheet Metal Work: a) To make a rectangular tray from the given sheet metal. b) To make a basket from the given sheet metal.	CO1
6.Special Laboratory a) Study of 3D Printing machine and its applications. b) Study of CO_2 Laser engraving & cutting machine and its applications. c) Study of Wood routing machine and its applications.	CO1
GROUP B **(ELECTRICAL & ELECTRONICS ENGINEERING)** **ELECTRICAL ENGINEERING PRACTICE**	
1. Residential house wiring and stair case wiring using switches, fuse, indicator & lamp.	CO3
2. LED lamp assembly.	CO3
3. Measurement of voltage, current, power & power factor using R-Load.	CO3
4. Measurement of energy using single phase meter.	CO3
5. Measurement of resistance to earth of electrical equipment.	CO3
6. Measurement of illumination in different lamps	CO3
7. Study of batteries.	CO3
ELECTRONICS ENGINEERING PRACTICE	
1. Study of Electronic components and equipments –Resistor, color coding, Inductor, Capacitor and CRO	CO4
2. Logic gates AND, OR, NOR, NAND and NOT.	CO4
3. Generation of Clock Signal.	CO4
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB	CO5
Total Periods	**45**

Reference Book :

1.	Dr.P.Kannan, Mr.T.Satheeskumar & Mr.K.Rajasekar, "Engineering Practices Laboratory Manual," First Edition, 2017.
2.	Mr.T.Jeyapoovan, Mr.M.Saravana Pandian, "Engineering Practices Lab Manual," Vikas Publishing House Pvt Ltd, 2017.

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Programme	**B.E.**	Programme Code		**106**	Regulation		**2023**	
Department	**BIOMEDICAL ENGINEERING**				Semester		**II**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23MCFY1	**Environmental Science and Engineering**	2	0	0	0	100	0	100

Course Objective	The Main Objective of the course is to: • Familiarize basics of ecosystem and creating environmental awareness. • Congregate about environmental pollution. • Contrast on solid waste and social issues. • Acquire knowledge in environmental legislation and protection. • Summarize population growth, human rights and Environment.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Acquire knowledge about Eco-system, Natural resources and Bio-diversity.	K1
	CO2: Be aware of Environmental Pollution and its control.	K3
	CO3: Infer and express Solid waste management and Social issues	K3
	CO4: Acquire Knowledge about Environmental legislation and protection.	K3
	CO5: Awareness about population growth, human rights and Environment	K2
Pre-requisites	Basic concepts of physics, particularly about Electricity and Magnetism.	

CO / PO Mapping (3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**													**CO/PSO Mapping**		
COs	Programme Outcomes (POs)												PSOs		
	PO1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO 1	1	2	2			2	3					2	2		
CO 2	3	2	2		1	2	3				1	3	3		2
CO 3	3	2	2		1	3	3				1	2	3		2
CO 4	1	1	1			2	3				1	2	2		1
CO 5	1	2	1			2	2				1	3	1		1

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment
Indirect
1.Course - end Survey

Content of the Course			
Unit – I	**Introduction to Environmental Science and Engineering**	Periods	**9**
Nature and scope of environmental education- Natural Resources – (Forest, Water, Food, Energy &Land Resources**)** problems, Ecosystem and Biodiversity- Ecosystem-Structure, Characteristics and functions of ecosystem (in general)- Biodiversity – Definition – Conservation of Biodiversity (in-situ and Ex-situ)- Environmental awareness and sustainable development			
Unit – II	**Water pollution and Waste water treatment process**	Periods	**9**
Water pollution-causes, effects and control measures of water pollution- case study- Waster water 57separator process-Water quality parameters- Hardness, Alkalinity, DO, COD, BOD-Water quality standard- WHO and BIS- Treatment Process- RO, Ion exchange and Zeolite process.			
Unit – III	**Air Pollution and its Control**	Periods	**9**
Air pollutants- causes, effects (Acid rain, greenhouse effect, Ozone layer depletion and global warming)- control measures (Electro static precipitator and cyclone separator).			
Unit – IV	**Radioactive Pollution and Solid waste management**	Periods	**9**
Radioactive pollutants-sources, effects and control measures-nuclear power plant- impacts- case study- solid waste-definition-Types of solid waste- Disposal method and its problem in solid waste management.			
Unit – V	**Human population and the environment**	Periods	**9**
Population growth, Human rights, Value education, environment and Human health, Family welfare Program, role of information technology in environment and Human health			
		Total Periods	**45**
Text Books			
1.	Dr. S. Vairam, “Environment Science and Engineering,” Gems publication. Edition 2018		
2.	Dr.S.Mageswari, Dr.G.Vijayakumar, Ms.A.Preethi, Environmental Science and Engineering, RK Publications, Revised Edition 2022.		
References			
1.	Linda Williams- “Environmental Science,” First Edition, Tata McGraw Hill Edition, 2008.		
2.	T. G. Miller Jr, “Environmental Science,” Tenth Edition, Wadsworth publishing Co, 2004		
3.	William P. Cunningham, Barbara Woodworth Saigo, Fourth Edition, Tata McGraw Hill, 2011.		
4.	NPTEL Course Notes		
5.	Cunnighum and cooper, “Environmental Science,”Jaico Publ, House Edition-4-2007		
E-Resources			
1.	https://libraries.ou.edu/		
2.	https://libguides.reading.ac.uk/		
3.	https://www.loc.gov/, https://libguides.reading.ac.uk/		

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