Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus for

Bachelor of Technology (Computer Science & Engineering)

Submitted by

Board of Studies in CSE/CT/IT/CE

Vision

To create globally competent engineers in Computer Science & Engineering and interdisciplinary areas that extend the scope of Computer Science Engineering to benefit humanity.

Mission

- To prepare students to excel in Computer Science and Engineering through quality education and enable them to succeed in computing and allied areas.
- To nurture the individual to become leaders and innovators in industry and other allied areas and enhance their entrepreneurship skills.
- To imbibe holistic education to promote ethics, lifelong learning and contribute to the social well-being.

Program Educational Objectives

After completion of graduation in Computer Science & Engineering, students will be able to

- Analyze problems and develop optimized hardware and software solutions for society.
- Have the knowledge of fundamental engineering theory and able to innovate.
- Continue to learn and to adapt technology developments combined with deep awareness of ethical responsibilities in profession.

Program Specific Outcomes

- Pertain current knowledge and adapting to emerging applications of Mathematics, Science and Engineering fundamentals in the field of Computer Science and Engineering.
- Exhibit proficiency through latest technologies to business and personal situations in demonstrating the ability for work efficacy as a part of team and apply professional behavior and ethics.
- Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems

Program Outcomes

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate and analyze hardware and software engineering problems and arrive at substantiated conclusions using first principles of mathematics, natural and engineering sciences.

PO3. Design/Development of solutions: Design and develop hardware / software system to meet desired needs within realistic constraints related to economic, environmental, social, political, ethical, health and safety, verifiability, and sustainability concerns.

PO4. Conduct investigations of complex problems: Use research based knowledge including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Use techniques, skills, and modern computer engineering tools, including simulation and modeling, for addressing the needs of engineering profession and interdisciplinary business.

PO6. The engineer and society: Understand the computing needs of inter-disciplinary scientific and engineering disciplines and design and develop algorithms and techniques for societal, health, safety, legal and cultural problems.

PO7. 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.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function as member or leader of team and to understand engineering management principles & finance to manage projects in multidisciplinary environment.

PO10. Communications: Effectively transfer technology to engineering community and society at large on broadly defined engineering needs through technical reports, presentations and software technologies.

PO11. Project management and finance:
Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

PO12. Life-long learning: Engage in lifelong learning and adapt to rapid changes in computer science & allied areas.

ANNEXURE I

CREDIT FRAMEWORK STRUCTURE

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course	BSC/ESC	3 * 2 = 6	4 * 2 = 8	--	--	--	--	--	--	14
Engineering Science Course		4 * 2 = 8	04	--	--	--	--	--	--	12
Program Core Course (PCC)	Program Courses	--	02	4 * 2 = 8	4 * 2 = 8	4 * 2 + 2 = 10	4 * 2 = 8	0	4+4=8	44
Program Elective Course (PEC)		--	--	--	--	04	4 * 2 = 8	02	3 * 2 = 6	20
Multidisciplinary Minor (MDM)	Multidisciplinary Courses	--	--	02	02	04	02	02	02	14
Open Elective (OE) Other than a particular program		--	--	04	02	02	--	--	--	08
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	02	02	--	02	--	02	--	--	08
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	02	--	--	02	--	--	--	--	04
Entrepreneurship/Economics/ Management Courses		--	--	02	02	--	--	--	--	04
Indian Knowledge System (IKS)		--	02	--	--	--	--	--	--	02
Value Education Course (VEC)		--	--	02	02	--	--	--	--	04
Research Methodology	Experiential Learning Courses	--	--	--	--	--	--	04	--	04
Comm. Engg. Project (CEP)/Field Project (FP)		--	--	02	--	--	--	--	--	02
Project		--	--	--	--	--	--	--	04	04
Internship/ OJT		--	--	--	--	--	--	12	--	12
Co-curricular Courses (CC)	Liberal Learning Courses	02	02	--	--	--	--	--	--	04
Total Credits (Major)		20	20	20	20	20	20	20	20	160

ANNEXURE II

B.Tech. Sem-I

(Computer Science & Engineering/ Information Technology/ Computer Technology/Computer Engineering)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							BOS
				(Th)	TU	P		Theory				Practical			
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	
1	BSC-I	Essentials of Chemistry	BCS1T01	2	-	-	2	3	70	30	45	-	-	-	AS&H
2	BSC-I	Essentials of Chemistry Lab	BCS1P01	-	-	2	1	-	-	-	-	25	25	25	AS &H
3	BSC-II	Applied Algebra	BCS1T02	3	-	-	3	3	70	30	45	-	-	-	AS&H
4.	ESC-I	Problem Solving using ‘C’	BCS1T03	3	-	-	3	3	70	30	45	-	-	-	CS
5.	ESC-I	Problem Solving using ‘C’	BCS1P03	-	-	2	1	-	-	-	-	25	25	25	CS
6.	ESC-II	Basics of Electronics Engineering	BCS1T04	3	-	-	3	3	70	30	45	-	-	-	ETC
7.	ESC-II	Basics of Electronics Engineering	BCS1P04	-	-	2	1	-	-	-	-	-	50	25	ETC
8.	VSC-I	Web Design Technology	BVS1P01	-	-	4	2	-	-	-	-	50	50	50	CS
9.	AEC-I	Communication Skills	BAE1T01	1	-	-	1	3	35	15	23	-	-	-	AS&H
10	AEC-I	Communication Skills Lab	BAE1P01	-	-	2	1	-	-	-	-	25	25	25	AS&H
11	CC-I	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50	
Total				**12**	-	**16**	**20**	**15**	**315**	**135**		**125**	**275**		

B.Tech. Sem-II

(Computer Science & Engineering/ Information Technology/ Computer Technology/Computer Engineering)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
				(Th)	TU	P		Theory				Practical			
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	BOS
1	BSC -III	Mathematical foundation of Computer Science	BCS2T05	3	-	-	3	3	70	30	45	-	-	-	AS&H
2	BSC -III	Mathematical foundation of Computer Science using Python	BCS2P05	-	-	2	1	-	-	-	-	25	25	25	AS &H
3	BSC -IV	Essentials of Physics	BCS2T06	3	-	-	3	3	70	30	45	-	-	-	AS&H
4	BSC -IV	Essentials of Physics Lab	BCS2P06	-	-	2	1	-	-	-	-	-	50	25	AS &H
5	ESC -III	Python Programming	BCS2T07	3	-	-	3	3	70	30	45	-	-	-	CS
6	ESC -III	Python Programming Lab	BCS2P07	-	-	2	1	-	-	-	-	25	25	25	CS
7	PCC -I	Computer Architecture and Organization	BCS2T08	2	-	-	2	3	70	30	45	-	-	-	CS
8	SEC -I	Refer SEC Basket	BSE2P01	-	-	4	2	-	-	-	-	50	50	50	CS
9	IKS	Refer to IKS Basket	BIK2T01	2	-	-	2	3	70	30	45	-	-	-	AS&H
10	CC-II	Refer to CC Basket	BCC2P01	-	-	4	2	-	-	-	-	-	100	50	AS &H
Total				**13**	**-**	**14**	**20**		**350**	**150**		**100**	**250**	**175**	

Exit option: Award of UG Certificate in Major with 40 credits and an additional 8 credits in skill-based courses, internship, mini projects etc.

Indian Knowledge System (IKS) Basket

(Offered by Applied Science & Humanities Board)

S N	Semester	Course Code	Name of Subject
1	2nd Semester	BIK2T01A	Consciousness Studies
2		BIK2T01B	Preserving Art, Culture and Tradition
3		BIK2T01C	Wellness, traditional medicines and yoga
4		BIK2T01D	Glimpses of ancient Science and Technology

B.Tech. Sem-III (Computer Science and Engineering- Major)

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
								Theory				Practical			BOS
				Th	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	CS
1	PCC-II	Data Structure and Algorithms	BCS3T09	3	-	-	3	3	70	30	45	-	-	-	CS
2	PCC-II	Data Structure and Algorithms Lab	BCS3P09	-	-	2	1	-	-	-	-	25	25	25	CS
3	PCC-III	Object Oriented Programming using Java	BCS3T10	3	-	-	3	3	70	30	45	-	-	-	CS
4	PCC-III	Object Oriented Programming using Java Lab.	BCS3P10	-	-	2	1	-	-	-	-	25	25	25	CS
5	MDM-I	Probability Theory and Statistics	BMD3T11	2	-	-	2	3	70	30	45	-	-	-	AS&H
6	OE-I	Refer Open Elective –I Basket	BOE3T01	3	-	-	3	3	70	30	45	-	-	-	
7	OE-I	Refer Open Elective-I Basket	BOE3P01	-	-	2	1	-	-	-	-	-	50	25	
8	HSSM-I	Entrepreneurship in Computer Science	BHM3T01	2	-	-	2	3	70	30	45	-	-	-	CS
9	VEC-I	Constitution of India	BVE3T01	2	-	-	2	3	70	30	45	-	-	-	AS&H
10	CEP	Community Engagement Project	BCE3P01	-	-	4	2	-	-	-	-	-	100	50	AS&H
Total				15	-	10	20		420	180		50	200		

B.Tech. Sem-IV (Computer Science and Engineering-Major)

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
								Theory				Practical			
				Th	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	BOS
1	PCC-IV	Operating System	BCSE4T12	3	-	-	3	3	70	30	45	-	-	-	CS
2	PCC-IV	Operating System Lab	BCSE4P12	-	-	2	1	-	-	-	-	25	25	25	CS
3	PCC-V	Artificial Intelligence	BCSE4T13	3	-	-	3	3	70	30	45	-	-	-	CS
4	PCC-V	Artificial Intelligence Lab	BCSE4P13	-	-	2	1	-	-	-	-	25	25	25	CS
5	MDM-II	Quantum Computing	BMD4T14	2	-	-	2	3	70	30	45	-	-	-	CS
6	OE-II	Refer Open Elective-II Basket	BOE4T02	2	-	-	2	3	70	30	45	-	-	-	
7	VSC-II	Hardware and Networking	BVE4P02	-	-	4	2	-	-	-	-	50	50	50	CS
8	AEC-II	Technical Report Writing	BAE4T02	2	-	-	2	3	70	30	45	-	-	-	AS&H
9	HSSM-II	Universal Human Values	BHM4T02	2	-	-	2	3	70	30	45	-	-	-	Civil
10	VEC-II	Environmental Science	BVE4T02	2	-	-	2	3	70	30	45	-	-	-	AS&H
			Total	16	-	08	20		490	210		100	100		

Exit option; Award of UG Diploma in Major and Minor with 80 credits and an additional 8 credits as per exit basket

B.Tech. Sem-V (Computer Science and Engineering-Major)

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
								Theory				Practical			
				Th	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	BOS
1	PCC-VI	Database management System	BCS5T15	3	-	-	3	3	70	30	45	-	-	-	CS
2	PCC-VI	Database management System Lab	BCS5P15	-	-	2	1	-	-	-	-	25	25	25	CS
3	PCC-VII	Computer Network	BCS5T16	3	-	-	3	3	70	30	45	-	-	-	CS
4	PCC-VII	Computer Network Lab	BCS5P16	-	-	2	1	-	-	-	-	25	25	25	CS
5	PCC-VIII	Theory of Computation	BCS5T17	2	-	-	2	3	70	30	45	-	-	-	CS
6	PEC-I	Elective – I (Refer Elective Basket)	BCS5T18	3	-	-	3	3	70	30	45	-	-	-	CS
7	PEC-I	Elective – I	BCS5P18	-	-	2	1	-	-	-	-	-	50	25	CS
8	MDM-III	UI/UX Design	BMD5T19	3	-	-	3	3	70	30	45	-	-	-	CS
9	MDM-III	UI/UX Design	BMD5T19	-	-	2	1	-	-	-	-	-	50	25	CS
10	OE-III	Refer Open Elective Basket	BOE5T03	2	-	-	2	3	70	30	45	-	-	-	
Total				16	-	08	20		420	180		50	150		

B.Tech. Sem-VI (Computer Science and Engineering-Major)

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
								Theory				Practical			
				Th	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	BOS
1	PCC-IX	Software Engineering & Testing	BCS 6T20	3	-	-	3	3	70	30	45	-	-	-	CS
2	PCC-X	Design and Analysis of Algorithm	BCS 6T21	2	-	-	2	3	70	30	45	-	-	-	CS
3	PCC-X	Design and Analysis of Algorithm Lab	BCS 6P21	-	-	2	1	-	-	-	-	25	25	25	CS
4	PCC-XI	Compiler Design	BCS 6T22	3	-	-	3	3	70	30	45	-	-	-	CS
5	PEC-II	Elective – II (Refer Basket for Elective)	BCS 6T23	3	-	-	3	3	70	30	45	-	-	-	CS
6	PEC-II	Elective – II	BCS 6P23	-	-	2	1	-	-	-	-	-	50	25	CS
7	PEC-III	Elective – III (Refer Basket for Elective)	BCS 6T24	3	-	-	3	3	70	30	45	-	-	-	CS
8	MDM-IV	Digital Forensics	BMD 6T25	2	-	-	2	3	70	30	45	-	-	-	CS
9	SEC-II	Refer SEC Basket	BSE6 P02	-	-	4	2	-	-	-	-	50	50	50	CS

Total	16	-	8	20		420	180		75	125		

**** Exit option: Award of UG Degree B. Voc./B.Sc.in Major with 120 credits and an additional 8 credits in skill-based courses, internship, mini projects etc.**

B.Tech. Sem-VII (Computer Science and Engineering-Major)

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
								Theory				Practical			
				Th	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	BOS
1	PEC-IV	Elective – IV# (Refer Basket for Elective)	BCS7T26	2	-	-	2	3	70	30	45	-	-	-	CS
2	MDM-V	Robotics & Automation#	BMD7T27	2	-	-	2	3	70	30	45	-	-	-	CS
3	OJT	Internship	BOJ7P01	-	-	24	12	-	-	-	-	200	200	200	CS
4	RM	Research Methodology#	BCS8T28	3	-	-	3	3	70	30	45	-	-	-	CS
5	RM	Research Methodology#	BCS8P28	-	-	2	1	3	-	-	-	-	50	25	CS
			Total	7	-	26	20		210	90		200	250		

 # Indicates that Online Courses to be done from NPTEL. Examination will be conducted by NPTEL/ RTMNU.

B.Tech. Sem-VIII (Computer Science and Engineering- Major)

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme							
								Theory				Practical			
				Th	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.	BOS
1	PCC-XII	Data warehousing and Mining	BCS8T29	3	-	-	3	3	70	30	45	-	-	-	CS
2	PCC-XII	Data warehousing and Mining Lab	BCS8P29	-	-	2	1	-	-	-	-	25	25	25	CS
3	PCC-XIII	Data Analytics	BCS8T30	3	-	-	3	3	70	30	45	-	-	-	CS
4	PCC-XIII	Data Analytics	BCS8P30	-	-	2	1	-	-	-	-	25	25	25	CS
5	PEC-V	Elective – V (Refer Basket for Elective)	BCS8T31	3	-	-	3	3	70	30	45	-	-	-	CS
6	PEC-VI	Elective – VI (Refer Basket for Elective)	BCS8T31	3	-	-	3	3	70	30	45	-	-	-	CS
7	MDM-VI	Operational Research	BMD8T32	2	-	-	2	3	70	30	45	-	-	-	CS
8	Project	Project	BPR8P01	-	-	8	4	-	-	-	-	100	100	100	CS
Total				14	-	12	20		350	150		150	150		

4-Years Bachelor's degree (B.Tech.) in Engg./Tech. with Multidisciplinary Minor

Program Electives

	PEC-1	PEC-2	PEC-3	PEC-4	PEC-5	PEC-6
System Software/ Hardware	Cloud Computing PCAP: Parallel Computer Architecture and Programming	POSIX programming	SA: System Administration GPU Computing	MT: Multicore Technology ADBMS: Advanced Database Management Systems	DS: Distributed Systems	S&V: Storage and Virtualization
Networking and Security	CS: Cyber Security	IOT: Internet of Things	BCT: BlockChain Technologies GIS	MAN: Mobile and Ad-hoc Networks	CL: Cyber Law	CFLP: Computer Forensics and Data Recovery
Artificial Intelligence	ML: Machine Learning	Data Visualization Techniques	Generative AI	NLP: Natural Language Processing	DL: Deep Learning	Reinforcement Learning
Algorithms and Programming	ADS: Advanced Data Structures	FP: Functional Programming	OOMD: Object Oriented Modeling and Design	Parallel Algorithms	G&M: Graphics and Multimedia	Social Networks

B. Tech. (Computer Science & Engineering/ Computer Engineering/ Information Technology/ Computer Technology)

Essentials of Chemistry (TH+P)	
Total Credits: 02 T + 01 P	**Subject Code: BCS1T01**
Teaching Scheme:	**Examination Scheme:**
Lectures: 2 Hours/Week	**Duration of University Exam: 03 Hrs.**
Tutorials: 0 Hours/Week	**College Assessment: 30 Marks**
Practical: 02 Hours/Week	**University Assessment:70 Marks**

Course Objectives	
1	To introduce ideas of electrochemistry necessary to understand the function of batteries.
2	To gain an understanding of the rare earth metals and waste handling generated out of their uses.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Students will be able to utilize the basics concepts of battery technology & energy storage devices.
2	Students will learn about rare earth elements, the correct disposal methods of e-wastes and while creating any tool they will keep this environmental aspect in mind.
3	They will know the role of nanomaterials and their applications.
4	Students will inculcate the use of instrumentation techniques and interpret its applications in material characterization.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1: Battery Technology			
Electrochemical & Galvanic Series, Electrochemical & Electrolytic cells Battery: Introduction, types-primary, secondary and reserve, Lithium-cobalt oxide and metal air batteries - characteristics, components/materials, working and applications. Super capacitors: Introduction, types (EDLC, pseudo and asymmetric capacitor) with examples and applications. Energy conversion devices: Introduction, characteristics, materials, working and applications of H2-O2 fuel cells, amorphous Si and quantum dye sensitized solar cells.	6		1
UNIT 2: Rare earth elements and E-wastes management			
Rare earth elements: Properties, applications in electronics. Lanthanide contraction.Types of E-wastes, environmental and health risks, segregation and recycling (Hydrometallurgical, pyrometallurgical and direct recycling), Extraction of rare earth and precious metals from e-wastes, Twelve principles of Green Chemistry. Green Computing, Role of Green Computing in Environment and Research, Green devices and Green data Servers.	6		2
UNIT 3: Nonmaterial's			
Introduction, classification, size dependent properties, surface area, optical and catalytic properties,Synthesis methods of nanomaterials-Top down and bottom-up approach. Carbon nanomaterials: Types, properties and applications of CNT and graphene. Applications of	6		3

nano materials.			
UNIT 4: Material Characterization Techniques			
Principles and applications of – Electronic Spectroscopy (Beer-Lambert's law and its numerical), Infra-Red spectroscopy and Nuclear Magnetic Resonance spectroscopy. Thermal analysis (Thermogravimetry, Differential Thermal Analysis, Differential Scanning Calorimetry), Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy, Brunauer-Emmett-Teller (BET) surface area analysis, X-ray Diffraction Analysis, particle size analyser (Dynamic Light Scattering), High Performance Liquid Chromatography and Gas Chromatography	6		4

References :

1. M AfsharAlam, Sapna Jain, HenaParveen, Green Computing Approach Towards Sustainable

Development, Wiley Interscience Publications.

2. S. S. Dara, A Textbook of Engineering Chemistry, S. Chand Publications
3. ShikhaAgrawal, Engineering Chemistry: Fundamentals and Applications, Cambridge University Press.
4. Supercapacitors and Their Applications Fundamentals, Current Trends, and Future Perspectives, Edited By Anjali Paravannoor, Baiju K.V, CRC Press
5. The Rare Earth Elements: An Introduction, JHL Voncken, Springer Link

Essentials of Chemistry Lab			
Course Code:	**BCS1P01**	**Credits:**	**01**
Teaching Hours / Week	**02 P**	**SEE**	**25 M**
Total number of teaching hours	**24**	**Course Category**	**BSC**
BoS	**AS&H**		

Credits: 01 **Marks: 50**

List of Practical (Any 6-performance based and 1 virtual lab experiment)

1. Estimation of Copper estimation (iodometrically)
2. Estimation of Ni by complexometry / gravimetry.
3. Fe(II)/ (III) estimation by redox titration.
4. Beer's Law verification by spectrophotometer.
5. Separation of copper nickel ions by paper chromatography.
6. Redox titration by potentiometry
7. Acid base titration by potentiometry
8. Acid base titration by conductometry
9. Virtual Lab: Experiment on Chromatography
10. Virtual Lab: Experiment on Spectroscopy

Applied Algebra	
Total Credits: 03T	**Subject Code : BCS1T02**
Teaching Scheme :	**Examination Scheme :**
Lectures: 2 Hours/Week	**Duration of University Exam : 03 Hrs.**
Tutorials: 0 Hours/Week	**College Assessment: 30 Marks**
Practical: 02 Hours/Week	**University Assessment:70 Marks**

Course Objectives	
1	The aim of this course is to acquaint aspiring engineers with methods in differential, integral, and linear algebra.
2	It seeks to provide students with common concepts and resources that will enable them to manage mathematics and its applications with ease and become proficient in their field.

Course Outcomes	
After completion of syllabus, students would be able to	
1	To apply knowledge of matrices and linear algebra in a comprehensive manner
2	To exhibit knowledge of the fundamental concepts of linear algebra, such as inner product space, bases and dimensions, vector space, subspace, linear transformations, and inner product space.
3	To solve engineering problem by using knowledge of differentiation.
4	To analyze length, area, volume using knowledge of curve tracing.
5	To evaluate series and sequences based on their convergence and type.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT I :Linear Algebra I			
Linear dependence of vectors, Eigen values and Eigen vectors, Reduction to diagonal form, Largest Eigen value and its corresponding Eigen vector by iteration method, Gaussian elimination, LU Decomposition (Crout's method).	7		1
UNIT II : Linear Algebra II			
Vector Space; Subspaces; Basis; Dimension; Linear transformation; Range Space and Rank; Null Space and Nullity; Rank nullity theorem, Matrix Representation of a linear transformation; **Inner Product Spaces**: Norm; Orthonormal Sets, Positive definite matrices, Singular Value Decomposition, Gram-Schmidt process.	7		2
UNIT III : Differential Calculus			
Successive differentiation: Leibnitz's Rule, Taylor's and Maclaurin's series for function of one variable, Indeterminate forms and L'Hospital's Rule, Maxima and Minima for function of one variable, continuity of functions; differentiability, Rolle's theorem, Mean value theorem.	7		3
UNIT IV : Integral Calculus			
Beta and Gamma functions and their properties. Curve Tracing: Tracing of curves (Cartesian), Applications of definite integrals to find length of the curve, area, volume & surface area of revolution.	8		4
UNIT V :Sequence and Series Sequence, types of sequence, test of convergence of sequences, Cauchy sequence, infinite series, power series, Alternating series, tests of convergence and absolute convergence of series.	7		5

References:

1. Hoffman and Kunze: Linear Algebra, Prentice Hal of India, New Delhi.
2. H. K. Dass, Advanced Engineering Mathematics, S. Chand, Reprint, 2014.
3. Murray Spiegel, John Schiller, R. A. Srinivasan, Probability and Statistics, Schaum's
4. Outline Series, McGraw Hills, 4th Edition, 2016.

Reference books:

1. GilbertStrang: Linear Algebra And Its Applications (Paperback), Nelson Engineering (2007)
2. ErwinKreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Problem Solving using 'C'	
Total Credits: 03 T	**Subject Code : BCS1T03**
Teaching Scheme :	**Examination Scheme:**
Lectures: 3 Hours/Week	**Duration of University Exam : 03 Hrs.**
Tutorials: 0 Hours/Week	**College Assessment: 30 Marks**
Practical: 02 Hours/Week	**University Assessment:70 Marks**

Course Objectives	
1	Design solutions to simple engineering problem by applying the basic programming principles of C language and basic mathematical knowledge.
2	Develop simple C programs to illustrate the applications of different data types such as arrays, pointers, functions.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Illustrate and explain the basic computer concepts and programming principles of C language.
2	Develop C programs to solve simple mathematical and decision making problems.
3	Develop C programs to solve simple engineering problems using looping constructs.
4	Develop C programs to demonstrate the applications of derived data types such as arrays, pointers, strings and functions.
5	Use and create functions for modular programming

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT I :			
UNIT I : **Introduction to Programming: Importance of C, Basic Structure of C Programs, Programming Style, Executing a C Program.** **Constants, Variables, and Data Types: Introduction ,Character Set ,C Tokens, Keyword sand Identifiers ,Constants, Variables, Data Types ,Declaration of Variables, Assigning Values to Variables, Defining Symbolic Constants** **Managing Input and Output Operations: Reading a Character, Writing a Character, Formatted Input, Formatted Output.** **Operators and Expressions: Introduction, Arithmetic Operators, Relational Operators ,Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators, Special Operators, Arithmetic Expressions ,Evaluation of Expressions, Precedence of Arithmetic Operators, Type Conversions in Expressions, Operator Precedence and Associativity.**	7		1
UNIT II :			
Decision Making and Branching: Introduction, Decision Making with IF Statement, Simple IF Statement, the IF.....ELSE Statement, Nesting of IF....ELSE Statements, The ELSE IF Ladder, The Switch statement. Decision Making and Looping: The WHILE Statement, The DO Statement, the FOR Statement, Jumps in LOOPS.	7		2

UNIT III :			
Arrays: **One-dimensional Arrays**, Declaration of One-dimensional Arrays, Initialization of One-dimensional Arrays, Example programs- Linear search, Binary search, Bubble sort, Selection sort. **Two-dimensional Arrays**, Declaration of Two-dimensional Arrays, Initialization of Two- dimensional Arrays, Example programs – Matrix Multiplication, Transpose of a matrix.	7		3
UNIT IV :			
Character Arrays and Strings : Declaring and Initializing String Variables, Reading Strings from Terminal ,Writing Strings to Screen ,Arithmetic Operations on Characters, String-handling Functions (strlen(), strcpy(), strcmp(), strcat(), strrev()), Example Programs(with and without using built-in string functions), Two-dimensional character arrays. **Pointers : Introduction,DeclaringPointerVariables,InitializationofPointervariables,accessing a Variable through its Pointer, Pointer Expressions, Pointer Increments and ScaleFactor,Pointers and1-D Arrays.**	8		4
UNIT V :	7		5
User-defined Functions: Elements of User-defined Functions, Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions, No Arguments and no Return Values, Arguments but no Return values, Arguments with Return Values, No Arguments but Returns a Value, Passing Arrays to Functions. Recursion - Factorial of an integer, Xn, Finding nth Fibonacci numbers.			

Reference Books :

1.	E.Balagurusamy	ProgramminginANSIC,5th Edition,Tata McGraw-Hill Publications
2.	PB Kottur	ComputerConceptsand CProgramming
3.	KerninghamDennis Ritchie	TheCprogramminglanguage(ANSI Cversion),2nd Edition, PHIIndia
4.	Jeri R HanlyElliotBKoffman	Problem solving and program design in CPersonAddison Wesley2006
5	YashwantKanetkar	LetusC,6th Edition, BPBpublication

URL:

1. **https://www.w3schools.com/c/**
2. **https://www.tutorialspoint.com/cprogramming/index.htm**
3. **https://www.geeksforgeeks.org/c-programming-language/**

Problem Solving using 'C'	
Total Credits: 01	**Subject Code : BCS1P03**
Teaching Scheme :	**Examination Scheme :**
Lectures: 2 Hours/Week	**Duration of University Exam : 03 Hrs.**
Tutorials: 0 Hours/Week	**College Assessment: 25 Marks**
Practical: 02 Hours/Week	**University Assessment:25 Marks**

Course objectives:

1. Understand the basic principles of C programming language.
2. Develop C programming skills.
3. Develop debugging skills using CodeBlocks IDE.

Course outcomes:

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

CO1: Develop,Debug and Execute programs to demonstrate decision making and looping constructs in.

CO2: Develop, Debug and Execute programs to demonstrate the applications of arrays in C.

CO3: Develop, Debug and Execute programs to demonstrate the applications of functions in C.

CO4: Develop, Debug and Execute programs to demonstrate the basic concepts of pointers in C.

Conduction:

The laboratory programs should be executed on CodeBlocks IDE using GCC Compiler.(Select any 10 Experiments)

Course Objectives	
1	
2	

Course Outcomes	
After completion of syllabus, students would be able to	
1	
2	
3	
4	
5	

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT I :			
	7		1
UNIT II :			
.	7		2
UNIT III :			
	7		3
UNIT IV :			
	8		4
UNIT V :	7		5

Laboratory Programs:

1. Develop a C Program to find the roots of quadratic equation for non-zero co- efficient using if-else
2. ladder construct.
3. Develop a C Program to conduct Binary search for a key element over an array of n
4. integer elements. Report success or failure with appropriate messages.
5. Develop a C Program to implement a simple calculator to perform addition, subtraction,
6. multiplication and division operations using switch construct. Display appropriate messages for
7. invalid operator and divide by zero error.
8. Develop a C program to read n elements into an integer array and sort the array using Bubble sort
9. technique. Print the input array and the resultant array with suitable messages.
10. Develop a C Program to generate the Prime numbers between the ranges m & n
11. using nested for loop construct. Also, print the number of prime numbers generated.
12. Develop a recursive C function to find the factorial of a number, n! , defined by fact(n)=1, if n=0.
13. Otherwise fact(n)=n*fact(n-1). Using this function, develop a C program to compute the Binomial
14. coefficient nCr. Perform input validation as well.
15. Develop a C Program to find the GCD & LCM of two integers using Euclid's algorithm.
16. Develop a C program to find the smallest and largest elements in an array using pointers and then
17. swap these elements and display the resultant array.
18. Develop a C program to find the Sine of an angle for the given n terms using the series Sin(x) = x –
19. x3 /3! + x5 /5! n terms.
20. Develop a C program to read two matrices A (m x n) and B (p x q) and compute the product of the
21. two matrices. Print both the input matrices and resultant matrix with suitable headings and output
22. should be in matrix format only. Program must check the compatibility of orders of the matrices
23. for multiplication. Report appropriate message in case of incompatibility.
    . Develop a C program to find the sum of all the elements of an integer array using pointers.
24. . Develop a C program to accept a matrix of order m x n. Implement the following functions:

i) Find the sum of each row
ii) Find the sum of each column
iii) The sum should be printed in main function only.

25. Develop a C program to count the vowels & consonants in a given string.
26. Develop a C program to perform the following operations using functions:
27. Read n elements into an array

i) ii) Print the contents of an array

28. Sort an array of n elements using Selection sort technique

Basics of Electronics Engineering	
Total Credits: 03 T	Subject Code : BCS1T04
Teaching Scheme :	Examination Scheme :
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 30 Marks
Practical: 02 Hours/Week	University Assessment:70 Marks

Course Objectives	
1	To make students understand about Semiconductor devices & its applications,Digital gates, flip-flops, counter and design of simple digital circuit, Microcontroller & its applications.
2	Introduce embedded system and IoT, Analog , digital communication and wireless communication

Course Outcomes	
After completion of syllabus, students would be able to	
1	Explain the working of semiconductor devices
2	Select best circuit for the given specifications/application.
3	Analyse, design and implement Combinational and Sequential Circuits.
4	Select sensors for specific applications. To design and implement Microcontroller based systems.
5	To understand the fundamental concepts of electronic communication and their use in computer applications.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT I : Introduction to Electronic components and Analog Electronics			
Importance of Electronics in Computer Science and engineering, voltage, Current, and Resistance, Passive Components (Resistors, Capacitors, Inductors), Active Components (Diodes, Transistors), Operational Amplifiers (Op-Amps), Amplifiers and Oscillators. Simple op-amp applications	7		1
UNIT II : Digital Logic and Circuits			
. Binary Number System, Logic Gates (AND, OR, NOT, XOR), Combinational Circuits, Sequential Circuits, Flip-Flops (RS and J-K) and Registers, truth table, Half Adder and Full Adder, Multiplexer and decoder, Shift registers, Building Simple Digital Circuits (Basic synchronous counter design)	7		2
UNIT III : Introduction to Microcontrollers			
Introduction to Microcontrollers, Arduino Platform, Interfacing Electronics with Microcontrollers, Analog-to-Digital and Digital-to-Analog Conversion, Types of Sensors (Temperature, Light, Proximity, etc.)	7		3
UNIT IV : Introduction to Embedded system and IoT			
Introduction to embedded system and types, Sensor Interfacing, Actuators (Motors, LEDs, Relays), Practical Applications, Building Simple microcontroller and Embedded Systems, Introduction to IoT system and its architecture, Design of simple IoT system	8		4

UNIT V : Introduction to Communication Systems			
Introduction to Communication Systems, Analog and Digital Communication, Serial and Parallel Communication, Wireless Communication, Wireless Network Topologies, Networking Basics, Building Simple Communication Systems, Cellular Wireless Networks - Introduction, Cellular system, cellular concept and frequency reuse. Wireless Network Topologies – Fourth Generation (4G) Technology and introduction to 5G , CDMA Technology, Wireless LAN, Introduction to Bluetooth technology	7		5

References:

1. S. Salivahanan, N. Suresh Kumar,"Electronic Devices and Circuits", Tata McGraw Hill.
2. A Textbook of Applied Electronics, R S Sedha, S Chand and company
3. The 8051 Microcontrollers & Embedded System, Mazidi, Pearson publications
4. Text Books: 1. "Electronics Devices" by Thomas. L. Floyd, 9th Edition, Pearson (Unit I, II)
5. "Modern Digital Electronics" by R.P. Jain, 4th Edition, Tata McGraw Hill (Unit III)
6. "Sensors and Transducers" by D. Patrnabis, 2nd Edition, PHI (Unit V)
7. Electronic Communication Systems" by Kennedy & Davis, 4th Edition, Tata McGraw Hill (Unit VI
8. "Mobile Wireless communication" by M. Schwartz, Cambridge University Press (Unit VI)

Basics of Electronics Engineering	
Total Credits: 01	Subject Code : BCS1P04
Teaching Scheme :	Examination Scheme :
Lectures0 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 50 Marks
Practical: 02 Hours/Week	University Assessment:---

Practical based on above syllabus

Web Design Technology (P)	
Total Credits: 02 P	Subject Code : BVS1P01
Teaching Scheme :	Examination Scheme :
Lectures: 0 Hours/Week	Duration of University Exam :
Tutorials: 0 Hours/Week	College Assessment: 50 Marks
Practical: 04 Hours/Week	University Assessment:50 Marks

Course Objectives	
1	Students will learn how to create visually appealing and user-friendly websites using a combination of HTML, CSS, and other web technologies.
2	Topics include web development tools, responsive design, accessibility, and best practices for creating modern websites.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Understand the fundamentals of Internet, and the principles of web design.
2	Construct basic websites using HTML and Cascading Style Sheets.
3	Build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.
4	Develop modern interactive web applications and deploy.

Course Outcomes: After Completing this course students will be able to

1. **HTML (Hypertext Markup Language)**

- Basic HTML Structure
- Text Formatting and Semantic Elements
- Lists and Links
- Forms and Input Elements

2. **: CSS (Cascading Style Sheets)**

- Introduction to CSS
- Selectors and Properties
- Layout and Positioning
- CSS Box Model

3. **: Responsive Web Design**

- Media Queries
- Fluid Layouts
- Flexbox and Grid Layout
- Mobile-First Design

4 : Web Typography

- Font Families and Styles
- Web Fonts and Icons
- Typography Best Practices

5 : Images and Multimedia

- Image Formats and Optimization
- Working with Images in HTML and CSS
- Embedding Audio and Video

6 : Web Accessibility

- Accessibility Principles and Guidelines
- ARIA Roles and Attributes
- Testing for Accessibility
- Designing for All Users

7 : Web Development Tools

- Text Editors and Integrated Development Environments (IDEs)
- Version Control with Git and GitHub
- Browser Developer Tools
- Debugging and Testing

8 : Advanced Topics

- CSS Preprocessors (e.g., Sass)
- JavaScript Basics
- Introduction to Content Management Systems (CMS)
- Web Hosting and Deployment

Reference Books :

1. HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, DT Editoral, Dreamtech press
2. MASTERING HTML, CSS & Java Script Web Publishing, Laura Lemay (Author), Rafe Colburn (Author), Jennifer Kyrnin (Author), BPB Publication

URL:

1. **https://www.flux-academy.com/free-resources**
2. **https://wordpress.com/website-builder/**

Communication Skills(T)	
Total Credits: 01 T	Subject Code : BAE1T01
Teaching Scheme :	Examination Scheme :
Lectures: 1 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 15 Marks
Practical: 0 Hours/Week	University Assessment:35 Marks

Course Objectives	
1	Basic knowledge of Communication Skills
2	Students would be able to enhance their communication skills.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Construct grammatically correct sentences.
2	Identify and overcome barriers of communication
3	Demonstrate good Listening and speaking skills.
4	Develop effective reading and writing skills.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT I :			
Grammar: Tenses and its types, sentences and its Types, Transformation of Sentences (Assertive, Affirmative, Negative, Interrogative, Exclamatory) Reported speech	4		1
UNIT II :			
Introduction to Communication, Importance of communication Types of communication -Verbal and non-verbal Communications: - Kinesics, Vocalics, Chronemics, Haptics, Proxemics), Barriers to communication and methods to overcome them.	3		2
UNIT III :			
Introduction to LSRW Skills-, Listening Skills: Importance of listening, Types of listening,listening barriers and methods to overcome, Speaking Skills: Components of public speaking,Essential steps for public speaking, Overcoming stage fear in public speaking, Do's, and Don'ts of Public speaking	4		3
UNIT IV :			
Reading Skills: Importance of reading skills, Types of reading, comprehending passages,Writing Skills: Importance of effective writing, Paragraph writing, Email etiquettes.	3		4

Reference books:

1. Technical Communication by Meenakshi Raman and Sangeeta Sharma, OUP
2. Public Speaking and Influencing Men in Business by Dale Carnegie
3. Professional Communication Skills by Bhatia and Sheikh, S. Chand Publications
4. Communication Skills by Sanjeev Kumar and Pushpalata, OUP
5. Communication Skills by LalitaBisen, BhumikaAgrawal, N. ThejoKalyani, Himalaya Publishing House

Communication Skills Lab

Communication Skills Lab	
Total Credits: 01	Subject Code : BAE1P01
Teaching Scheme :	Examination Scheme :
Lectures: 0 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 25 Marks
Practical: 2 Hours/Week	University Assessment:25 Marks

List of Experiments: (Perform any 6 – 8 Practical)

a. Barriers to Communication
b. Non-verbal Communication
c. Listening Skills
d. Reading Skills
e. Speaking Skills
f. Presentation Skills
g. Group Discussion
h. Interview Techniques

Beyond/Additional Syllabus Experiments

a. Development of Word Power
b. Use of Figurative language

Suggested Textbooks/Reference Books/ Web page (URL)/Research paper, etc.

1. Technical Communication by Meenakshi Raman and Sangeeta Sharma, OUP
2. Public Speaking and Influencing Men in Business by Dale Carnegie
3. Professional Communication Skills by Bhatia and Sheikh, S. Chand Publications
4. Communication Skills by LalitaBisen, BhumikaAgrawal, N.ThejoKalyani, Himalaya

Community Based Participatory Research			
Course Code:	**BCC1P01**	**Credits:**	**02**
Teaching Hours / Week	**04 P**	**SEE**	**100 M**
Total number of teaching hours	**60**	**Course Category**	**CC/LL**
BoS	**AS&H / Branch**		

Course Outcome:

- Gain an understanding of rural life, Indian culture and ethos and social realities
- Develop a sense of empathy and bonds of mutuality with the local community
- Appreciate significant contributions of local communities to Indian society and economy
- Learn to value the local knowledge and wisdom of the community
- Identify opportunities for contributing to community's socio-economic improvements.

Unit – I

Appreciation of Rural Society:

Rural lifestyle, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure.

Task to perform - Prepare a map (physical, visual or digital) of the village you visited and write an essay about interfamily relations in that village. – Classroom discussions – Field visit** – Assignment Map

Unit – II

Understanding rural and local economy and livelihood:

Agriculture, farming, land ownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets, migrant labour.

Task to perform - Describe your analysis of the rural house hold economy, its challenges and possible pathways to address.Circular economy and migration patterns. – Field visit** – Group discussions in class – Assignment

Unit – III

Rural and local Institutions:

Traditional rural and community organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), Nagarpalikas and municipalities, local civil society, local administration.

Task to perform - How effectively are Panchayati Raj and Urban Local Bodies (ULBs) institutions functioning in the village? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual). – Classroom – Field visit** – Group presentation of assignment

Unit – IV

Rural and National Development Programmes:

History of rural development and current national programmes in India: SarvaShikshaAbhiyan, BetiBachao, BetiPadhao, Ayushman Bharat, Swachh Bharat, PM AwaasYojana, Skill India, Gram PanchayatDecentralised Planning, National Rural Livelihood Mission (NRLM), Mahatma Gandhi National Rural Employment Guarantee Act 2005 (MGNREGA), SHRAM, JalJeevan Mission, Scheme of Fund for Regeneration of Traditional Industries (SFURTI), AtmaNirbhar Bharat, etc

Task to perform - Describe the benefits received and challenges faced in the delivery of one of these programmes in the local community; give suggestions about improving the implementation of the programme for the poor. Special focus on the urban informal sector and migrant households. – Classroom – Each student selects one program for field visit** – Written assignment

Assessment: Readings from e-content and reflections from field visits should be maintained by each student in a Field Diary. Participation in Field Visits should be allocated 30% marks; group field project should have 40% of total marks; presentation of field project findings to the community institution should have 30% of total marks.

**** Recommended field-based practical activities:**

- Interaction with Self Help Groups (SHGs) women members, and study their functions and challenges; planning for their skill-building and livelihood activities;
- Visit Mahatma Gandhi National. Rural Employment Guarantee Act 2005 (MGNREGS) project sites, interact with beneficiaries and interview functionaries at the work site;
- Field visit to Swachh Bharat project sites, conduct analysis and initiate problem-solving measures;
- Conduct Mission Antyodaya surveys to support under Gram Panchayat Development Plan (GPDP);
- Interactive community exercise with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization;
- Visit Rural Schools/mid-day meal centres, study academic and infrastructural resources, digital divide and gaps;
- Participate in Gram Sabha meetings, and study community participation;
- Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries;
- Visit to local Nagarpalika office and review schemes for urban informal workers and migrants;
- Attend Parent Teacher Association meetings, and interview school drop outs;
- Visit local Anganwadi Centre and observe the services being provided;
- Visit local NGOs, civil society organisations and interact with their staff and beneficiaries;
- Organize awareness programmes, health camps, Disability camps and cleanliness camps; • Conduct soil health test, drinking water analysis, energy use and fuel efficiency surveys and building solar powered village;
- Raise understanding of people's impacts of climate change, building up community's disaster preparedness; 10 Guidelines for Fostering Social Responsibility & Community Engagement in Higher Education Institutions in India 2.0
- Organise orientation programmes for farmers regarding organic cultivation, rational use of irrigation and fertilizers, promotion of traditional species of crops and plants and awareness against stubble burning;
- Formation of committees for common property resource management, village pond maintenance and fishing;
- Identifying the small business ideas (handloom, handicraft, khadi, food products, etc.) for rural areas to make the people self-reliant.

Teaching and Learning Methods:

A large variety of methods of teaching must be deployed.

An ICT based online module needs to be prepared for self-paced learning by students for one credit which can be supplemented through discussions in the classroom.

Reading and classroom discussions, Participatory Research Methods and Tools, Community dialogues, Oral history, social and institutional mapping, interactions with elected panchayat leaders and government functionaries, Observation of Gram Sabha, Field visits to various village institutions (see Section -3 Implementation Strategy).

SECOND SEMESTER B.Tech. (Computer Science & Engineering/ Computer Engineering/ Information Technology/ Computer Technology)

Mathematical foundation of Computer Science (TH+P)	
Total Credits: 03 T + 01 P	Subject Code : BCB2T05
Teaching Scheme :	Examination Scheme :
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 30 Marks
Practical: 02 Hours/Week	University Assessment:70 Marks

Course Objectives	
1	Develop mathematical and logical thinking for enhancing computational power of the students.
2	Equipped the students with fundamental mathematical tools used in computer science.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Define mathematical structures, relations, functions and use them to model real life situations.
2	Apply the concept of sets & fuzzy logics in their computer domain.
3	Interpret the data in mathematical form
4	Analyze basic facts of algebraic structures.
5	Implement the concept of counting principles.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT I : Relations and Functions			
Relations: Ordered pairs and n-tuples, Types of relations, Composite relation, Transitive closure of a relation, Partially ordered set, Hasse diagrams. **Functions:** Definition, Composition of functions, Types of functions, Characteristics function and its properties.	8		1
UNIT II : Set Theory & Fuzzy Logic			
Sets: Review of sets, Types and operations on sets, Principle of mathematical induction, **Fuzzy sets:** Fuzzy sets and systems, Crisp set, Operations and combinations on Fuzzy sets, Relation between Crisp set and Fuzzy set, Fuzzy relations, Overview of Fuzzy logic and classical logic.	7		2
UNIT III : Curve Fitting			
Fitting of a Curve by Method of Least Squares: Straight line $y = a+bx$, Second degree parabola $y = a+bx+cx^2$ and curves of the type $y = ae^{bx}$, $y = ab^x$ and $y = ax^b$, Coefficient of correlation and Lines of regression, Rank correlation.	7		3
UNIT IV : Algebraic Structures			
Introduction, Algebraic Systems, Groups, properties of algebraic groups, Semi groups, Monoids, Subgroup. Lagrange's theorem, Cosets, Normal Subgroup, quotient group. Homomorphism, Isomorphism of semi groupmonoid.	8		4
UNIT V : Elementary Combinatorics	7		5
Basics of counting techniques, Pigeonhole principle, Definition of generating functions and examples, Recurrence relations: definitions & examples, Solving Linear Recurrence Relations, Inclusion and Exclusion principle.			

REFERENCES 1.Discrete Mathematical Structures with Applications to Computer Science, J .P.Trembley and R. Manohar, Tata McGraw Hill-35th reprint, 2017.
2. Discrete Mathematical Structures, Kolman, R.C. Busby and S.C. Ross, 6th Edition, PHI, 2018
3. K.H. Rosen, Discrete Mathematics and its Applications, Mc-Graw Hill Book Company, 1999.

Mathematical foundation of Computer Science using Python(PRACTICAL)	
Total Credits: 01	Course Code : BCB2P05
Teaching Scheme :	Examination Scheme :
Practical: 02 Hours/Week	College Assessment: 25 Marks
	University Assessment: 25 Marks

Practical Course Objectives:
Solving problems using PYTHON Programming Language

Practical Course Outcomes:
After completing the practical course, students will be able to solve the following using PYTHON Programming Language.

CO1	Describe the components of a computer and notion of an algorithm.
CO2	Apply suitable programming constructs and built-in discrete mathematics to solve aproblem.
CO3	Develop, document, and debug modular python
CO4	Use classes and objects in application on programs and visualize data

SR.NO	Title of Experiment/ Practical
1	Introduction to Python Programming
2	Basic Commands.
3	Functions, Relations& their Graphs.
4	Fitting of Straight line ,parabola & exponential curve to the data
5	Coefficient of correlation
6	Recurrence Relation.
7	Lattices and Boolean Algebra.
8	Counting techniques
9	Student activity

Essential of Physic	
Total Credits: 03 T	Subject Code : BCB2T06
Teaching Scheme :	Examination Scheme :
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 30 Marks
Practical: 0 Hours/Week	University Assessment:70 Marks

Course Objectives	
1	To introduce ideas of quantum mechanics necessary to understand the function of quantum computing
2	To gain an understanding of the total internal reflection in optical communication system

Course Outcomes	
After completion of syllabus, students would be able to	
1	Learn the basic concepts of the dual nature of matter, differentiate between bits and qubits, and apply them to analyze various relevant phenomena in Quantum Computers and solve related numerical problems.
2	Relate the basic idea of total internal reflection to the propagation of light in an optical fiber and make use of the fiber concepts to solve numerical problems and relate to applications in engineering
3	Identify and explain different types of diodes, transistors, and their applications
4	Find how to extend the basic concepts of motion of charged particles in electric magnetic fields to solve numerical problems and to relate to applications in electron optic devices and CRO
5	Learn and explain nanoscience and its properties related to bulk materials

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT I : Quantum Computing			
Introduction to bits and qubits.Difference in bits and qubits. Quantum entanglement, Brief introduction about quantum computers **Concept of wave-particle duality, De-Broglie Hypothesis, Matter Waves, Davisson-Germer Experiment** **Concept of wave packets, Heisenberg Uncertainty Principle. Schrodinger wave equation (time dependent and time independent), Wave function Ψ, probability function, normalization condition, Eigen values, eigen function, Application to one dimensional infinite potential well.**	7		1
UNIT II : Optical fiber			
Structure of optical fiber, total internal reflection, modes of propagation, Graded index profile, Numerical aperture, classification of optical fiber, Acceptance angle and cone , attenuation and dispersion, fiberoptic communication system .	7		2
UNIT III : Semiconductor Physics			
Classification of materials on the basis of band gap, conductivity, drift and diffusion current intrinsic and extrinsic semiconductors. Diode and types of diodes: PN junction, Zener diode, LED, Tunnel diode, Photo diode, transistors, common base, common emitter configurations.	7		3
UNIT IV : Electron optics			
Motion of electron in magnetic and electric field, Bethe's law, Electrostatic lens, Block diagram and functions of each part of CRT and CRO, trigger circuit, time base circuit applications of CRO	8		4
UNIT V : Nanotechnology			
Concept of nanotechnology, Top-down and bottom-up approach, comparison of properties of bulk and nanomaterials, sol gel and ball mill process, special types of materials, Zeolite and Graphene, applications of nanotechnology.	7		5

Reference Books

1. P. M. Mathews and K. Venkatesan, A Textbook of Quantum Mechanics, Tata McGraw Hill (1977).
2. J. L. Powell and B. Crasemann, Quantum Mechanics, Narosa Publishing House (1993).
3. Charles Kittel, Introduction to Solid State Physics, Wiley Eastern, 5th edition, (1983).
4. A. J. Dekker, Solid State Physics, Prentice Hall of India (1971).
5. A Textbook of Engineering Physics, Dr. M. N. Avdhanulu, Dr. P. G. Kshirsagar, S. Chand Publication
6. Text book of Applied Physics, Dr. D. S. Hardas, Dr. D. S. Bhoumik, Dr.S. Shastri, Das Ganu Publication ISBN-978-93-84336-59-2 (2021)
7. Applied Physics, M. N. Avdhanulu, Shilpa A. Pande, Arti R. Golhar, Mohan Giriya, S. CHAND
8. A Text Book of Engineering Physics Dr. DevashreeHardas& Dr. AshishPanat, Das Ganu Publication ISBN-978-81-921757-7-5 (2011)
9. Applied Physics, - Dr. (Mrs)S.P. Wankhede, Dr.ShrutiPatle, Dr.(Mrs.)S.U.Bhonsule and Dr.N. S. Ugemuge DNA Publication ISBN-978-81-945174-6-7 (2020)
10. Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles by R. Eisberg and R. Resnick, Wiley and Sons
11. Engineering Physics, second edition, Sanjay Jain, G. Sahasrabudhe, University's Press(India) Pvt. Ltd.(2016)
12. D. J. Griffiths, Quantum mechanics, Prentice Hall of India Private Limited, New Delhi
13. L. I. Schiff, Quantum Mechanics, TMH Publications
14. Advanced Engineering Materials - Dr. Sangeeta G. Itankar, Dr. ManjushaDandekar, Dr. Tushar R. Shelke, Dr. Swati Fartode, Alliance & Co. ISBN 978-93-91322-12-0 (2023)
15. Applied Physics- Dr. Sangeeta G. Itankar, Dr. ManjushaDandekar, Dr. Tushar R. Shelke, Dr. Swati Fartode, Alliance &Co. ISBN 978-93-91322-97-7 (2023)
16. David Halliday, Robert Resnick, Jearl Walker, Principles of Physics, 10th Edition, John Wiley and Sons (2017)
17. Advanced physics - Dr.ShrutiPatle, Dr.(Mrs).S.U.Bhonsule, Dr.Ashish N. Bodhaye, Dr.ManoharD.Mehare DNA Publication (2019)
18. Engineering Physics - Dr.N. S. Ugemuge, Dr.(Mrs.)S.U.Bhonsule and Dr.ShrutiPatle DNA Publication(2019)

Essential of Physics Lab	
Total Credits: 01	Subject Code : BCB2P06
Teaching Scheme :	Examination Scheme :
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 50 Marks
Practical: 0 Hours/Week	University Assessment:-- Marks

List of Experiments

1. Introduction to quantum computers.
2. Energy gap of semiconductor /thermistor.
3. Parameter extraction from V-I characteristics of PN junction diode.
4. Parameter extraction from V-I characteristics of Zener diode.
5. Parameter extraction from V-I characteristics of PNP/NPN transistor in CB and CE mode.
6. V-I Characteristics of Tunnel diode.
7. V-I Characteristics of Light Emitting Diodes/ Determination of Plank's constant by using LEDs.
8. Study of Diode rectification.
9. Study of Hall Effect and determination of Hall Voltage of given sample.
10. Variation of Hall coefficient (R_H) with temperature.
11. To study B-H curve and to find out the values of coercivity, retentivity and saturation magnetization of experimental material.
12. Determination of NA for optical fiber
13. Calibration of Time Base circuit of CRO and determination of AC , DC voltage & frequency of electrical signals using CRO.
14. To determine the number of lines per cm on a diffraction grating using LASER beam.
15. Virtual Lab: Experiment on the determination of the thickness of a thin foil using an air wedge arrangement.
16. Virtual Lab: Experiment on the determination of the refractive indices of the material corresponding to ordinary and extra - ordinary rays.

Note: Performance of at least **six** experiments is compulsory in a semester.

Python Programming	
Total Credits: 03	Subject Code : BCB2T07
Teaching Scheme :	Examination Scheme :
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 30 Marks
Practical: 02 Hours/Week	University Assessment:70 Marks

Course Objectives	
1	This course is aimed at offering the fundamental concepts of Python scripting language to the students. It starts with the basics of Python programming and deals with lists, dictionaries, functions, exceptions and files.
2	The objective of this course is to enable the students to develop the applications using the concepts of Python.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Understand the basic terminology used in computer programming to write, compile and debug programs in Python programming language.
2	Use different data types to design programs involving decisions, loops, and functions.
3	Handle the exceptions which are raised during the execution of Python scripts.
4	Handle data using tuples and dictionaries
5	Implement files and classes in the Python programming environment.

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT I : INSTALLATION, DATA TYPES AND INPUT/OUTPUT:			
Importance of Python, Installing Python in Windows & Ubuntu, Executing Python programs, Comments in Python, Internal working of Python, Python character set, Tokens, Python Core Data Types, The print () function, Assignment of values to variables, The input() function, The eval() function.	7		1
UNIT II : OPERATORS AND CONTROL STATEMENTS:			
Operators- Arithmetic Operators, Operator precedence and Associativity, Bitwise operator, The compound assignment operator; Decision statements- Boolean operators, Boolean Expressions and Relational operators, Decision making statements; Loop Control Statements-while loop, range() function, for loop; break statement, continue statement	7		2
UNIT III : FUNCTIONS AND LISTS			
Functions- Syntax and basics of a function, Use of a function, Parameters and arguments in a function, The local and global scope of a variable, The return statement, Recursive functions, The lambda function; Lists-Creating Lists, Accessing the elements of a List, List slicing, Python in-built functions for lists, List Comprehension, List Methods, Passing list to a function, Returning a list to function.	7		3
UNIT IV : TUPLES, SETS AND DICTIONARIES			
Tuples - Creating tuples, tuple() function, Inbuilt functions for tuples, Indexing and Slicing, Operations on tuples, Passing variable length arguments to tuples, Sort tuples, Traverse tuples from a list, The zip() function, The Inverse zip(*) function; Sets - Creating sets, The set in and not in operator, The Python Set Class, Set operations; Dictionaries -Basics of Dictionaries, Creating a Dictionary, Adding and replacing values, Retrieving values, Formatting dictionaries, Deleting items,	8		4

Comparing two dictionaries, Methods of dictionary class, Traversing dictionaries, Nested dictionaries, Traversing nested dictionaries.			
UNIT V : FILES			
File Handling-Opening a file, Writing Text, Closing files, Writing numbers to a file, Reading Text, Reading numbers from a file, Appending data, seek() function	7		5

Reference Books :

1. The complete reference PYTHON, Martin C Brown, McGraw Hill
2. Python Crash Course, 2nd Edition: A Hand: A Hands-On, Project-Based Introduction to Programming, Eric Matthes, **No Starch Press**

URL:

1. https://www.python.org/about/gettingstarted/
2. https://www.learnpython.org/
3. https://www.w3schools.com/python/

Python Programming	
Total Credits: 01	Subject Code : BCB2P07
Teaching Scheme :	Examination Scheme :
Lectures: 0 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 25 Marks
Practical: 02 Hours/Week	University Assessment:25 Marks

Python Programming Lab: Practical based on above

Computer Architecture &Organization(TH)	
Total Credits: 02 T	Subject Code : BCB2T08
Teaching Scheme :	Examination Scheme :
Lectures: 2 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 30 Marks
Practical: 0 Hours/Week	University Assessment:70 Marks

Course Objectives	
1	Aims to understand basic architecture of computers and data representation on it
2	Teach memory and IO operations and devices.

Course Outcomes	
After completion of syllabus, students would be able to	
1	**Understand basic functional blocks of computer**
2	Represent data using different methods
3	Understand memory read, write policies
4	Understand I/O and roles

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT I :			
Basic functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU - registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study - instruction sets of some common CPUs.	6		1
UNIT II :			
Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shift-and-add, Booth multiplier, carry save	6		2

multiplier, etc. Division - non-restoring and restoring techniques, floating point arithmetic.			
UNIT III :			
Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs block size, mapping functions, replacement algorithms, write policy	6		3
UNIT IV :			
Peripheral devices and their characteristics: Input-output subsystems, I/O transfers - program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes - role of interrupts in process state transitions.	6		4

Reference Books :

- Computer Organisation, Hamacher, McGraw Hill
- Computer Organization and Design, 4th Ed, D. A. Patterson and J. L. Hennessy
- Computer Architecture, Berhooz Parhami
- Microprocessor Architecture, Jean Loup Baer

URL:

https://onlinecourses.nptel.ac.in/noc20_cs64/preview
https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/

Linux and Shell Programming	
Total Credits: 02	Subject Code : BSE2P01
Teaching Scheme :	Examination Scheme :
Lectures: 0 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 50 Marks
Practical: 04 Hours/Week	University Assessment:50 Marks

- Learn Linux Commands required to execute below practical list
- Write a shell script to reverse a number
- Write a shell script to write your user name as banner & print it on the screen.
- Write a shell script called is dirs which just lists the directories in the current directory
- Write a shell script called see taking a file name, as arguments which uses is, if the file is a directory & more if file is otherwise
- Write a shell script, using command cp, which over writes a files or copies a file.
- Write a shell script that asks a user to type w word, in, then tells the user how long that word is.
- Write a shell script which appends line to the file. Both the file name and line name have to be specified to the script at the command line. Ensure that it runs the sh. shell script. Print the no of lines after you are done.
- Write a shell script that gives person's UID, tell you how many times that person has logged in.
- Write a shell script that takes UID as argument prints out the person's names, directory name, shell & group & other that person may belong to.
- Write a shell script that for mail merging. facility.

**This is recommended list, to be changed every year by subject teacher

Consciousness Studies	
Total Credits: 02	Subject Code : BIK2T01A
Teaching Scheme :	Examination Scheme :
Lectures: 0 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 100 Marks
Practical: 04 Hours/Week	University Assessment:--Marks

Course Objectives	
1	This course aims to focus on psychology, sensory processes and perception
2	Application of classical conditioning and understand behavior of mind.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Analyze the basics of Psychology and its applications
2	Develop knowledge about the sensory processes and perception
3	Apply various theories of classical conditioning
4	Integrate the theories of memory and behaviour of mind

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT I :			
An introduction to Psychology Introduction to Psychology, Definition of psychology, history, methods in Psychology, Subfields of Psychology and its applications	6		1
UNIT II :			
Basic Cognitive Processes Sensory processes-general characteristics of senses, visual sense, auditory sense, other senses Perceptual organization-principles of perceptual organization, object perception and perceptual constancies, influences upon perception, extrasensory perception	6		2
UNIT III :			
Classical conditioning, theories about classical conditioning, Reinforcement and Punishment	6		3
UNIT IV :			
Theories about memory, brain and memory, long term memory, forgetting	6		4

Reference Books:

1. Clifford T. Morgan, King, Weisz and Schopler, Introduction to Psychology, McGraw Hill Education (India) Private Limited
2. Hilgard, Atkinson and Atkinson(1977). Introduction to Psychology. Tata McGraw Hill
3. Kao H.S R.&Sinha D. (Eds)(1977). Asian perspectives on psychology. New Delhi: Sage

Preserving Art, Culture and Tradition	
Total Credits: 02	Subject Code : BIK2T01B
Teaching Scheme :	Examination Scheme :
Lectures: 0 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 100 Marks
Practical: 04 Hours/Week	University Assessment:--Marks

Course Objectives	
1	To provide overview of Indian Knowledge System (IKS)
2	Sensitize the students to the contributions made by Indians in the field of philosophy, art and health.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Interpret basics of Indian Knowledge system.
2	Integrate the teaching of Indian culture and civilization
3	Appreciate Indian artistic tradition.
4	Analyze Indian health and wellness system for healthy living

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT I :			
Introduction to Indian Knowledge System Introduction and overview of Indian Knowledge system, The Vedic Corpus -Vedas, Types of Vedas, Upavedas, Types of Upavedas	6		1
UNIT II :			
Indian Culture and Civilization Indian culture and Civilization: its characteristics, Difference between Culture and Civilization, Indus valley civilization, Vedic civilization.	6		2
UNIT III :			
Indian Artistic Tradition, Indian Artistic tradition: Chitrakala- Indian style painting (Madhubani, Warli, Phad, Kalamkari, Gond, Mandana), Nritya : Indian dance forms (Bharatnatyam, Kathak, Kathakali, Kuchipudi, Manipuri, Mohiniattyam) Sangeet- Carnatic music & Hindustani music	6		3
UNIT IV :			
Health and Wellness, Well being: Mental & Physical, Dimensions of Wellness, Concept of healthy living in Ayurveda, Tri-doshas – Relationship to Health	6		4

References:

1. Introduction to Indian Knowledge System by Mahadevan, B, Bhat, VinayakRajat, NagendraPavana R.N., Prentice Hall India Pvt., Limited, 2022.
2. Indian knowledge Systems, KapilKapoor, Avadhesh Kumar Singh, D.K, Printworld.
3. Traditional Knowledge System in India by AmitJha, Atlantic Publishers, 2002
4. Exploring The Mysterious, By T.N. Dhar · Mittal Publications, 2004
5. Indian Art & Culture (E), By Anurag Kumar, Arihant Publication India Limited, 2016
6. A History of Indian Philosophy, Volume 2, By SurendranathDasgupta, Diamond Publishers, 2017
7. Sri Suresh Soni, Sources of our cultural heritage, PrabhatPrakashan, 2018.
8. A Beautiful Tree by Dharampal, RashtrotthanaSahitya, 2021

Wellness, traditional medicines and yoga	
Total Credits: 02	Subject Code : BIK2T01C
Teaching Scheme :	Examination Scheme :
Lectures: 0 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 100 Marks
Practical: 04 Hours/Week	University Assessment:--Marks

Course Objective:

The course will enable engineering students to acquire the knowledge of richness of healthy lifestyle and strong heritage of yoga and Vedas in Indian traditional system.

Course Outcomes:

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

CO1: Understand the importance of a healthy lifestyle

CO2: Familiarize to manage stress and health consciousness about physical and mental health.

CO3: Appreciate the benefits of yoga and medicinal plant.

CO4: Identify the social changes in Indian society.

Unit1: Importance of health and wellness, Essential components of balanced diet for healthy living, Processed foods and unhealthy eating habits.

Unit 2:

Body systems and common diseases, Sedentary lifestyle and its risk of disease, Stress, anxiety, and depression, Factors affecting mental health.

Unit 3:

Importance and benefits of yoga, Purpose of yoga, traditional knowledge of medicinal plant, use of home available herbs and spices.

Unit 4:

Vedas and it types, Social change in Indian society, Social stratification and class conflicts.

Textbooks/References:

1. Sociology in India – Surendra Sharma, Rawat Publication.
2. Bradfird B, Strand and Others. Fitness Education Arizona GorsuchSeani; sbrick Publishers, 1997.
3. Scott K. Powers and Stephen L. Dodd. Total Fitness: Exercise, Nutrition and wellness, Boston: Allyn and Bacon, 1999.
4. RigvedaSamhita with Sayanabhasya, VaidikSamshodhanMandal, Pune
5. Riksuktashati, H. D. Velankar, BharatiyaVidyaBhavan, Mumbai

Glimpses of ancient Science and Technology	
Total Credits: 02	Subject Code : BIK2T01C
Teaching Scheme :	Examination Scheme :
Lectures: 0 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment: 100 Marks
Practical: 04 Hours/Week	University Assessment:--Marks

Course Objectives	
1	To provide the students with scientific foundation of Ancient Indian Knowledge System
2	To create awareness about scientific heritage of the ancient civilization

Course Outcomes	
After completion of syllabus, students would be able to	
1	To understand about great mathematicians and to help students to trace, identify, practice, and develop the significant Indian mathematics
2	To understand the concept of motion and its application in Indian ancient physics literature.
3	To understand the concepts of basic chemical & metallurgical process of ancient and medieval India.
4	

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT I :			
Mathematics in India: Introduction of inception of Mathematics from vedic periods. Great Mathematician and their contribution (e.g. Arytabhatta, Bhaskara, Brahmagupta, Ramanujan, Pingala, Bhaskara-II), Sulbhasutras (Pythagoras theorem), Square, Square root, Square root of imperfect Squares, Magic Squares, Value of Pi.	8		1
UNIT II :			
India: Vaisheshikadarshan Atomic theory & law of motion, theory of Panchmahabhoota, BrihathShathaka (divisions of the time, unit of distance), Bhaskarachaya (Introduction to theory of Gravity, Suryasiddhanta&Sidhantashriomani), Lilavati (Gurutvakashan Shakti).	8		2
UNIT III :			
Chemistry in India:Vatsyayana, Nagarjuna, Vagbhaṭa –building of Theras-Shala (laboratory), working arrangements of Ras-Shala, material and equipment,YaśodharaBhaṭṭa-process of distillation, apparatus. Metallurgy in India: Survarṇa(gold) and its different types, properties, Rajata(silver), Tamra(copper), Loha(iron), Jasta(zinc), Naga /Sisa(lead), Pittala(brass).	8		3

Reference Books

1. R P Kulkarni, Glimpses of Indian Engineering and Technology (Ancient & Medieval period, MunshiramManoharlal Publishers Pvt. Ltd. 2018
2. AK Pathak, Science and Technology in India, Anshikaprakashanpratapgarh, 2016
3. PB Sharma, S. Narain, Doctors Scientists and Engineers of Ancient India, Kalpaz Publications 2017
4. NVP, Unithiri, Indian Scientific Traditions (Professor K.N. NeelakantanElayath Felicitation Volume), publication division university of Calicut, 2006

5. Anonyms, History of Science in India- Volume-I Part-I (Physics, Mathematics and Statistics), the national academy of science, India & the Ramkrishna mission institute of culture, 2014
6. Kapur K and Singh A.K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of Sankaracharya, Central Chinmay Mission Trust, Bombay, 1995
7. Dharmpal, Indian Science and Technology in the eighteen century, Rashtrottahanasahitya, 1983
8. S Biswal, B L Ray, Vedic Science and technology, DK Print world, 2009
9. A.K Bag, History of technology in Indian (Set 3 vol), Indian Nation Science Academy, 1997.
10. A Gosh, History of Science in India (Volume-I Part-II Astronomy), the national academy of science, India & the Ramkrishna mission institute of culture, 2014