School of Computing

(AMARAVATI, AMRITAPURI, BANGALORE, COIMBATORE, CHENNAI)

Curriculum and Syllabi

B.Tech - Computer Science and Engineering

CURRICULUM & SYLLABUS 2023 onwards

GENERAL INFORMATION

ABBREVIATIONS USED IN THE CURRICULUM

Cat - Category
L - Lecture
T - Tutorial
P - Practical
Cr - Credits
ENGG - Engineering Sciences (including General, Core and Electives)
HUM - Humanities (including Languages and others)
SCI - Basic Sciences (including Mathematics)
PRJ - Project Work (including Seminars)
AES - Aerospace Engineering
AIE - Computer Science and Engineering - Artificial Intelligence
BIO - Biology
CCE - Computer and Communication Engineering
CHE - Chemical Engineering
CHY - Chemistry
CSE - Computer Science and Engineering
CVL - Civil Engineering
CUL - Cultural Education
EAC - Electronics and Computer Engineering
ECE - Electronics and Communication Engineering
EEE - Electrical and Electronics Engineering
ELC - Electrical and Computer Engineering
HUM - Humanities
MAT - Mathematics
MEE - Mechanical Engineering
PHY – Physics
CGPA - Cumulative Grade Point Average

Course Outcome (CO) – Statements that describe what students are expected to know, and are able to do at the end of each course. These relate to the skills, knowledge and behaviour that students acquire in their progress through the course.

Program Outcomes (POs) – Program Outcomes are statements that describe what students are expected to know and be able to do upon graduating from the Program. These relate to the skills, knowledge, attitude and behaviour that students acquire through the program. NBA has defined the Program Outcomes for each discipline.

PROGRAM OUTCOMES FOR ENGINEERING

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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.
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.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
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.
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.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.

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.
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 EDUCATIONAL OBJECTIVES (PEO):

• Graduate will strive on a global platform to pursue their professional career in Computer Science and Engineering.
• Graduate will contribute to product development as entrepreneurs in inter-disciplinary fields of engineering and technology.
• Graduate will demonstrate high regard for professionalism, integrity and respect values in diverse culture, and have a concern for society and environment.

PROGRAM SPECIFIC OUTCOMES (PSO):

• Ability to design and implement innovative, optimal and elegant computing solutions to interdisciplinary problems using standard practices, tools and technologies.
• Ability to learn emerging computing paradigms for research and innovation

Department of Computer Science and Engineering
2023 Onwards

General Framework

CATEGORY	DESCRIPTION	No. of COURSES	CREDITS	AICTE Reco
HUMANITIES	Languages and Humanities	10	19	16
SCIENCES	Science Courses	6	23	23
ENGINEERING	Engineering Sciences	11	27	29
CSE	Computer Science – Core	13	52	59
CSE	Electives	6	18	12
ENGINEERING	Open Subjects - Electives from other technical and /or emerging subjects	3	8	9
PROJECT	Project	3	15	15
	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition]	2	(Non-Credit)	(Non-Credit)
	TOTAL		162	163

CURRICULUM 2023 onwards

Semester I					
Cat	**Code**	**Title**	**L T P**	**Credit**	**Evaluation Pattern**
HUM	23ENG101	Technical Communication	2-0-3	3	70:30
SCI	23MAT107	Calculus	3-0-2	4	70:30
CSE	23CSE101	Computational Problem Solving	3-0-2	4	70:30
ENGG	23EEE104	Introduction to Electrical and Electronics Engineering	3-0-0	3	50:50
ENGG	23EEE184	Basic Electrical and Electronics Engineering Practice	0-0-2	1	80:20
ENGG	23CSE102	Computer Hardware Essentials	1-0-2	2	70:30
HUM	22ADM101	Foundations of Indian Heritage	2-0-1	2	50:50
HUM	22AVP103	Mastery Over Mind	1-0-2	2	80:20
		Total (14 L + 1 T + 13 P = 28 hrs)		21	

Semester II					
Cat	**Code**	**Title**	**L T P**	**Credit**	**Evaluation Pattern**
SCI	23MAT116	Discrete Mathematics	3-0-2	4	70:30
SCI	23MAT117	Linear Algebra	3-0-2	4	70:30
CSE	23CSE111	Object Oriented Programming	3-0-2	4	70:30
SCI	23PHY115	Modern Physics	2-1-0	3	50:50
CSE	23CSE113	User Interface Design	2-0-2	3	70:30
ENGG	23MEE115	Manufacturing Practice	0-0-3	1	80:20
HUM	22ADM111	Glimpses of Glorious India	2-0-1	2	50:50
		Total (15L + 1T + 11P = 27hrs)		21	

Semester III					
Cat	**Code**	**Title**	**L T P**	**Credit**	**Evaluation Pattern**
SCI	23MAT206	Optimization Techniques	3-0-2	4	70:30
ENGG	23ECE205	Digital Electronics	3-0-0	3	60:40
CSE	23CSE201	Procedural Programming using C	3-0-2	4	70:30
CSE	23CSE202	Database Management Systems	3-0-2	4	70:30
CSE	23CSE203	Data Structures and Algorithms	3-1-2	5	70:30
ENGG	23ECE285	Digital Electronics Laboratory	0-0-3	1	80:20
HUM	23LSE201	Life Skills for Engineers I	1 0 2	P/F	50:50
HUM		Amrita Value Programme I	1-0-0	1	
		Total (19L + 1T + 11P = 31 hrs)		22	

Semester IV					
Cat	**Code**	**Subject**	**L - T – P**	**Credits**	**Evaluation Pattern**
SCI	23MAT216	Probability and Random Processes	3-0-2	4	70:30
CSE	23CSE211	Design and Analysis of Algorithms	3-0-2	4	70:30
CSE	23CSE212	Principles of Functional Languages	2-0-2	3	70:30
ENGG	23CSE213	Computer Organization and Architecture	3-1-0	4	50:50
CSE	23CSE214	Operating Systems	3-0-2	4	70:30
HUM		Amrita Value Programme II	1-0-0	1	
HUM		Free Elective I**	2-0-0	2	
HUM	23LSE211	Life Skills for Engineers II	1 0 2	2	50:50
		Total (20L + 1T + 8P = 29 hrs)		24	

Semester V					
Cat	**Code**	**Subject**	**L - T - P**	**Credits**	**Evaluation Pattern**
CSE	23CSE301	Machine Learning	3-0-2	4	70:30
CSE/ ENGG		Professional Elective I	3-0-0	3	70:30
CSE	23CSE302	Computer Networks	3-1-2	5	70:30
CSE	23CSE303	Theory of Computation	3-1-0	4	50:50
ENGG	23CSE304	Embedded Systems	3-0-2	4	70:30
CSE/ ENGG		Professional Elective II	3-0-0	3	70:30
HUM	23LSE301	Life Skills for Engineers III	1 0 2	2	50:50
ENGG	23LIV390	Live-in –Labs I***	[3]-0-0	[3]	
HUM	23ENV300	Environmental Science		P/F	
		Total (21L + 2T + 6P = 29hrs)		25+[3]	

Semester VI					
Cat	**Code**	**Subject**	**L - T - P**	**Credits**	**Evaluation Pattern**
ENGG	23CSE311	Software Engineering	3-0-2	4	70:30
ENGG	23CSE312	Distributed Systems	3-0-2	4	70:30
CSE	23CSE313	Foundations of Cyber Security	3-0-0	3	70:30
CSE/ ENGG		Professional Elective III	3-0-0	3	70:30
CSE	23CSE314	Compiler Design	3-0-2	4	70:30
PRJ	23CSE399	Project Phase-I	0-0-6	3	70:30
HUM	23LSE311	Life Skills for Engineers IV	1 0 2	2	50:50
ENGG	23LIV490*	Live-in –Labs II***	[3]-0-0	[3]	
		Total (18L + 0T +12P = 30 hrs)		23+[3]	

Semester VII					
Cat	**Code**	**Subject**	**L - T – P**	**Credits**	**Evaluation Pattern**
CSE/ENGG		Professional Elective IV	3-0-0	3	70:30
CSE/ENGG		Professional Elective V	3-0-0	3	70:30
CSE/ENGG		Professional Elective VI	3-0-0	3	70:30
ENGG		Free Elective II**	2-0-0	2	
CSE	23CSE401	Fundamentals of Artificial Intelligence	2-0-2	3	70:30
PRJ	23CSE498	Project - Phase II	0-0-12	6	70:30
HUM	23LAW300	Indian Constitution		P/F	
		Total (13L+0T+14P=27hrs)		20	

Semester VIII					
Cat	**Code**	**Subject**	**L - T – P**	**Credits**	**Evaluation Pattern**
PRJ	23CSE499	Project - Phase III	0-0-12	6	70:30
		Total (12 hrs)		6	
		Total Credits		162	

* Free Electives will include courses offered by Faculty of Humanities and Social Sciences/ Faculty Arts, Commerce and Media / Faculty of Management/Amrita Darshanam - (International Centre for Spiritual Studies).

**Professional Electives categorised under Engineering, Science, Mathematics, Live-in- Labs, and NPTEL Courses. Student can opt for such electives across departments/campuses. Students with CGPA of 7.0 and above can opt for a maximum of 2 NPTEL courses with the credits not exceeding 8. If one student would like to opt for specialisation, the student must take the professional electives from the respective specialisation baskets.

***Live-in-Labs - Students undertaking and registering for a Live-in-Labs project, can be exempted from registering for an Elective course in the higher semester

Professional Electives

Electives in Cyber Security					
Cat	**Code**	**Subject**	**L - T – P**	**Credits**	**Evaluation Pattern**
CSE	23CSE331	Cryptography	3 0 0	3	70:30
CSE	23CSE332	Information Security	3 0 0	3	70:30
CSE	23CSE333	Secure Coding	3 0 0	3	70:30
CSE	23CSE334	Cyber Forensics and Malware	3 0 0	3	70:30
CSE	23CSE335	Block Chain and its Applications	3 0 0	3	70:30
ENGG	23CSE336	Secure Networks	3 0 0	3	70:30

Electives in Computer Networks					
Cat	**Code**	**Subject**	**L - T - P**	**Credits**	**Evaluation Pattern**
ENGG	23CSE341	Wireless Sensor Networks	3 0 0	3	70:30
ENGG	23CSE342	Advanced Computer Networks	3 0 0	3	70:30
ENGG	23CSE343	Wireless and Mobile Networks	3 0 0	3	70:30
ENGG	23CSE344	Modern Cellular Wireless Networks	3 0 0	3	70:30
CSE	23CSE345	Software Defined Networks	3 0 0	3	70:30

Electives in Data Science					
Cat	**Code**	**Subject**	**L - T – P**	**Credits**	**Evaluation Pattern**
CSE	23CSE351	Foundations of Data Science	3 0 0	3	70:30
CSE	23CSE352	Big Data Analytics	3 0 0	3	70:30
CSE	23CSE353	Data Visualization	3 0 0	3	70:30
CSE	23CSE354	Database Management Systems for Data Science	3 0 0	3	70:30
CSE	23CSE355	Mining of Massive Datasets	3 0 0	3	70:30
CSE	23CSE356	Social Network Analytics	3 0 0	3	70:30
CSE	23CSE357	Time Series Analysis and Forecasting	3 0 0	3	70:30

Electives in Cyber Physical Systems					
Cat	**Code**	**Subject**	**L - T – P**	**Credits**	**Evaluation Pattern**
ENGG	23CSE361	Real Time Operating Systems for Cyber- Physical Systems	3 0 0	3	70:30
ENGG	23CSE362	Edge Computing	3 0 0	3	70:30
ENGG	23CSE363	Cloud Computing	3 0 0	3	70:30
ENGG	23CSE364	Cyber Physical Systems	3 0 0	3	70:30
ENGG	23CSE365	Internet of Things	3 0 0	3	70:30

Electives in Computer Vision					
Cat	**Code**	**Subject**	**L - T – P**	**Credits**	**Evaluation Pattern**
CSE	23CSE371	Digital Image Processing	3 0 0	3	70:30
CSE	23CSE372	Computer Graphics and Animation	3 0 0	3	70:30
CSE	23CSE373	Computer Vision	3 0 0	3	70:30
CSE	23CSE374	Video Analysis	3 0 0	3	70:30
CSE	23CSE375	Augmented and Virtual Reality	3 0 0	3	70:30

Electives in Artificial Intelligence					
Cat	**Code**	**Subject**	**L - T – P**	**Credits**	**Evaluation Pattern**
CSE	23CSE470	Semantic Web	3 0 0	3	70:30
CSE	23CSE471	Natural Language Processing	3 0 0	3	70:30
CSE	23CSE472	Artificial Intelligence and Robotics	3 0 0	3	70:30
CSE	23CSE473	Neural Networks and Deep Learning	3 0 0	3	70:30
CSE	23CSE474	Computational Intelligence	3 0 0	3	70:30
CSE	23CSE475	Generative AI	3 0 0	3	70:30
CSE	23CSE476	Conversational AI	3 0 0	3	70:30
CSE	23CSE477	Reinforcement Learning	3 0 0	3	70:30
CSE	23CSE478	Drones and Robotics	3 0 0	3	70:30
CSE	23CSE479	Machine Learning with Graphs	3 0 0	3	70:30
CSE	23CSE480	AI for Industrial Decision Making	3 0 0	3	70:30

General Electives

Cat	**Code**	**Subject**	**L - T - P**	**Credits**	**Evaluation Pattern**
CSE	23CSE451	Graph Mining	3-0-0	3	70:30
CSE	23CSE452	Business Analytics	3-0-0	3	70:30
CSE	23CSE453	Competitive Programming	3-0-0	3	70:30

CSE	23CSE454	Concurrent Programming	3-0-0	3	70:30
CSE	23CSE455	Design Patterns	3-0-0	3	70:30
CSE	23CSE456	Domain Specific Languages	3-0-0	3	70:30
CSE	23CSE457	Elements of Computing	3-0-0	3	70:30
CSE	23CSE458	Embedded Programming	3-0-0	3	70:30
ENGG	23CSE459	Fault tolerant Computing Systems	3-0-0	3	70:30
CSE	23CSE460	Features in Modern Programming Languages	3-0-0	3	70:30
CSE	23CSE461	Full Stack Frameworks	3-0-0	3	70:30
CSE	23CSE462	Multimedia Communication Systems	3-0-0	3	70:30
CSE	23CSE463	Quantum Computing	3-0-0	3	70:30
CSE	23CSE464	Formal Verification	3-0-0	3	70:30
CSE	23CSE465	Mobile Application Development	3-0-0	3	70:30
CSE	23CSE466	Parallel Programming	3-0-0	3	70:30

Professional Electives for Other Branches

Cat	Code	Subject	L - T - P	Credits	Evaluation Pattern
CSE	23CSE431	Principles of Artificial Intelligence	3 0 0	3	70:30
CSE	23CSE432	Principles of Operating Systems	3 0 0	3	70:30
CSE	23CSE433	Fundamentals of Software Engineering	3 0 0	3	70:30
CSE	23CSE434	Introduction to Big Data Analytics	3 0 0	3	70:30
CSE	23CSE435	Foundation of Information Technology	3 0 0	3	70:30
CSE	23CSE436	Principles of Database Management Systems	3 0 0	3	70:30
CSE	23CSE437	Principles of Computer Networks	3 0 0	3	70:30
CSE	23CSE438	Object Oriented Programming	3 0 0	3	70:30

CSE	23CSE439	Introduction to Data Structures and Algorithms	3 0 0	3	70:30
CSE	23CSE440	Advanced Algorithms and Analysis	3 0 0	3	70:30
CSE	23CSE441	Introduction to Machine Learning	3 0 0	3	70:30
ENGG	23CSE442	Distributed Systems	3 0 0	3	70:30
ENGG	23CSE443	Cloud and IOT	3 0 0	3	70:30

List of courses in Amrita Value Programme I & II			
Course Code	Title	L-T-P	Credits
22ADM201	Strategic Lessons from Mahabharatha	1-0-0	1
22ADM211	Leadership from Ramayana	1-0-0	1
22AVP210	Kerala Mural Art and Painting	1-0-0	1
22AVP218	Yoga Therapy and Lessons	1-0-0	1
22AVP212	Introduction to Traditional Indian Systems of Medicine	1-0-0	1
22AVP201	Amma’s Life and Message to the modern world	1-0-0	1
22AVP204	Lessons from the Upanishads	1-0-0	1
22AVP205	Message of the Bhagavad Gita	1-0-0	1
22AVP206	Life and Message of Swami Vivekananda	1-0-0	1
22AVP207	Life and Teachings of Spiritual Masters of India	1-0-0	1
22AVP208	Insights into Indian Arts and Literature	1-0-0	1
22AVP213	Traditional Fine Arts of India	1-0-0	1
22AVP214	Principles of Worship in India	1-0-0	1
22AVP215	Temple Mural Arts in Kerala	1-0-0	1
22AVP218	Insights into Indian Classical Music	1-0-0	1
22AVP219	Insights into Traditional Indian Painting	1-0-0	1
22AVP220	Insights into Indian Classical Dance	1-0-0	1
22AVP221	Indian Martial Arts and Self Defense	1-0-0	1
22AVP209	Yoga and Meditation	1-0-0	1

PROFESSIONAL ELECTIVES UNDER SCIENCE STREAM

CHEMISTRY				
Cat.	**Course Code**	**Title**	**L T P**	**Credit**
SCI	23CHY240	Computational Chemistry and Molecular Modelling	3 0 0	3
SCI	23CHY241	Electrochemical Energy Systems and Processes	3 0 0	3
SCI	23CHY242	Fuels and Combustion	3 0 0	3
SCI	23CHY243	Green Chemistry and Technology	3 0 0	3
SCI	23CHY244	Instrumental Methods of Analysis	3 0 0	3
SCI	23CHY245	Batteries and Fuel Cells	3 0 0	3
SCI	23CHY246	Corrosion Science	3 0 0	3
PHYSICS				
SCI	23PHY240	Advanced Classical Dynamics	3 0 0	3
SCI	23PHY241	Electrical Engineering Materials	3 0 0	3
SCI	23PHY242	Physics of Lasers and Applications	3 0 0	3
SCI	23PHY243	Concepts of Nanophysics and Nanotechnology	3 0 0	3
SCI	23PHY244	Physics of Semiconductor Devices	3 0 0	3
SCI	23PHY245	Astrophysics	3 0 0	3
Mathematics				
SCI	23MAT240	Statistical Inference	3 0 0	3
SCI	23MAT241	Introduction to Game Theory	3 0 0	3
SCI	23MAT242	Numerical Methods and Optimization	3 0 0	3

FREE ELECTIVES

FREE ELECTIVES OFFERED UNDER MANAGEMENT STREAM				
Cat.	**Course Code**	**Title**	**L T P**	**Credit**
HUM	23MNG331	Financial Management	3 0 0	3
HUM	23MNG332	Supply Chain Management	3 0 0	3
HUM	23MNG333	Marketing Management	3 0 0	3
HUM	23MNG334	Project Management	3 0 0	3
HUM	23MNG335	Enterprise Management	3 0 0	3
HUM	23MNG336	Operations Research	3 0 0	3
HUM	23MEE321	Industrial Engineering	3 0 0	3
HUM	23MEE322	Managerial Statistics	3 0 0	3
HUM	23MEE323	Total Quality Management	3 0 0	3
HUM	23MEE324	Lean Manufacturing	3 0 0	3
HUM	23CSE321	Software Project Management	3 0 0	3
HUM	23CSE322	Financial Engineering	3 0 0	3
HUM	23CSE323	Engineering Economic Analysis	3 0 0	3
HUM	23CSE324	Information Systems	3 0 0	3

FREE ELECTIVES OFFERED UNDER HUMANITIES / SOCIAL SCIENCE STREAMS				
Cat.	Course Code	Title	L T P	Credit
HUM	23CUL230	Achieving Excellence in Life - An Indian Perspective	2 0 0	2
HUM	23CUL231	Excellence in Daily Life	2 0 0	2
HUM	23CUL232	Exploring Science and Technology in Ancient India	2 0 0	2
HUM	23CUL233	Yoga Psychology	2 0 0	2
HUM	23ENG230	Business Communication	1 0 3	2
HUM	23ENG231	Indian Thought through English	2 0 0	2
HUM	23ENG232	Insights into Life through English Literature	2 0 0	2
HUM	23ENG233	Technical Communication	2 0 0	2
HUM	23ENG234	Indian Short Stories in English	2 0 0	2
HUM	23FRE230	Proficiency in French Language (Lower)	2 0 0	2
HUM	23FRE231	Proficiency in French Language (Higher)	2 0 0	2
HUM	23GER230	German for Beginners I	2 0 0	2
HUM	23GER231	German for Beginners II	2 0 0	2
HUM	23GER232	Proficiency in German Language (Lower)	2 0 0	2
HUM	23GER233	Proficiency in German Language (Higher)	2 0 0	2
HUM	23HIN230	Hindi I	2 0 0	2
HUM	23HIN231	Hindi II	2 0 0	2
HUM	23HUM230	Emotional Intelligence	2 0 0	2
HUM	23HUM231	Glimpses into the Indian Mind - the Growth of Modern India	2 0 0	2
HUM	23HUM232	Glimpses of Eternal India	2 0 0	2
HUM	23HUM233	Glimpses of Indian Economy and Polity	2 0 0	2
HUM	23HUM234	Health and Lifestyle	2 0 0	2
HUM	23HUM235	Indian Classics for the Twenty-first Century	2 0 0	2
HUM	23HUM236	Introduction to India Studies	2 0 0	2
HUM	23HUM237	Introduction to Sanskrit Language and Literature	2 0 0	2
HUM	23HUM238	National Service Scheme	2 0 0	2
HUM	23HUM239	Psychology for Effective Living	2 0 0	2
HUM	23HUM240	Psychology for Engineers	2 0 0	2
HUM	23HUM241	Science and Society - An Indian Perspective	2 0 0	2
HUM	23HUM242	The Message of Bhagwat Gita	2 0 0	2
HUM	23HUM243	The Message of the Upanishads	2 0 0	2
HUM	23HUM244	Understanding Science of Food and Nutrition	2 0 0	2
HUM	23HUM245	Service Learning	2 0 0	2
HUM	23JAP230	Proficiency in Japanese Language (Lower)	2 0 0	2
HUM	23JAP231	Proficiency in Japanese Language (Higher)	2 0 0	2
HUM	23KAN230	Kannada I	2 0 0	2
HUM	23KAN231	Kannada II	2 0 0	2
HUM	23MAL230	Malayalam I	2 0 0	2
HUM	23MAL231	Malayalam II	2 0 0	2
HUM	23SAN230	Sanskrit I	2 0 0	2
HUM	23SAN231	Sanskrit II	2 0 0	2
HUM	23SWK230	Corporate Social Responsibility	2 0 0	2
HUM	23SWK231	Workplace Mental Health	2 0 0	2
HUM	23TAM230	Tamil I	2 0 0	2
HUM	23TAM231	TAMIL II	2 0 0	2

B.Tech - Computer Science and Engineering

SYLLABUS 2023 onwards

SEMESTER I

23ENG101	TECHNICAL COMMUNICATION	L-T-P-C:2-0-3-3

Course Objectives

- Learn the fundamentals of mechanics of writing.
- Acquire the ability to draft formal correspondence and various technical documents.
- Develop abilities in critical thinking and analysis.
- Acquire skills of scanning for specific information, comprehension, and organization of ideas.
- Enhance competency in technical presentation skills.

Course Outcomes

CO1: Apply the mechanics of writing in formal correspondence
CO2: Write technical documents with appropriate form and content
CO3: Organize technical information or ideas in a logical and coherent manner
CO4: Compose grammatically and stylistically accurate project reports/ term papers
CO5: Make effective technical presentations

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										3				
CO2				1						2				
CO3										3				
CO4				1						2				
CO5									2	1				

Syllabus

Unit 1
Error Analysis
Mechanics of Writing: Grammar rules -articles, tenses, auxiliary verbs (primary & modal) prepositions, subject-verb agreement, pronoun-antecedent agreement, discourse markers and sentence linkers, impersonal passive, modifiers, phrasal verbs
General Reading and Listening comprehension - rearrangement & organization of sentences

Unit 2
Different kinds of written documents: Definitions- Descriptions- Instructions-Recommendations- User manuals - Reports – Proposals
Formal Correspondence: Writing Formal Letters/Emails
Punctuation
Scientific Reading & Listening Comprehension

Unit 3
Technical paper writing: Documentation style - Document editing – Proof reading - Organizing and Formatting
Tone and style
Graphical representation
Reading and listening comprehension of technical documents
Mini Technical project / Term paper (10 -12 pages)
Technical presentations

References(s)

Hirsh, Herbert. L, "Essential Communication Strategies for Scientists, Engineers and Technology Professionals". II Edition. New York: IEEE press, 2002.
Anderson, Paul. V. "Technical Communication: A Reader-Centred Approach". V Edition. Harcourt Brace College Publication, 2003.
Strunk, William Jr. and White. EB. "The Elements of Style" New York. Alliyan & Bacon, 1999.
Riordan, G. Daniel and Pauley E. Steven. "Technical Report Writing Today", VIII Edition (Indian Adaptation).New Delhi: Biztantra, 2004.
Michael Swan. "Practical English Usage", Oxford University Press, 2000.

Evaluation Pattern: 70:30

Assessment	Internal (Weightage)	End Semester (Weightage)
Mid Term	20 (50 marks exam)	
*Continuous Assessment (Theory)	20	
*Continuous Assessment (Lab)	30	
End Semester		30 (50 marks; 2 hours exam)

*CA Theory – Quizzes, Assignments etc.
*CA Lab - User Manual, Abstract, Project Report, Presentation

23MAT107	CALCULUS	L-T-P-C: 3-0-2-4

Course Objectives

Understand the various functions and their graphs. The basic concept of continuous function and find the extreme values of the continuous functions. Also, to understand parameterisation of curves and to find arc length and familiarise with calculus of multiple variables.

Course Outcomes

CO1: To understand the concepts of shifting, scaling of functions, limits, continuity, and differentiability.
CO2: To understand the definite integral and compute the definite integral for standard functions.
CO3: To understand the limits, continuity and partial derivatives of multivariable functions and its computations.
CO4: To understand the scalar and vector fields, gradient, divergence and curl of vector fields and their physical interpretations.
CO5: To understand the computing techniques of line integral, surface integral and volume integrals.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-			
CO2	2	2	-	-	2	-	-	-	-	-	-			
CO3	2	2	-	-	1	-	-	-	-	-	-			
CO4	2	2	-	-	1	-	-	-	-	-	-			
CO5	1	2	-	-	-	-	-	-	-	-	-			

Syllabus

Unit 1
Graphs: Functions and their Graphs. Shifting and Scaling of Graphs. Limit and Continuity: Limit (One Sided and Two Sided) of Functions. Continuous Functions, Discontinuities, Monotonic Functions, Infinite Limits and Limit at Infinity. Graphing: Extreme Values of Functions, Concavity and Curve Sketching, Integration: Definite Integrals, The Mean Value Theorem for definite integrals, Fundamental Theorem of Calculus, Integration Techniques.

Unit 2
Functions of severable variables: Functions, limit and continuity. Partial differentiations, total derivatives, differentiation of implicit functions and transformation of coordinates by Jacobian. Taylor's series for two variables. Vector Differentiation: Vector and Scalar Functions, Derivatives, Curves, Tangents, Arc Length, Curves in Mechanics, Velocity and Acceleration, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field.

Unit 3
Vector Integration: Line Integral, Line Integrals Independent of Path. Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals, Triple Integrals – Gauss Divergence Theorem, Stoke's Theorem.

Textbook(s)
G.B. Thomas, "Calculus", Pearson Education, 2009, Eleventh Edition.

Reference(s)
Monty J. Strauss, Gerald J. Bradley and Karl J. Smith, "Calculus", 3rd Edition, 2002.
E Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, Tenth Edition, 2018.
Dennis G. Zill and Michael R.Cullen, "Advanced Engineering Mathematics", second edition CBS Publishers, 2012.

Lab Experiments:
1. Basic commands in MATLAB (Vectors, matrices)
2. Plotting of single variable functions
3. Plotting of functions using concepts of shifting, scaling, reflection
4. Derivatives and Evaluation of derivatives numerically using excel
5. Solutions to differential equations numerically-RC, LC, RL circuits (using excel)
6. Velocity and acceleration
7. Definite Integrals – evaluation numerically
8. Taylor series expansion for single and multi variable functions
9. Plotting of two-variable functions-surface plots using parametric representation

10. Contour plots to identify the optimum
11. Gradient of scalar functions and plotting of gradient vectors
12. Hessian to identify the concavity of the surface
13. Divergence and Curl of a vector field

Evaluation Pattern: 70:30

Assessment	Internal	External
Midterm	20	
*Continuous Assessments (CA)	50	
**End Semester		30 (50 Marks; 2 hours exam)

*CA – Can be Quizzes, Assignment, Lab Practice, Projects, and Reports
**End Semester can be theory examination/ lab-based examination

23CSE101	COMPUTATIONAL PROBLEM SOLVING	L-T-P-C: 3-0-2-4

Course Objectives

The objective of this course is to introduce the computational aspects of problem solving to the students. The course exposes computational thinking to the students through systematic treatment on algorithms, logical reasoning and solutions. The course then introduces Python language which will be used as a computational tool for both designing algorithms and solving problems.

Course Outcomes

CO1: Apply algorithmic thinking to understand, define and solve problems.
CO2: Design and implement algorithm(s) for a given problem.
CO3: Apply the basic programming constructs for developing solutions and programs.
CO4: Analyze an algorithm by tracing its computational states, identifying bugs and correcting them.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2										2	2
CO2	3	2	3		3								2	2
CO3	2	2	2		2								2	2
CO4	2	1	1		2								2	2

Syllabus

Unit 1

Problem Solving and Algorithmic Thinking Overview – Algorithms - Properties, Constituents of Algorithms: Sequence, Selection and Repetition - Designing Algorithms, Expressing and Analyzing Algorithms - Algorithms vs Programs - Logical Reasoning - Logical Errors - Problem Definition - Problem Understanding and Analysis - Designing Solutions.

Unit 2

Overview of Programming Paradigms - Introduction to Python - Variables - Strings, IO - Control Flow - Data Abstraction: Working with Lists/Arrays, Dictionaries, Tuples and Sets - Functions - Recursion - Files - Debugging - Computational Tracing of Python Programs.

Unit 3

Problem Solving with Algorithms - Searching and Sorting - Applied Computational Thinking Problems: Python Libraries, Text Processing, Data Processing and Analysis, Chatbot etc.

Textbook(s)

Sofia De Jesus and Dayrene Martinez, "Applied Computational Thinking with Python: Design algorithmic solutions for complex and challenging real-world problems", Packt Publishing, November 2020.

Reference(s)

Thomas Mailund, "Introduction to Computational Thinking: Problem Solving, Algorithms, Data Structures, and More", Apress, 2021.
Karl Beecher, "Computational Thinking: A beginner's guide to problem-solving and programming", BCS, The Chartered Institute for IT, 2017.
Curzon P, McOwan PW, "The Power of Computational Thinking: Games, Magic and Puzzles to help you become a computational thinker", World Scientific Publishing Company; 2017.

Evaluation Pattern - 70:30

Assessment	Internal	External
Mid Term Examination	20	-
*Continuous Assessment - Theory	10	-
*Continuous Assessment - Lab	40	-
**End Semester	-	30 (50 Marks - 2 hours)

*Continuous Assessment – Can be Quizzes, Assignments, Case Studies, Projects, and Reports
**End Semester can be theory examination/ lab-based examination

23EEE104 INTRODUCTION TO ELECTRICAL AND ELECTRONICS ENGINEERING L-T-P-C: 3-0-0-3

Course Objectives

- To impart basic knowledge of electrical quantities and provide working knowledge for the analysis of DC and AC circuits.
- Understand the characteristics and applications of diode and Transistors.
- To facilitate understanding of Thyristors and operational amplifier circuits.

Course Outcomes

CO1: Ability to understand the basic electric and magnetic circuits.
CO2: Ability to analyze DC and AC circuits.
CO3: Ability to understand the basic principles of pn junctions and transistors.
CO4: Ability to analyze basic transistor and op amp-based circuits.

CO-PO Mapping

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus

Unit 1

Introduction to Electrical Engineering, current and voltage sources, Resistance, Inductance and Capacitance; Ohm's law, Kirchhoff's law, Energy and Power – Series parallel combination of R, L, C components,Voltage Divider and Current Divider Rules – Super position Theorem, Network Analysis – Mesh and Node methods- Faraday's Laws of Electro-magnetic Induction, Magnetic Circuits, Self and Mutual Inductance, Generation of sinusoidal voltage, Instantaneous, Average and effective values of periodic functions, Phasor representation. Introduction to 3-phase systems, Introduction to electric grids.

Unit 2

PN Junction diodes, Diode Characteristics, Diode approximation- Clippers and Clampers, Rectifiers: Half wave, Full wave, Bridge- Zener Diode- Design of regulator and characteristics, Optoelectronic devices, Introduction to BJT, Characteristics and configurations, Transistor as a Switch.

Unit 3

Field Effect Transistors – Characteristics, Thyristors – operation and characteristics, Diac, Triac –Thyristor based power control, IC 555 based Timer-multi-vibrators, Operational Amplifiers – Inverting and Non-inverting amplifier, Oscillators, Instrumentation amplifiers.

Textbooks

Edward Hughes. "Electrical and Electronic Technology", 10th Edition, Pearson Education Asia, 2019.
A. P. Malvino, "Electronic Principles", 7th Edition, Tata McGraw Hill, 2007.
S. K. Bhattcharya, "Basic Electrical and Electronics Engineering", Pearson, 2012.
Vincent Del Toro, "Electrical Engineering Fundamentals", Prentice Hall of India Private Limited, 2nd Edition, 2003.
David A. Bell, "Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.
(Michael Tooley B. A., "Electronic circuits: Fundamentals and Applications", 3rd Edition, Elsevier Limited, 2006.

Evaluation Pattern: 50:50

Assessment	Internal	External
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, and Tutorials.

23EEE184 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING PRACTICE L-T-P-C: 0-0-2-1

Course Objectives

- To impart basic knowledge of electrical quantities and provide working knowledge for the analysis of DC and AC circuits.
- To facilitate understanding of basic electronics and operational amplifier circuits.

Course Outcomes

CO1: Create basic electrical connections for domestic applications.
CO2: Measure the various electrical parameters in the circuit.
CO3: Construct and analyze basic electronic circuits.
CO4: Develop amplifier circuits using Op-Amp.

CO-PO Mapping

PO/PSO / CO	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
CO1	3	1	1	-	-	-	-	1	1	1	-	-	-	-	-
CO2	3	1	1	-	-	-	-	1	1	1	-	-	-	-	-
CO3	3	2	1	-	-	-	-	1	1	1	-	-	-	-	-
CO4	3	2	1	-	-	-	-	1	1	1	-	-	-	-	-

Syllabus

1. Electrical Wiring practices.
2. Study of Electrical protection systems.
3. Verification of circuit theorem.
4. VI characteristics of PN junction and Zener diode.
5. Implementation of Half wave and Full wave rectifier using PN junction diode.
6. Transistor as a switch.
7. Characteristics of BJT.
8. Experiment on Thyristor.
9. Implementation of inverting and non-inverting amplifier using Op-amp.
10. Experiments on Oscillators and Multivibrators.

Reference(s)

Lab Manual

Evaluation Pattern: 80:20

Assessment	Internal	External
*Continuous Assessment (CA)	80	
End Semester		20

*CA – Can be Experiments, Quiz, Viva, and Record.

23CSE102	COMPUTER HARDWARE ESSENTIALS	L-T-P-C: 1-0-2-2

Course Objectives

- This course is designed to introduce the students to the basics of computing devices, operating systems, installation, configuration, and troubleshooting.
- Elementary concepts of physical computing and Internet of Things are also covered.

Course Outcomes

CO1: Understand the working principles of different computing devices.
CO2: Understand hardware components used for building computing devices.
CO3: Understand the different types of sensors, actuators and methods of interfacing to computing devices.
CO4: Understand the fundamentals of physical computing and related use cases.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1			1							2	3	2
CO2	3	2			1							2	3	2
CO3	3	3	2		2			2	2	2		2	3	2
CO4	3	3	2		2			2	2	2		2	3	2

Syllabus

Unit 1
An overview of the hardware components used to build general purpose and single board computers, mobile phones and laptops, chipsets, interface standards, specifications, and configurations. Installation of operating systems and dual booting.

Unit 2
Introduction to physical computing, Sensors, actuators, digital and analog I/O ports, communicating over a wired/wireless network.

Unit 3
Introduction to Raspberry Pi, GPIO programming, interfacing sensors and actuators. Introduction to IoT, communicating sensor data to cloud platforms.

Textbook(s)
Banzi, Massimo, and Michael Shiloh. "Getting started with Arduino". Maker Media, Inc., 4th edition 2022.
Pan, T., Zhu, Y., "Getting Started with Arduino. In: Designing Embedded Systems with Arduino". Springer, Singapore, 2018
Molloy, Derek. "Exploring Raspberry Pi: interfacing to the real world with embedded Linux". John Wiley & Sons, 2016.

Reference(s)
Singh, Rajesh, et al. "Internet of things with Raspberry Pi and Arduino". CRC Press, 2019.

Evaluation Pattern: 70:30

Assessment	Internal	External
Midterm	20	
*Continuous Assessments (CA)	50	
**End Semester		30

*CA – Can be Quizzes/Assignment/Lab Practice
**End Semester - lab-based examination

22ADM101	FOUNDATIONS OF INDIAN HERITAGE	L-T-P-C:2-0-1-2

Course Objectives

To introduce students to the depths and richness of the Indian culture and knowledge traditions, and to enable them to obtain a synoptic view of the grandiose achievements of India in diverse fields. To equip students with a knowledge of their country and its eternal values.

Course Outcomes

CO1: Increase student understanding of true essence of India's cultural and spiritual heritage. Emancipating Indian histories and practices from manipulation, misunderstandings, and other ideological baggage thus, shows its contemporary relevance.

CO2: Understand the ethical and political strategic concepts to induce critical approach to various theories about India.

CO3: Familiarize students with the multidimension of man's interaction with nature, fellow beings and society in general.

CO4: Appreciate the socio-political and strategic innovations based on Indian knowledge systems. Gives an understanding of bringing Indian teaching into practical life.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				2				2						
CO2		1				1	1	3						
CO3						1	2	3						
CO4	3					3	3	3						

Syllabus

Educational Heritage of Ancient India, Life and Happiness, Impact of Colonialism and Decolonization, A timeline of Early Indian Subcontinent, Pinnacle of Selflessness and ultimate freedom, Indian approach towards life, Circle of Life, Ocean of love; Indian Mahatmas, Man's association with Nature, Celebrating life 24/7, Metaphors and Tropes, Become A Strategic Thinker (Games / Indic activity), India: In the Views of Other Scholars and Travellers, Personality Development Through Yoga, Hallmark of Indian Traditions: Advaita Vedanta, Theory of oneness, Conversations on Compassion with Amma.

Textbook(s)

"Foundations of Indian Heritage", In house publication (In print).

Reference(s)

The beautiful tree by Dharampal.
Peasants and Monks in British India by William Pinch.
India, that is Bharat: Coloniality, Civilisation, Constitution by J Sai Deepak.
Awaken Children Dialogues with Mata Amritanandamayi.
Man and Nature by Mata Amritanandamayi Devi.
What Becomes of the Soul After Death, Divine Life Society.

Evaluation Pattern: 50:50

Assessment	Internal	End Semester
Periodical 1	15%	
Periodical 2	15%	
*Continuous Assessment (CA)	20%	
End Semester		50%

*CA includes Quizzes and Tutorials

22AVP103	MASTERY OVER MIND	L-T-P-C:1-0-2-2

Course Objectives

- Mastery Over Mind (MaOM) is an Amrita initiative to implement schemes and organize university-wide programs to enhance health and wellbeing of all faculty, staff, and students (UN SDG -3).
- It gives an introduction to immediate and long-term benefits of MA OM meditation and equips every attendee to manage stressful emotions and anxiety, in turn facilitating inner peace and harmony.
- This course will enhance the understanding of experiential learning based on the University's mission: "Education for Life along with Education for Living" and is aimed to allow learners to realize and rediscover the infinite potential of one's true Being and the fulfilment of life's goals.

Course Outcomes

CO1: To be able to describe what meditation is and to understand its health benefits.
CO2: To understand the causes of stress and how meditation improves well-being.
CO3: To understand the science of meditation.
CO4: To learn and practice MA OM meditation in daily life.
CO5: To understand the application of meditation to improve communication and relationships.
CO6: To be able to understand the power of meditation in compassion-driven action.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	2	2		2		
CO2			2		2				2	2		2		
CO3					2			2	2	2		2		
CO4			3		3		2	3	3	3		3		
CO5			2		2			2	2	3		3		
CO6			2					2	2	2		2		

Syllabus

The course syllabus will be covered in six units as described below

Unit 1: Describe Meditation and Understand its Benefits (CO1)
A: Importance of meditation. How does meditation help to overcome obstacles in life *(Pre- recorded video with Swami Shubhamritananda Puri)*
Reading 1: Why Meditate? (Swami Shubamritananda ji)
Reading 2: 'Stillness of the Mind' Chapter 17 in *Amritam Gamaya* (2022). Mata Amritanandamayi Mission Trust.
Additional Reading: Abhyasa Yoga: The Yoga of Practice. (Br. Achyutamrita Chaitanya)
B: Understand how meditation works. Understand how meditation helps in improving physical and mental health. Understand how meditation helps in the development of personality *(Pre-recorded video with Dr. Ram Manohar)*
Reading 1: Allen, Cynthia (2020) The Potential Health Benefits of Meditation
Additional Reading: Sharma, Hari (2022) Meditation: Process and Effects

Unit 2: Causes of Stress and How Meditation Improves Well-being (CO2)
A: Learn how to prepare for meditation. Understand the aids that can help in effectively practicing meditation. Understand the role of sleep, physical activity, and a balanced diet in supporting meditation. (*Pre-recorded video with Dr. Ram Manohar)*
B: Causes of Stress. The problem of not being relaxed. Effects of stress on health. How meditation helps to relieve stress. Basics of stress management at home and the workplace. *(Pre-recorded video with Prof Udhaykumar)*
Reading 1: Mayo Clinic Staff (2022, April 29). *Meditation: A Simple, Fast Way to Reduce Stress.* Mayo Clinic. https://www.mayoclinic.org/tests-procedures/meditation/in- depth/meditation/art-20045858 (PDF provided)
Reading 2: 'Efficient Action.' Chapter 28 in *Amritam Gamaya* (2022). Mata Amritanandamayi Mission Trust.

Unit 3: The Science of Meditation (CO3)
A: A preliminary understanding of the Science of meditation. What can modern science tell us about this tradition-based method? *(Pre-recorded video with Dr. Shyam Diwakar)*
B: How meditation helps humanity according to what we know from scientific research
(Pre-recorded video with Dr. Shyam Diwakar)
Reading 1: Does Meditation Aid Brain and Mental Health (Dr Shyam Diwakar)
Reading 2: 'Science and Spirituality.' Chapter 85 in *Amritam Gamaya* (2022). Mata Amritanandamayi Mission Trust.

Unit 4: Practicing MA OM Meditation in Daily Life (CO4)
Guided Meditation Sessions following scripts provided (Level One to Level Five)
Reading 1: MA OM and White Flower Meditation: A Brief Note (Swami Atmananda Puri)
Reading 2: 'Live in the Present Moment.' Chapter 71 in *Amritam Gamaya* (2022). Mata Amritanandamayi Mission Trust.

Unit 5: Improving Communication and Relationships (CO5)
How meditation and mindfulness influence interpersonal communication. The role of meditation in improving relationship quality in the family, at the university and in the workplace. *(Pre-recorded video with Dr Shobhana Madhavan)*
Reading 1: Seppala E (2022, June 30th) *5 Unexpected Ways Meditation Improves Relationships a Lot.* Psychology Today. https://www.psychologytoday.com/intl/blog/feeling-it/202206/5-unexpected-ways- meditation-improves-relationships-lot
Reading 2: 'Attitude.' Chapter 53 in *Amritam Gamaya* (2022). Mata Amritanandamayi Mission Trust.

Unit 6: Meditation and Compassion-driven Action (CO6)
Understand how meditation can help to motivate compassion-driven action. *(Pre- recorded video with Dr Shobhana Madhavan)*
Reading 1: Schindler, S., & Friese, M. (2022). The relation of mindfulness and prosocial behavior: What do we (not) know?. *Current Opinion in Psychology*, *44*, 151-156.
Reading 2: 'Sympathy and Compassion.' Chapter 100 in *Amritam Gamaya* (2022). Mata Amritanandamyi Mission Trust.

Textbook(s)/Reference(s):

1. Meditation and Spiritual Life-Swami Yatiswarananda, Ramakrishna Math
2. The Complete Works of Swami Vivekananda Vol Vii by Advaita Ashram Mayavati Almora Himalayas
3. Dhyana Yoga-Holy Gita Swami Chinmayanda
4. Voice of God, Chandrasekharendra Saraswati, 68th Acharya of Sri Kanchi Kamakoti Peetam,
5. Hindu Dharma-Chandrasekharendra Saraswati, 68th Acharya of Sri Kanchi Kamakoti Peetam,
6. Mind: It's Mysteries and control-Swami Sivananda Saraswati
7. Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.
8. Books on Amma's teachings like Awaken children, From Amma's Heart etc.
9. The Science of Meditation: How to Change Your Brain, Mind and Body by Daniel Goleman and Richard. J. Davidson.
10.Allen, Cynthia (2020) The Potential Health Benefits of Meditation
11. Seppala E (2022, June 30th Unexpected Ways Meditation Improves Relationships a Lot.Psychology Today
12. Sharma, Hari (2022) Meditation: Process and Effects
13. Mayo Clinic Staff (2022, April 29). Meditation: A Simple, Fast Way to Reduce Stress.
14. Schindler, S., & Friese, M. (2022). The relation of mindfulness and prosocial behavior: What do we (not) know? Current Opinion in Psychology, 44, 151-156

Course Outcomes and Bloom's Taxonomy:
Each of the course outcomes can be mapped to specific levels of Bloom's Taxonomy as described in Table 1 below

Table 1: Unit-wise Scope for Outcomes and Bloom's Taxonomy:

CO Bloom's Levels of Learning	CO1	CO2	CO3	CO4	CO5	CO6
Creating						
Evaluating					Yes	Yes
Analyzing					Yes	Yes
Applying			Yes	Yes	Yes	Yes
Understanding	Yes	Yes	Yes	Yes	Yes	Yes
Remembering	Yes	Yes	Yes	Yes	Yes	Yes

Evaluation Pattern: 80:20

Assessment	**Internal**	**End semester**
Reflective Journal	20	
Group Activities	20	
Class Participation	40	
End Semester		20

SEMESTER II

23MAT116	DISCRETE MATHEMATICS	L-T-P-C: 3-0-2-4

Course Objectives

- Understand the logic and various functions.
- Understand the basic concept of combinatorics.
- Understand the concepts of recurrence relations and their applications.
- Understand the concepts of equivalence and partial order relations.
- Understand various definitions and theorems on graph theory.

Course Outcomes

CO1: To understand the basic concepts of Mathematical reasoning and basic counting techniques.
CO2: To understand the recursive functions and apply the concepts of generating functions to solve the recurrence relations.
CO3: Apply the concepts of divide and conquer method and principle of inclusion and exclusion to solve some simple algorithms in discrete mathematics.
CO4: To understand the concepts of various types of relations, partial ordering and equivalence relations.
CO5: To understand the basic concepts of graph theory and apply to shortest path problems.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	1	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	1	-	-	-	-	-	-	-	-	-
CO5	1	2	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus

Unit 1
Logic, Mathematical Reasoning and Counting: Logic, Prepositional Equivalence, Predicate and Quantifiers, Theorem Proving. Recursive Definitions, Recursive Algorithms, Basics of Counting, Pigeonhole Principle, Permutation and Combinations.

Unit 2
Relations and Their Properties: Representing Relations, Closure of Relations, Partial Ordering, Equivalence Relations and partitions.
Advanced Counting Techniques and Relations: Recurrence Relations, Solving Recurrence Relations, Generating Functions, Solutions of Homogeneous Recurrence Relations, Divide and Conquer Relations, Inclusion-Exclusion.

Unit 3
Graph Theory: Graphs and Sub graphs, isomorphism, matrices associated with graphs, degrees, walks, connected graphs, shortest path algorithm. Euler and Hamilton Graphs: Euler graphs, Euler's theorem. Fleury's algorithm for Eulerian trails. Hamilton cycles, Chinese-postman problem, approximate solutions of traveling salesman problem. Closest neighbour algorithm.

Lab Practice Problems: Verifications of logical statements, truth table, tautology. Recursive algorithms. Graph problems, degree, shortest path algorithm, Euler's algorithm and closest neighbour algorithm.

Textbook(s)
Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw- Hill Publishing Company Limited, New Delhi, Sixth Edition, 2007.
James Strayer, "Elementary Number Theory", Waveland Press, 2002.

Reference(s)

R.P. Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, Fifth Edition, 2007.
Thomas Koshy, "Discrete Mathematics with Applications", Academic Press, 2005.
Liu, "Elements of Discrete Mathematics", Tata McGraw- Hill Publishing Company Limited , 2004.

Lab Experiments:

1. Program to construct truth tables for some compound propositions
2. Program to check the validity for all rules of inference using truth tables
3. Program to check whether a given function is one-one and / or onto
4. Programs on mathematical induction
5. Programs involving recursion-i : factorial, power, gcd, modular exponentiation
6. Programs involving recursion-ii : fibonnaci series, towers of hanoi
7. Program to check whether a given number is prime
8. Programs involving modelling of recurrence relations
9. Program to check different properties of relations- reflexivity, symmetry, antisymmetry, transitivity
10. Program to find transitive closure using warshalls algorithm
11. Programs on divisibility and factorization
12. Program on fundamental theorem of airthmetic
13. Program on chinese remainder theorem

Evaluation Pattern: 70:30

Assessment	Internal	External
Midterm	20	
*Continuous Assessments (CA)	50	
**End Semester		30 (50 Marks; 2 hours exam)

*CA – Can be Quizzes, Assignment, Lab Practice, Projects, and Reports
**End Semester can be theory examination/ lab-based examination

23MAT117	LINEAR ALGEBRA	L-T-P-C: 3-0-2-4

Course Objectives

Understand the basic concepts of vector space, subspace, basis and dimension. Also to understand the orthogonality concepts and apply to various problems computer science.

Course Outcomes

CO1: To understand the basic concepts of vector space, subspace, basis and dimension.
CO2: To understand the basic concepts of inner product space, norm, angle, Orthogonality and projection and implementing the Gram-Schmidt process, to compute least square solution.
CO3: To understand and compute the linear transformations.
CO4: To compute the eigen values and eigen vectors and apply to transformation problems.
CO5: To perform case studies on least square and image transformations.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	3	-	-	-	-	-	-	-		
CO2	2	2	-	-	2	-	-	-	-	-	-	-		
CO3	3	3	-	-	2	-	-	-	-	-	-	-		
CO4	2	2	-	-	1	-	-	-	-	-	-	-		
CO5	3	2	-	-	2	-	-	-	-	-	-	-		

Syllabus

Unit 1
Vector Spaces: Vector spaces - Sub spaces - Linear independence - Basis – Dimension; Inner Product Spaces: Inner products - Orthogonality - Orthogonal basis - Gram Schmidt Process - Change of basis - Orthogonal complements - Projection on subspace - Least Square Principle. QR- Decomposition.

Unit 2
Linear Transformations: Linear transformation - Relation between matrices and linear transformations - Kernel and range of a linear transformation - Change of basis - Nilpotent transformations. Symmetric and Skew Symmetric Matrices, Adjoint and Hermitian Adjoint of a Matrix, Hermitian, Unitary and Normal Transformations, Self-Adjoint and Normal Transformations.

Unit 3
Eigen values and Eigen vectors: Eigen Values and Eigen Vectors, Diagonalization, Orthogonal Diagonalization, Quadratic Forms, Diagonalizing Quadratic Forms, Conic Sections. Similarity of linear transformations - Diagonalization and its applications - Jordan form and rational canonical form. Case Studies: Applications on least square and image transformations.

Textbook(s)

Howard Anton and Chris Rorres, "Elementary Linear Algebra", Tenth Edition, John Wiley & Sons, 2010.

Reference(s)

Nabil Nassif, Jocelyne Erhel, Bernard Philippe, "Introduction to Computational Linear Algebra", CRC press, 2015.
Sheldon Axler, "Linear Algebra Done Right", Springer, 2014.
Gilbert Strang, "Linear Algebra for Learning Data", Cambridge press, 2019.
Kenneth Hoffmann and Ray Kunze, "Linear Algebra", Second Edition, Prentice Hall, 1971.
Mike Cohen, "Practical Linear Algebra for Data Science", Oreilly Publisher, 2022.

Lab Experiments

1. Matrix operations, Generation of random matrices with given rank
2. Solution to linear system of equations, Left Inverse, Right Inverse, Pseudo Inverse
3. Revision of curve and surface plots using parametric representations

4. Span of a set (scatter plots for span of different sets)
5. Finding basis for row space, column space, null space and left null space
6. Finding orthogonal compliment of a given vector space
7. QR decomposition
8. Projections onto subspaces, Least Square Approximation, Linear Regression
9. Eigenvalues, Eigenvectors, characteristic polynomial.
10. Similar matrices, diagonalization, Cayley Hamilton Theorem.
11. Scaling, Shifting, Rotation of images using Linear Transformations

Evaluation Pattern: 70:30

Assessment	Internal	External
Midterm	20	
*Continuous Assessments (CA)	50	
**End Semester		30 (50 Marks; 2 hours exam)

*CA – Can be Quizzes, Assignment, Lab Practice, Projects, and Reports
**End Semester can be theory examination/ lab-based examination

23CSE111	OBJECT ORIENTED PROGRAMMING	L-T-P-C: 3-0-2-4

Course Objectives

- The course aims at teaching students to develop Object-Oriented software using the Unified Modelling Language and the Java Programming Language to first year students.
- This course motivates the students to think of problem solving in an Object-Oriented way using the methods and tools that support the paradigm.

Course Outcomes

CO1: Understand Object Oriented paradigm and represent the problem using objects and classes.
CO2: Apply the Object Oriented concepts to design and develop effective models using UML.
CO3: Develop program logic in Java from design models in UML.
CO4: Design applications with procedural and data abstraction using Java libraries.

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1		2								3	2
CO2	3	3	2	1	2								3	2
CO3	1	2	3	2	3			2	2	2			3	2
CO4	2	2	3	3	2			2	2	3			3	2

Syllabus

Unit1

Structured to Object Oriented Approach by Examples - Object Oriented languages - Properties of Object Oriented system – UML and Object Oriented Software Development - Use case diagrams and documents as a functional model - Identifying Objects and classes - Representation of Objects and its state by Object Diagram - Simple Class using class diagram – Encapsulation - Data Hiding - Reading and Writing Objects - Class Level and Instance Level Attributes and Methods- JIVE environment for debugging.

Unit2

Aggregation and Composition using Class Diagram – Generalization using Class Diagram – Inheritance - `Constructor and Over Riding – Visibility – Attribute – Parameter – Package - Local and Global - Polymorphism – Overloading - Abstract Classes and Interfaces.

Unit3

Exception Handling - Inner Classes - Wrapper classes – String - and String Builder classes – Number – Math – Random - Array methods - File Streams - Serialization - Generics - Collection framework - Comparator and Comparable - Vector and Arraylist - Iterator and Iterable.

Textbook(s)

Y.Daniel Liang, "Introduction to Java Programming", Tenth Edition, PHI, 2013.
Grady Booch and Robert A. Maksimchuk, "Object-oriented Analysis and Design with Applications", Third Edition, Pearson Education, 2009.

Reference(s)

Naughton P. and Schildt H., "Java2 Complete Reference", Eighth Edition, Tata McGraw- Hill, 2011.
Ali Bahrami, "Object Oriented Systems Development", Second Edition, McGraw-Hill,2008.
Jaime Nino, Fredrick A Hosch, "An Introduction to Programming and Object Oriented Design using Java", Wiley India Private Limited, 2010.

Evaluation Pattern: 70:30

Assessment	Internal	End Semester
Midterm	20	
*Continuous Assessment Lab (CAL)	40	
*Continuous Assessment Theory (CAT)	10	
**End Semester		30 (50 Marks; 2 hours exam)

*CAT includes Quizzes and Tutorials
*CAL – Can be Lab Assessments, Project, Case Study and Report, Case Study/project for 10 marks suggested.
**End Semester - lab-based examination

23PHY115	MODERN PHYSICS	L-T-P-C: 2-1-0-3

Course Objectives

The main objective of the course is to expose to the development of Physics with special emphasis onQuantum mechanics-which enable a computer science engineer to apply this in the field of emerging areas like quantum computing.

Course Outcomes

CO1: To be exposed to the fundamental concepts of Wave nature of Particles and Particle nature ofWaves.
CO2: To understand various atomic models and their application to phenomena like spectrumformation including LASERS.
CO3: To be introduced to the basics of Quantum mechanics like Wave function, Operators, States ofwave function etc.
CO4: To be able to apply quantum mechanics to simple applications like particle in a box, tunnellingof particle across a barrier etc. Equipment use in water treatment.
CO5: Apply Quantum mechanics in the emerging field of Quantum computing.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2								2
CO2	3	3	2	2								2
CO 3	3	3	3	3								2
CO4	3	3	3	3								
CO5	3	3	3	3								2

Syllabus

Unit 1
Origin of quantum theory of radiation: Black body radiation, photo-electric effect, Compton Effect – pair production and annihilation, De-Broglie hypothesis, description of waves and wave packets,group velocities. Evidence for wave nature of particles: Davisson-Germer experiment, Heisenberguncertainty principle.

Unit 2
Atomic structure: Historical Development of atomic structures: Thomson's Model, Rutherford's Model: Scattering formula and its predictions, Atomic spectra - Bohr's Model, Sommerfield's Model, The correspondence principle, nuclear motion, and atomic excitation, Application: Lasers.

Unit 3
Quantum mechanics: Wave function, Probability density, expectation values - Schrodinger equation – time dependent and independent, Linearity and superposition, expectation values, operators, Eigen functions and Eigen values

Unit 4
Application of 1D Schrodinger Wave equation: Free particle, Particle in a box, Finite potential well,Tunnel effect, Harmonic oscillator.

Unit 5
Intro to Quantum computing- Q bits- II Quantum correlations: Bell inequalities and entanglement,Schmidt decomposition, super dense coding, teleportation. Module

Textbook(s)

Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, "Concepts of Modern Physics" - McGraw HillEducation (Ondia) Private Ltd, Sixth edition, 2009.

Eleanor G. Rieffel and Wolfgang H. Polak, "Quantum Computing, A Gentle Introduction", MIT press.

Reference(s)

R Shankar, "Principles of Quantum Mechanics", Pearson India (LPE), 2E, 2006.

L I Schiff, "Quantum Mechanics", TMH, 2E,2010.

Evaluation Pattern: 50:50

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23CSE113	USER INTERFACE DESIGN	L-T-P-C:2-0-2-3

Course Objectives

The course focuses on the basic understanding of user interface design by applying HTML, CSS and Java Script. The course introduces the necessary skills to develop web applications with simple animation and transitions. An overview of UI Frameworks is given. Working of Internet is discussed. The protocols required are introduced.

Course Outcomes

CO1: To understand the basics and working of World Wide Web
CO2: To understand the fundamentals of HTML5
CO3: To understand the fundamentals of CSS and Java Script
CO4: To design and deploy a simple web application

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2			2	2						3	2
CO2	2	2	2							3			3	2
CO3	2	2	2					1		3			3	2
CO4	2	2	3	2	3			3	3				3	2

Syllabus

Unit 1
Introduction to Internet and Web design – Working of Web – Roles of Front-end, Back-end and Full stack development – Web Server – Internet protocols – Web Hosting – HTML – HTML Tags – Create a simple Web Page – Marking up Text – Adding Links – Adding Images – SVG – Table Markup – Embedded Media - Web Based Forms – HTML Forms - CSS for Presentation - Basic Style Sheet - A CSS Style Primer - Using Style Classes - Using Style IDs - Formatting Text - Advanced Typography with CSS3 - Working with Margins, Padding, Alignment, and Floating. Responsive web design, Introduction to version control systems.

Unit 2
CSS Box Model and Positioning - Creating Layouts Using Modern CSS - Backgrounds and Borders - CSS Transformations and Transitions - Animating with CSS and the Canvas - Dynamic Web Pages – Web Scripting - JavaScript programming for Web Applications – Including JavaScript in HTML – HTML5 Form Controls and Validation - Document Object Model - DOM manipulation and events - Event Handlers

Unit 3
Overview of UI Frameworks – User Interface Design Concepts in Web Development – Accessibility - Introduction to Electron - Overview of Electron - Setting up an Electron project - Creating a basic desktop application with Electron - Object communication - Introduction to other popular frameworks and libraries (e.g., JavaFX, WPF, GTK).

Textbook(s)
Jennifer Kyrnin, Julie Meloni, "Sams Teach Yourself HTML, CSS, and JavaScript All in One", Third Edition, Pearson Education, Inc., 2019.

Reference(s)
Jennifer Niederst Robbin, "LEARNING WEB DESIGN A BEGINNER'S GUIDE TO HTML, CSS, JAVASCRIPT, AND WEB GRAPHICS", Fifth Edition, O'Reilly Media, Inc., 2018.
Jessica Minnick, "Responsive Web Design with HTML 5 and CSS", 9th Edition, Cengage Learning, Inc., 2021.
Electron JS.
https://www.electronjs.org/docs/latest
https://www.electronforge.io/
https://www.electronjs.org/fiddle

Evaluation Pattern: 70:30

Assessment	Internal	End Semester
Midterm	20	
*Continuous Assessment (Theory) (CAT)	10	
*Continuous Assessment (Lab) (CAL)	40	
**End Semester		30 (50 Marks; 2 hours exam)

*CAT includes Quizzes and Tutorials
*CAL – Can be Lab Assessments, Project, Case Study and Report
**End Semester - lab-based examination

23MEE115	MANUFACTURING PRACTICE	L-T-P-C:0-0-3-1

Course Objectives

- Imparting the knowledge of general safety procedures that should be observed on the shop floor.
- Use modelling software to design and print simple geometry for additive manufacturing processes.
- Hands-on experience - arc welding and soldering operations.
- Use of different tools and accessories used for basic manufacturing processes.
- Familiarize with the essential pneumatic and electro-pneumatic components for automation and design pneumatic / electropneumatic circuits for the given simple application
- Understanding the functioning of various sub-systems of automobiles, such as the power train, steering system, suspension system, and braking system and realize the importance of recent developments in automotive technologies.

Course Outcomes

CO1: Practice safety procedures in a shop floor environment.
CO2: Select appropriate tools and methods for basic manufacturing processes.
CO3: Build simple geometries using additive manufacturing process.
CO4: Perform basic metals joining using welding and soldering.
CO5: Design, simulate and test simple pneumatic and electro pneumatic circuit for automation application.
CO6: Understand the functioning of automotive systems and realize the importance of recent developments in automotive technologies.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1			1				1		2
CO2	2	3				2				2		3
CO3	2	2	1		3	1	1			2	1	3
CO4	2	3	2							2	1	3
CO5	3	2	2		3					2	1	3
CO6	3	2	2		3					3	1	3

Syllabus

1. **Additive Manufacturing Laboratory –12 hours**

Introduction to digital manufacturing. Introduction to Additive Manufacturing - types – additive manufacturing applications - Materials for 3D printing, CAD Modelling for Additive manufacturing, Slicing and STL file generation- G code generation - 3D printing of simple geometries.

2. **Mechanical Engineering Laboratory –12 hours**

Study of tools and equipment used for basic manufacturing processes.
Manual arc welding practice for making Butt and Lap joints - Soldering Practice
Introduction to Machine Tools and Machining Processes

3. **Automation lab –12 hours**

Design, simulate and test pneumatic and electro-pneumatic circuits. Introduction to PLC –PLC programming for automation applications.

4. **Automobile Engineering lab –9 hours**

Overview of automobiles – components –functioning of various sub-systems; Power train, steering system, suspension system and braking system. Introduction to electric vehicles, hybrid vehicles, alternate fuels. Introduction to E Mobility.

Reference(s)
Lab Manual
Evaluation Pattern: 80:20

Assessment	Internal	End Semester
*CA	80	
End Semester		20

*CA – Can be Quizzes, Assignment, Lab Practice, Projects, and Reports

22ADM111	GLIMPSES OF GLORIOUS INDIA	L-T-P-C:2-0-1-2

Course Objectives

The course aims at introducing Bhārath in nutshell to the student, which includes the sources of Indian thoughts, eminent personalities who shaped various disciplines, India's significant contribution to the man kind, the current stature of Indian in the geopolitics and Indian approach to science and ecology.

Course Outcomes

CO1: Will be able to recognise the call of Upanishads and outstanding personalities for confronting the wicked in the real world while admiring the valour, pursuit and divinity in both classical and historical female characters of India.

CO2: Will get introduced to Acharya Chanakya, his works, and his views on polity and nation to find synchrony between public and personal life, alongside understanding India's cultural nuances and uniqueness concerning the comprehension of God across major global communities.

CO3: Will be able to appreciate Bhagavad Gita as the source of the Indian worldview through the various Yogic lessons enshrined in it, making it one of India's numerous soft powers, and also understand the faith-oriented mechanism of preserving nature.

CO4: Will be informed about the enormous contribution of Indian civilisation over two and a half millennia to humanity and develop awareness about India's approach toward science, devoid of dogmas and rooted in humanism.

CO-PO- Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			1	2				2						
CO2	2	1				1		3	1					
CO3	2		1	2	1	1		3						
CO4	2			3				3	2					

Syllabus

Face the Brutes, Role of Women in India, Acharya Chanakya, God and Iswara, Bhagavad Gita: From Soldier to Samsarin to Sadhaka, Lessons of Yoga from Bhagavad Gita, Indian Soft powers, Preserving Nature through Faith, Ancient Indian Cultures (Class Activity), Practical Vedanta, To the World from India, Indian Approach to Science.

Textbook(s)

"Glimpses of Glorious India", In house publication (In print).

Reference(s)

The Kautilya Arthashastra by Chankaya – Translation with critical and explanatory note by R P Kangle – Motilal Banarasidass Publishers- 1972.

Chanakya Neeti – Strategies for success – Radhakrishnan pillai – Jaico Publishing house -2020.

Universal Message of the Bhagavad Gita: An exposition of the Gita in the Light of Modern Thought and Modern Needs. - Swami Ranganathananda, Advaita Ashrama Belur Math, 2000.

A Concise History Of Science In India – D M Bose, S N Sen, B V Subbarayappa,The Indian National Science Academy 1971.

Indian Culture and India's Future – Michel Danino - D.K. Printworld (P) Ltd -2011.

Evaluation Pattern: 50:50

Assessment	Internal	End Semester
Periodical 1	15%	
Periodical 2	15%	
*Continuous Assessment (CA)	20%	
End Semester		50%

*CA includes Quizzes and Tutorials