DEPARTMENT

OF

COMPUTER SCIENCE & ENGINEERING

SCHOOL OF ENGINEERING & TECHNOLOGY

Course Structure
Programme Outcome
Programme Specific Outcome
Course Specific Outcome

NAGALAND UNIVERSITY
Dimapur: Nagaland

**DEPARTMENT OF
COMPUTER SCIENCE & ENGINEERING
COURSE STRUCTURE FOR B.TECH. PROGRAMME**

Total Credit: 160

FIRST YEAR

1st Semester

Sl No.	Subject Code	Type	Course Name	L	T	P	Credits	Contact Hrs/Week	Marks
THEORY									
1	G1T01	BS	Engineering Mathematics –I	3	1	-	4	4	100
2	G1T02	BS	Engineering Physics-I	3	-	-	3	3	100
3	G1T03	MC	Technical English	2	1	-	3	3	100
4	G1T04	ES	Basic Electrical Engineering	3	-	-	3	3	100
5	G1T05	BS	Engineering Chemistry	3	-	-	3	3	100
6	G1T06	ES	Engineering Graphics	1	-	-	1	1	100
PRACTICAL									
7	G1L01	BS	Engineering Physics –I Lab	-	-	2	1	2	100
8	G1L02	BS	Engineering Chemistry Lab	-	-	2	1	2	100
9	G1L03	ES	Engineering Graphics Lab	-	-	4	2	4	100
Total							**21**	**25**	**900**

2nd Semester

Sl No.	Subject Code	Type	Course Name	L	T	P	Credits	Contact Hrs/Week	Marks
THEORY									
1	G2T01	BS	Engineering Mathematics –II	3	1	-	4	4	100
2	G2T02	BS	Engineering Physics-II	3	-	-	3	3	100
3	G2T03	ES	Fundamentals of Computing	3	-	-	3	3	100
4	G2T04	ES	Basic Electronics	3	-	-	3	3	100
5	G2T05	ES	Engineering Mechanics	2	1	-	3	3	100
6	G2T06	MC	Environmental Science	3	-	-	0	3	100
PRACTICAL									
7	G2L01	ES	Workshop Practice	-	-	4	2	4	100
8	G2L02	ES	Basic Electronics Lab	-	-	2	1	2	100
9	G2L03	ES	Fundamentals of Computing	-	-	2	1	2	100
10	G2L04	BS	Engineering Physics II Lab	-	-	2	1	2	100
Total							**21**	**29**	**1000**

SECOND YEAR

3rd Semester:

Theory								
Sl No	**Subject Code**	**Course Name**	**Contact hours per week**				**Credits**	**Marks**
			L	**T**	**P**	**Total**		
1	CSB301	Object Oriented Programming	3	0	0	3	3	100
2	CSB302	Data Structures & Algorithm	3	0	0	3	3	100
3	CSB303	Computer Graphics & Virtual Reality	3	0	0	3	3	100
4	MAT3T2	Differential Calculus	3	1	0	4	4	100
5	EC3T03	Digital Electronics & Logic Design	2	1	0	3	3	100
			Total Theory		**16**	**16**	**500**
Practical								
1	CSB311	Object Oriented Programming Lab	0	0	3	3	1.5	100
2	CSB312	Data Structures & Algorithm Lab	0	0	3	3	1.5	100
3	EC3L02	Digital Electronics & Logic Design Lab	0	0	3	3	1.5	100
			Total Practical		**9**	**4.5**	**300**
			Total of Semester		**25**	**20.5**	**800**

4th Semester:

Theory								
Sl No	**Subject Code**	**Course Name**	**Contact hours per week**				**Credits**	**Marks**
			L	**T**	**P**	**Total**		
1	CSB401	Design & Analysis of Algorithms	3	0	0	3	3	100
2	CSB402	Web & Internet	3	0	0	3	3	100
3	CSB403	Formal Language & Automata Theory Automata Theory	3	0	0	3	3	100
4	CSB404	Computer Organization & Architecture	4	0	0	4	4	100
5	MAT4T2	Discrete Mathematics	3	1	0	4	4	100
			Total Theory		**17**	**17**	**500**
Practical								
1	CSB411	Design & Analysis of Algorithms Lab	0	0	3	3	1.5	100
2	CSB412	Web & Internet Lab	0	0	3	3	1.5	100
3	CSB413	Computer Organization & Architecture Lab	0	0	2	2	1	100
			Total Practical		**8**	**4**	**300**
			Total of Semester		**25**	**21**	**800**

THIRD YEAR:

5ᵗʰ Semester:

Theory								
Sl No	Subject Code	Course Name	Contact hours per week				Credits	Marks
			L	T	P	Total		
1	CSB501	Graph Theory	3	0	0	3	3	100
2	CSB502	Operating System	3	0	0	3	3	100
3	CSB503	Database Management Systems	3	0	0	3	3	100
4	CSB504	Software Engineering	3	0	0	3	3	100
5	MAT5T1	Numerical Analysis & Probability	3	1	0	4	4	100
					Total Theory	16	16	500
Practical								
1	CSB511	Software Engineering Lab	0	0	3	3	1.5	100
2	CSB512	Operating System Lab	0	0	3	3	1.5	100
3	CSB513	Database Management Systems Lab	0	0	3	3	1.5	100
					Total Practical	9	4.5	300
					Total of Semester	25	20.5	800

6ᵗʰSemester:

Theory								
Sl No	Subject Code	Course Name	Contact hours per week				Credits	Marks
			L	T	P	Total		
1	CSB601	Compiler Design	4	0	0	4	4	100
2	CSB602	Computer Networks	3	0	0	3	3	100
3	CSB62X	Elective-I	3	0	0	3	3	100
4	CSB62X	Elective-II	3	0	0	3	3	100
5	HSB601	Project Management & Entrepreneurship	2	0	0	2	2	100
					Total Theory	16	15	500
Practical								
1	CSB611	Computer Networks Lab	0	0	3	3	1.5	100
2	CSB612	Compiler Design Lab	0	0	3	3	1.5	100
3	CSB613	Application Programming Lab	0	1	3	3	2.5	100

Total Practical	**9**	**5.5**	**300**
Total of Semester	**25**	**20.5**	**800**

FOURTH YEAR:

7th Semester:

Theory

Sl No	Subject Code	Course Name	Contact hours per week				Credits	Marks
			L	**T**	**P**	**Total**		
1	CSB701	Distributed System	3	0	0	3	3	100
2	CSB702	Machine Learning	3	0	0	3	3	100
3	CSB72X	Elective-III	3	0	0	3	3	100
					Total Theory	*9*	*9*	**300**
Practical								
1	CSB711	Project-I #	0	0	12	12	6	100
2	CSB712	Machine Learning Lab	0	0	3	3	1.5	100
3	CSB713	Colloquium-I*	0	0	0	0	0	100
								300
					Total Practical	**15**	7.5	
					Total of Semester	**24**	**19.5**	**600**

8th Semester:

Theory

Sl No	Subject Code	Course Name	Contact hours per week				Credits	Marks
			L	**T**	**P**	**Total**		
1	CSB82X	Elective-V	3	0	0	3	3	100
2	CSB83X	Open Elective-I	3	0	0	3	3	100
3	G8T01	Constitution of India	3	0	0	0	0	100
4	HSB801	Human Relations at work	2	0	0	2	2	100
					Total Theory	*8*	*8*	**400**
Practical								
1	CSB811	Project-II	0	0	16	16	8	100
					Total Practical	*16*	*8*	**100**
					Total of Semester	*24*	*16*	**500**

List of Elective				**S**
				ummary of Contact Periods per Week and Credits
Sl. No	**Course Code**	**Semester**	**Course Title**	
1	CSB621	6	Data Mining	
2	CSB622	6	Data Analytics	
3	CSB623	6	Information Retrieval	
4	CSB624	6	Multimedia Technology	
5	CSB625	6	Software Testing	
6	EC6T06	6	Information Theory & Coding	
7	EC8T01	6	Digital Image Processing	
8	MAT6T1	6	Operations Research	
1	CSB721	7	Design & Management of Computer Network	
2	CSB722	7	Human Computer Interaction	
3	CSB723	7	Cloud Computing	
4	CSB724	7	Wireless Sensor Networks	
5	CSB725	7	Internet-of- Things	
6	CSB726	7	Real Time Systems	
7	CSB727	7	Advanced Computer Architecture & parallel programming	
8	EC7EL1	7	Embedded Systems & Design	
1	CSB821	8	Distributed Database	
2	CSB822	8	Artificial Intelligence	
3	CSB823	8	Speech & Natural Language Processing	
4	CSB824	8	Neural Networks & Deep Learning	
List of Open Elective				
1	CSB831	8	Cryptography & Network Security	
2	CSB832	8	Mobile Applications & Services	
3	CSB833	8	Cyber Law & Ethics	
4	CSB834	8	Linux Internal	

Semester	Contact periods/ week	Credits
I	25	21
II	29	21
III	25	20.5
IV	25	21
V	25	20.5
VI	25	20.5
VII	24	19.5
VIII	24	16
TOTAL	**202**	**160**

Programme Outcome

1. Ability to acquire and apply knowledge of mathematics, computer sciences, communication engineering, image processing, Internet of things, data science, machine learning, artificial intelligence and deep learning.

2. Ability to identify, formulate and solve engineering problems, design a system, component or process to meet desired needs.

3. Ability to use techniques, skills and modern engineering tools necessary for engineering practices so as to be easily adaptable to industrial needs.

4. Understanding of the social, cultural, global and environmental responsibilities of a professional engineer.

5. Understanding of professional, ethical responsibilities, commitment to the community and the ability to function on multi-disciplinary teams.

6. Apply research-based knowledge to design and conduct experiments, analyze, synthesize and interpret the data pertaining to COMPUTER SCIENCE & ENGINEERING problems and arrive at valid conclusions.

7. Apply the contextual knowledge to assess social, health, safety and cultural issues and endure the consequences of responsibilities relevant to the professional engineering practice.

8. Design & develop systems that meet the requirements of public safety and offer solutions to societal and environmental concerns.

9. Examine the impact of engineering solutions in global and environmental contexts and utilize the knowledge for sustained development.

10. Develop consciousness of professional, ethical and social responsibilities as experts in the field of Computer Science & Engineering.

11. The technical students don't get the opportunity to know about the constitution of India since they divert their aim to acquire a technical degree. The programme, also gives the opportunity to know about the Indian constitution parallelly with technical education which is most important.

12. The coverage of the programme allows the students to consider different competitive exams such as CSIR-NET, GATE, RBI, SSC, UPSC(IES), UPSC(IAS), …etc

Programme Specific Outcome

1. Ability to Apply the fundamental concepts of computer science & engineering in designing components, developing systems for applications in various fields of technology such as signal processing, image processing, communication, networking, embedded systems, IoT, and Artificial Intelligence.

2. Ability to Select and apply cutting-edge engineering hardware and software tools to solve complex problems.

3. Apply principles of Engineering Mathematics, Physics and core engineering including applications appropriate to the COMPUTER SCIENCE & ENGINEERING.

4. Apply basic knowledge related to Computer Science, electronic Devices & Circuits, Electromagnetics, Digital Signal Processing, Communication Engineering and Embedded Systems to provide engineering solutions for IoT, ML and AI applications.

5. Demonstrate proficiency in use of software and hardware required in real life applications.

Course Specific Outcome

Semester	Course Code	Course Name	Course Outcome
III	CSB301	Object Oriented Programming	1. Specify simple abstract data types and design implementations, using abstraction functions to document them. 2. Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity. 3. Name and apply some common object-oriented design patterns and give examples of their use. 4. Design applications with an event-driven graphical user interface.
	CSB302	Data Structures & Algorithm	1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness. 2. For a given Search problem (Linear Search and Binary Search) student will able to implement it. 3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity. 4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity. 5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.
	CSB303	Computer Graphics & Virtual Reality	1.To list the basic concepts used in computer graphics. 2. To implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping. 3. To describe the importance of viewing and projections. 4. To define the fundamentals of animation and its related technologies. 5. Develop design and problem solving skills with application to computer graphics. 6. Gain experience in constructing interactive computer graphics programs using OpenGL

	MAT3T2	Differential Calculus	The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. The students will learn: 1. The mathematical tools needed in evaluating multiple integrals and their usage. 2. The effective mathematical tools for the solutions of differential equations that model physical processes. 3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.
	EC3T03	Digital Electronics & Logic Design	1. Understand working of logic families and logic gates. 2. Design and implement Combinational and Sequential logiccircuits. 3. Understand the process of Analog to Digital conversion and Digital to Analog conversion. 4. Be able to use PLDs to implement the given logical problem.
	CSB311	Object Oriented Programming Lab	To write programs based on the concepts (class, object, encapsulation, inheritance, polymorphism, etc.) learned in their theory subject.
	CSB312	Data Structures & Algorithm Lab	To write programs based on the concepts (data structures (stack, queue, tree, graph, etc.), sorting, searching, etc.) learned in their theory subject.
	EC3L02	Digital Electronics & Logic Design Lab	To clear the concepts of digital components and digital circuits to design complex digital circuits.
IV	CSB401	Design & Analysis of Algorithms	1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms . 2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms. 3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation. 4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming

CSB402	Web & Internet	1. Students are able to develop a dynamic webpage by the use of java script and HTML 2. Students will be able to write a well formed / valid XML document. 3. Students will be able to write a server side java application called Servlet to catch update and delete operations on DBMS table. 4. Students will be able to write a server side java application called JSP to catch form form data sent from client, process it and store it on database. data sent from client and store it on database.
CSB403	Formal Language & Automata Theory Automata Theory	1. Write a formal notation for strings, languages and machines. 2. Design finite automata to accept a set of strings of a language. 3. For a given language determine whether the given language is regular or not. 4. Design context free grammars to generate strings of context free language . 5. Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars 6. Write the hierarchy of formal languages, grammars and machines. 7. Distinguish between computability and non-computability and Decidability and undecidability.

	CSB404	Computer Organization & Architecture	1. Draw the functional block diagram of a single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. 2. Write assembly language program for specified microprocessor for computing 16 bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication). 3. Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process. 4. Given a CPU organization and instruction, design a memory module and analyze its operation by interfacing with the CPU. 5. Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology
	MAT4T2	Discrete Mathematics	1. For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives 2. For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference 3. For a given a mathematical problem, classify its algebraic structure 4. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra 5. Develop the given problem as graph networks and solve with techniques of graph theory.
	CSB411	Design & Analysis of Algorithms Lab	To write programs based on the concepts (quick sort, merge sort, heap sort, shortest path, graph/tree traversal, etc.) learned in their theory subject.
	CSB412	Web & Internet Lab	To write programs based on the concepts (Designing web using html, javascript, css, etc.) learned in their theory subject.
	CSB413	Computer Organization & Architecture Lab	To understand how the different components work and also design circuits to various ALU operations.
V	CSB501	Graph Theory	1. To learn the basic terminology and some of the theory associated with graphs. 2. To learn to model problems using graphs and to solve these problems algorithmically. 3. Modern applications of graph theory will be explored.

	CSB502	Operating System	1. Create processes and threads. 2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time. 3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time. 4. Design and implement file management system. 5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.
	CSB503	Database Management Systems	1. For a given query write relational algebra expressions for that query and optimize the developed expressions 2. For a given specification of the requirement design the databases using E R method and normalization. 3. For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2. 4. For a given query optimize its execution using Query optimization algorithms 5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability. 6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

	CSB504	Software Engineering	1. Acquire strong fundamental knowledge in science, mathematics, fundamentals of computer science, software engineering and multidisciplinary engineering to begin in practice as a software engineer. 2. Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns. 3. Deliver quality software products by possessing the leadership skills as an individual or contributing to the team development and demonstrating effective and modern working strategies by applying both communication and negotiation management skill. 4. Apply new software models, techniques and technologies to bring out innovative and novelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development
	MAT5T1	Numerical Analysis & Probability	1. To solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration by programming 2. To solve ordinary and partial differential equations using programming languages like C and softwares like MATLAB.
	CSB511	Software Engineering Lab	To understand the life cycle of software development., the use of various tools.
	CSB512	Operating System Lab	To write programs based on the concepts (file, various commands, memory management, etc.) learned in their theory subject.
	CSB513	Database Management Systems Lab	To write programs based on the concepts (storing/reading/updating data in tables, relationship among tables, extracting data) learned in their theory subject.
VI	CSB601	Compiler Design	1. For a given grammar specification develop the lexical analyser 2. For a given parser specification design top-down and bottom-up parsers 3. Develop syntax directed translation schemes 4. Develop algorithms to generate code for a target machine

	CSB602	Computer Networks	1. Explain the functions of the different layer of the OSI Protocol. 2. Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block. 3. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component 4. For a given problem related TCP/IP protocol developed the network programming. 5. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.
	CSB621	Data Mining	1. Study of different sequential pattern algorithms 2. Study the technique to extract patterns from time series data and it application in real world. 3. Can extend the Graph mining algorithms to Web mining 4. Help in identifying the computing framework for Big Data
	CSB622	Data Analytics	1. Explain NoSQL big data management 2. Install, configure, and run Hadoop and HDFS 3. Perform map-reduce analytics using Hadoop 4. Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics
	CSB623	Information Retrieval	1. To identify basic theories and analysis tools as they apply to information retrieval. 2 To develop understanding of problems and potentials of current IR systems. 3 To learn and appreciate different retrieval algorithms and systems. 4 To apply various indexing, matching, organizing, and evaluating methods to IR problem. 5 To become aware of current experimental and theoretical IR research.

	CSB624	Multimedia Technology	1. To identify a range of concepts, techniques and tools for creating and editing the interactive multimedia applications. 2. To identify the current and future issues related to multimedia technology. 3. To identify both theoretical and practical aspects in designing multimedia systems surrounding the emergence of multimedia technologies using contemporary hardware and software technologies.
	CSB625	Software Testing	1. Demonstrate knowledge of the fundamentals of software testing 2. Use fundamental techniques to implement techniques to extrapolate fundamental techniques in the framework of real world scenarios 3. Demonstrate competence in using software designed to assist in the software testing life cycle for given portions of the testing cycle 5. Methods of test generation from requirements 6.Test adequacy assessment using: control flow, data flow, and program mutations 5. The use of various test tools and Application of software testing techniques in commercial environments
	EC6T06	Information Theory & Coding	1. The aim of this course is to introduce the principles and applications of information theory. 2. The course will study how information is measured in terms of probability and entropy. 3 The students learn coding schemes, including error correcting codes, The Fourier perspective; and extensions to wavelets, complexity, compression, and efficient coding of audio-visual information

EC8T01	Digital Image Processing	1. Review the fundamental concepts of a digital image processing system. 2. Analyze images in the frequency domain using various transforms. 3. Evaluate the techniques for image enhancement and image restoration. 4. Categorize various compression techniques. 5. Interpret Image compression standards. 6. Interpret image segmentation and representation techniques.
MAT6T1	Operations Research	1. Apply the dynamic programming to solve problems of discreet and continuous variables. 2. Students should able to apply the concept of non-linear programming 3. Students should able to carry out sensitivity analysis 4. Student should able to model the real world problem and simulate it.
HSB601	Project Management & Entrepreneurship	1. Manage the selection and initiation of individual projects and of portfolios of projects in the enterprise. 2. Conduct project planning activities that accurately forecast project costs, timelines, and quality. Implement processes for successful resource, communication, and risk and change management. 3. Demonstrate effective project execution and control techniques that result in successful projects. 4. Demonstrate effective organizational leadership and change skills for managing projects, project teams, and stakeholders 5. To encourage students to take up entrepreneurship as a career option and to impart skills related to it. 6. Provide knowledge about various theories related to entrepreneur and entrepreneurship. 7. Entrepreneurship programme provides knowledge and skills on how to successfully develop captivating products and services to solve challenging problems in a highly uncertain environment, often under considerable time constraints with very limited resources. You will be able to apply these skills in the context of both new ventures as well as in established companies.
CSB611	Computer Networks Lab	Design, analyze, and test various network architectures. Implement various topologies and configure the network devices.

	CSB612	Compiler Design Lab	To write programs based on the concepts (token, parser) learned in their theory subject.
	CSB613	Application Programming Lab	To write programs based on the concepts learned in their theory subject.
VII	CSB701	Distributed System	1. To demonstrate knowledge of the basic elements and concepts related to distributed system technologies; 2. To demonstrate knowledge of the core architectural aspects of distributed systems; 3. To Design and implement distributed applications; 4. To Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems); 5. To use and apply important methods in distributed systems to support scalability and fault tolerance; 6. To demonstrate experience in building large-scale distributed applications.
	CSB702	Machine Learning	1. Extract features that can be used for a particular machine learning approach in various IOT applications. 2. To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach. 3. To mathematically analyze various machine learning approaches and paradigms.
	CSB721	Design & Management of Computer Network	1. A comprehensive knowledge of applicable methods and techniques and their limitations. 2. A deep knowledge and understanding of the principles of their specialties. 3. The ability to critically analyze the network.
	CSB722	Human Computer Interaction	1. Understand the structure of models and theries of human computer interaction and vision.\ 2. Design an interactive web interface on the basis of models studied.
	CSB723	Cloud Computing	1. Identify security aspects of each cloud model 2. Develop a risk-management strategy for moving to the Cloud 3. Implement a public cloud instance using a public cloud service provider 4. Apply trust-based security model to different layer

	CSB724	Wireless Sensor Networks	1. Describe and explain radio standards and communication protocols for wireless sensor networks. 2. Explain the function of the node architecture and use of sensors for various applications. 3. Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.
	CSB725	Internet-of- Things	1. Understand the vision of IoT from a global context. 2. Determine the Market perspective of IoT. 3. Use of Devices, Gateways and Data Management in IoT. 4. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints. Building state of the art architecture in IoT.
	CSB726	Real Time Systems	1. Characterise real time systems and describe their functions. 2. Analyse, design and implement a real-time system. 3. Apply formal methods to the analysis and design of real-time systems. 4. Apply formal methods for scheduling real-time systems. 5. Characterise and debug a real-time system. 6. Explain fundamental principles for programming of real time systems with time and resource limitations. 7. Describe the foundation for programming languages developed for real time programming. 8. Use real time system programming languages and real time operating systems for real time applications. 9. Analyse real time systems with regard to keeping time and resource restrictions.
	CSB727	Advanced Computer Architecture & parallel programming	2. Describe the operation of performance enhancements such as pipelines, dynamic scheduling, branch prediction, caches, virtual memory and vector processors. 3. Describe modern architectures such as RISC, Super Scalar, VLIW (very large instruction word), multi-core and multi-cpu systems. 4. Compare the performance of different architectures. **5.** Understand the concepts and programming principles involved in developing scalable parallel/HPC applications. 6. Write scalable parallel program using OpenMP for multicore architecture.

	EC7EL1	Embedded Systems & Design	1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 2. Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems. 3. Become aware of the architecture of the ATOM processor and its programming aspects (assembly Level) 4. Become aware of interrupts, hyper threading and software optimization. 5. Design real time embedded systems using the concepts of RTOS. 6. Analyze various examples of embedded systems based on ATOM processor
	CSB711	Project-I #	To identify real-world problems, analyze, and test a study by implementing it either individually or in a team. It helps to develop problem-solving skills and foster leadership qualities.
	CSB712	Machine Learning Lab	To write programs based on the concepts learned in their theory subject.
	CSB713	Colloquium-I*	Students are sent for industrial training to get real-life experience, Where they learn various technology such as IoT, machine learning, AI, web designing, application based software, etc.
VIII	CSB821	Distributed Database	Able to understand relational database management systems, normalization to make efficient retrieval from database and query.
	CSB822	Artificial Intelligence	1. Knowledge of what constitutes "Artificial" Intelligence and how to identify systems with Artificial Intelligence. 2. Explain how Artificial Intelligence enables capabilities that are beyond conventional technology, for example, chess-playing computers, self-driving cars, robotic vacuum cleaners. 3. Implement classical Artificial Intelligence techniques, such as search algorithms, minimax algorithm, neural networks, tracking, robot localisation. 4. Ability to apply Artificial Intelligence techniques for problem solving. 5. Explain the limitations of current Artificial Intelligence techniques.

	CSB823	Speech & Natural Language Processing	**1.** Compose key NLP elements to develop higher level processing chains **2.** Assess / Evaluate NLP based systems **3.** Choose appropriate solutions for solving typical NLP subproblems (tokenizing, tagging, parsing) **4.** Describe the typical problems and processing layers in NLP **5.** Analyze NLP problems to decompose them in adequate independant components
	CSB824	Neural Networks & Deep Learning	1. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains. 2. Implement deep learning algorithms and solve real-world problems 3. Explain different network architectures and how these are used in current applications 4. Implement, train, and evaluate neural networks using existing software libraries 5. Present and critically assess current research on neural networks and their applications 6. Relate the concepts and techniques introduced in the course to your own research 7. Plan and carry out a research project on neural networks within given time limits
	CSB831	Cryptography & Network Security	1. Describe network security services and mechanisms. 2. Symmetrical and Asymmetrical cryptography. 3. Data integrity, Authentication, Digital Signatures. 4. Various network security applications, IPSec, Firewall, IDS, Web security, Email security, and Malicious software etc.
	CSB832	Mobile Applications & Services	1. Identify the target platform and users and be able to define and sketch a mobile application 2. Understand the fundamentals, frameworks, and development lifecycle of mobile application platforms including iOS, Android, and PhoneGap 3. Design and develop a mobile application prototype in one of the platform (challenge project)

	CSB833	Cyber Law & Ethics	1. Describe laws governing cyberspace and analyze the role of Internet Governance in framing policies for Internet security 2. Discuss different types of cybercrimes and analyze legal frameworks of different countries to deal with these cybercrimes. 3. Explain the importance of jurisdictional boundaries and identify the measures to overcome cross jurisdictional cyber crimes. 4. Illustrate the importance of ethics in the legal profession and determine the appropriate ethical and legal behaviour according to legal frameworks 5. Identify intellectual property right issues in the cyberspace and design strategies to protect your intellectual property. 6. Assess the legal issues with e-commerce 7. Recognize the importance of digital evidence in prosecution and compare laws of different countries
	CSB834	Linux Internal	1. comfortably use basic UNIX/Linux commands from the command line (from a terminal window); 2. organize and manage their files within the UNIX/Linux file system; 3. organize and manage their processes within UNIX/Linux; 4. usefully combine UNIX/Linux tools using features such as filters, pipes, redirection, and regular expressions; 5. customize their UNIX/Linux working environment; 6. be knowledgeable enough about basic UNIX/Linux shell scripting to be able to successfully read and write bash shell scripts; 7. know how to use UNIX/Linux resources to find additional information about UNIX/Linux commands
	G8T01	Constitution of India	Enhance knowledge about the salient features of the constitution of India, the fundamental rights of citizen of India, the role of constitution in a democratic society and the need of constitution.
	HSB801	Human Relations at work	1. Students will develop skills required to interact with people at work. 2. Students will develop psychological and physical health in maintaining human relations at work and progressing in career.
	CSB811	Project-II	To identify real-world problems, analyze, and test a study by implementing it either individually or in a team. It helps to develop problem-solving skills and foster leadership qualities.

Number of courses having employability/entrepreneurship/skill development

Course Code	Course name	Activities having direct bearing on employability/entrepreneurship/skill development	Year of Introduction
G2L01	Workshop Practice	Content with direct bearing on Employability	2007
G1T05	Fundamentals of Computing	Content with direct bearing on Employability	2007
G1L02	Fundamentals of Computing Lab	Content with direct bearing on Employability	2007
CSB302	Data Structures & Algorithm	Content with direct bearing on Employability	2019
CSB312	Data Structures Lab	Content with direct bearing on Employability	2019
HSB601	Project Management and Entrepreneurship	Skill Development	2019
CSB621	Data Mining	Content with direct bearing on Employability	2019
CSB622	Data Analytics	Content with direct bearing on Employability	2019
CSB623	Information Retrieval	Content with direct bearing on Employability	2019
CSB624	Multimedia Technology	Content with direct bearing on Employability	2019
CSB625	Software Testing	Content with direct bearing on Employability	2019
CSB832	Mobile Applications & Services	Content with direct bearing on Employability	2019
EC3T03	Digital Electronics & Logic Design	Content with direct bearing on Employability	2019
EC3L02	Digital Electronics & Logic Design Lab	Content with direct bearing on Employability	2019
EC8T01	Digital Image Processing	Content with direct bearing on Employability	2019
EC7EL1	Embedded Systems & Design	Skill Development	2019
CSB727	Advanced Computer Architecture & parallel programming	Skill Development	2019
CSB724	Wireless Sensor Networks	Skill Development	2019
CSB725	Internet-of- Things	Content with direct bearing on Employability	2019
CSB726	Real Time Systems	Content with direct bearing on Employability	2019

CSB821	Distributed Database	Content with direct bearing on Employability	2019
CSB822	Artificial Intelligence	Content with direct bearing on Employability	2019
MAT6T1	Operations Research	Skill Development	2019
CSB723	Cloud Computing	Content with direct bearing on Employability	2019
CSB823	Speech & Natural Language Processing	Content with direct bearing on Employability	2019
CSB824	Neural Networks & Deep Learning	Content with direct bearing on Employability	2019
CSB831	Cryptography & Network Security	Content with direct bearing on Employability	2019
CSB833	Cyber Law & Ethics	Skill Development	2019
CSB834	Linux Internal	Content with direct bearing on Employability	2019