



RAMAIAH
Institute of Technology

CURRICULUM

Academic Year 2026– 2027

Batch - 2023

VII & VIII Semester B. E.
INFORMATION SCIENCE AND ENGINEERING

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
(Approved by AICTE, New Delhi & Govt. of Karnataka)
Accredited by NBA & NAAC with A⁺ Grade

About the Institute:

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 18 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with '**A***' grade by NAAC **in March 2021** for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute has also been conferred autonomous status for Ph.D. program since 2021. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 70% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation.

The Entrepreneurship Development Cell (EDC) and "Ramaiah Evolute" have been set up on campus to incubate startups. MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. The Institute is a member of DELNET, CMTI and VTU E-Library Consortium. The Institute has a modern auditorium, recording studio, and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 75th rank among 1584 top Engineering Institutions & 31st Rank among 131 Schools of Architecture in India for the year 2025.

About the Department:

The Department of Information Science and Engineering (ISE) was established in the year 1992 with an objective of producing high quality professionals to meet the demands of the emerging field of Information Technology. Department offers Bachelor's program in Information Science and Engineering (B. E), Master's program in Data Sciences (MTech) and Doctoral program (Ph.D.). The Department of Information Science and Engineering, is a progressive department that has made significant contributions to Academics, Research and Innovation. Under Graduate (UG) is accredited by the National Board of Accreditation in 2001, 2004, 2010, 2015, 2018 and reaccredited in 2022 under Tier-1 till 2028. The department has highly qualified and competent faculty members committed to innovative teaching learning and quality research. Department has 8 well-equipped state of the art laboratories which meets the requirement of curriculum, innovation and research. Collaboration with industries such as Apple, Unisys, Mindtree, Intel, Google, SECO, IBM, NVIDIA etc., has a significant impact on the curriculum, computing infrastructure, teaching & learning and research. The curriculum is centered around Data Science, Artificial Intelligence, IOT, Cloud & Distributed Computing, System Programming, Computer Security and Software development. Curriculum and the teaching learning process ensure that the students demonstrate technical competence, ethical reasoning, creativity in identification & formulation of the problems and develop solutions by using appropriate tools & techniques. Department has established technical clubs/professional student chapters to provide collaborative learning platform for the students. Echo system has been built to initiate start-ups/Innovation at the department level along with the mentorship program. The activities of the Department led to high profile placements, motivation to become an entrepreneur, and encouragement for higher learning.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

1. Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
2. Establishing research clusters in emerging areas in collaboration with globally reputed organizations
3. Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs

QUALITY POLICY

We at MS Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To evolve as an outstanding education and research center of Information Technology to create high quality Engineering Professionals for the betterment of Society

MISSION OF THE DEPARTMENT

Department of Information Science and Engineering shall create high quality IT Engineering Professionals for the betterment of society by:

1. Providing education through an ever improving curriculum and effective pedagogy techniques.
2. Encouraging extra and co-curricular activities to develop their overall personality along with technical skills.
3. Collaborating with industry and academia for strengthening research, innovation and entrepreneur ship ecosystem.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO1: Become competent Information Technology professionals with continuous progress in career or learning.

PEO2: Productively engage with society by practicing research or entrepreneurship.

PEO3: Function effectively as professionals in a team environment or individually.

PROGRAM OUTCOMES (POs):

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

PO2: 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.

PO3: 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.

PO4: 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.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: 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.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: 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.

PO11: 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.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: Apply Mathematical models, programming paradigms and software development practices to solve real world problems

PSO2: Adopt computing and communication models for developing IT solutions.

PSO3: Acquire data engineering skills to develop intelligent systems in a multidisciplinary environment.

Semester wise Credit Breakdown for B.E Degree Curriculum Batch 2023-27

Semester	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Total Credits
Course Category									
Basic Sciences (BSC)	08	08	03	03	--	--	--	--	22
Engineering Sciences (ESC)	09	08	--	--	--	--	--	--	17
Humanities, Social Sciences and Management (HSMC)	02	02	--	--	03	03	--	--	10
Ability Enhancement Course (AEC)	01	02	01	01	01	--	--	--	06
Universal Human Values (UHV)	--	--	02	--	--	--	--	--	02
Professional Core Courses (PCC)	--	--	11	12	12	06	04	--	45
Integrated Professional Core Course (IPCC)	--	--	04	04	03		04	--	15
Professional Elective Courses (PEC)	--	--	--	--	03	06	03	--	12
Institutional Open Elective Courses (IOE)	--	--	--	--	--	03	03	--	06
Internship (INT)	--	--	--	--	--	--	--	05	05
Mini Project / Project Work (PW)	--	--	--	--	--	04	--	13	17
Non Credit Mandatory Courses (NCMC)	--	--	Yes	Yes	Yes	--	--	Yes	--
Skill Development Course (SDC)	--	--	--	--	--	01	02	--	03
Total Credits	20	20	21	20	22	23	16	18	160

**SCHEME OF TEACHING
VII SEMESTER**

VII SEMESTER									
Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	IS71	Distributed Computing	ISE	IPCC	3	0	1	4	5
2	IS72	Information Security	ISE	PCC	3	0	0	3	3
3	ISE73x	Program Elective Course-4	ISE	PEC	3	0	0	3	3
4	ISOE0*	Institutional Open Elective-2	ISE	OEC	3	0	0	3	3
5	ISL74	Big Data Lab	ISE	PCC	0	0	1	1	2
6	ISL75	Skill Enhancement Lab: Generative AI	ISE	SDC	0	1	1	2	4
Total					12	1	3	16	20

Programme Electives Course – 4

Sl. No	Code	Subject
1	ISE731	Deep Learning
2	ISE732	Predictive Analytics
3	ISE733	Quantum Computing
4	ISE734	Software Testing

Institutional Open Elective-2

Sl. No	Code	Subject
1	ISOE03	Introduction to Artificial Intelligence
2	ISOE04	Fundamental of Cloud Computing

**SCHEME OF TEACHING
VIII SEMESTER**

Sl.no	Subject Code	Subject	Teaching Department	Category	Credits				Total Contact hours/week
					L	T	P	Total	
1	ISP81	Project Work	ISE	PW	0	0	13	13	-
2	INT82	Research/Industrial Internship	ISE	INT	0	0	5	5	-
		Total			0	0	18	18	
3	PE83	Physical Education		NCMC	All students have to register compulsorily for any one of the courses with the concerned coordinator in the beginning of III semester. Attending the registered course from III to VI semesters. Qualification is mandatory for the award of the degree.				
	YO83	Yoga							
	NS83	NSS							

DISTRIBUTED COMPUTING	
Course Code: IS71	Credits: 3:0:1
Pre – requisites: NIL	Contact Hours:42L+14P
Course Coordinator: Mr. Shivananda S	

Course Content

Unit-1

Introduction to parallel programming, Parallel hardware and parallel software – Classifications of parallel computers, SIMD systems, MIMD systems, Interconnection networks, Cache coherence, Shared-memory vs. distributed-memory, Coordinating the processes/threads, Shared-memory, Distributed-memory.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: <https://archive.nptel.ac.in/courses/106/102/106102163/>

Unit-2

GPU programming, Programming hybrid systems, MIMD systems, GPUs, Performance - Speedup and efficiency in MIMD systems, Amdahl's law, Scalability in MIMD systems, Taking timings of MIMD programs, GPU performance.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: <https://archive.nptel.ac.in/courses/106/105/106105220/>

Unit-3

Distributed memory programming with MPI – MPI functions, The trapezoidal rule in MPI, Dealing with I/O, Collective communication, MPI-derived datatypes, Performance evaluation of MPI programs, A parallel sorting algorithm.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: <https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-cs21/>

Unit-4

Shared-memory programming with Open MP – open MP pragmas and directives, The trapezoidal rule, Scope of variables, The reduction clause, loop carried dependency, scheduling, producers and consumers, Caches, cache coherence and false sharing in open MP, tasking, thread safety.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: <https://hpc-tutorials.llnl.gov/openmp/>

Unit-5

GPU programming with CUDA - GPUs and GPGPU, GPU architectures, Heterogeneous computing, Threads, blocks, and grids Nvidia compute capabilities and device architectures, Vector addition, returning results from CUDA kernels, CUDA trapezoidal rule I, CUDA trapezoidal rule II: improving performance, CUDA trapezoidal rule III: blocks with more than one warp.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: <https://developer.nvidia.com/cuda-education-training>

LAB Programs

Programs:

1. Write a program to sort an array of n elements using both sequential and parallel merge sort (using Section). Record the difference in execution time.
2. Estimate the value of pi using:

$$\Pi = 4 \sum_{k=0}^{\infty} \frac{(-1)^k}{2k+1}$$

Parallelize the code by removing loop carried dependency and record both serial and parallel execution times.

3. Write an Open MP program that divides the Iterations into chunks containing 2 iterations, respectively (OMP_SCHEDULE=static,2). Its input should be the number of iterations, and its output should be which iterations of a parallelized for loop are executed by which thread. For example, if there are two threads and four iterations, the output might be the following:
 - i. Thread 0: Iterations 0 — 1
 - ii. Thread 1: Iterations 2 — 3
4. Write a program to calculate n Fibonacci numbers using tasks.
5. Write a program to find the prime numbers from 1 to n employing parallel for directive. Record both serial and parallel execution times.
6. Demonstration of MPI_Send and MPI_Recv
7. Demonstration of deadlock using point to point communication
8. Avoidance of deadlock by altering the call sequence
9. Avoidance of deadlock by non-blocking calls
10. Demonstration of Broadcast operation
11. Demonstration of MPI_Scatter and MPI_Gather
12. Demonstration of MPI_Reduce and MPI_Allreduce (MPI_MAX, MPI_MIN, MPI_SUM, MPI_PROD).

Text Books:

1. Peter S Pacheco, Matthew Malensek – An Introduction to Parallel Programming, second edition, Morgan Kaufman,2022
2. Michael J Quinn – Parallel Programming in C with MPI and Open MP, McGraw-Hill,2021

Reference Books:

1. Calvin Lin, Lawrence Snyder – Principles of Parallel Programming, Pearson,2021
2. Barbara Chapman – Using Open MP: Portable Shared Memory Parallel Programming, Scientific and Engineering Computation,2023
3. William Gropp, Ewing Lusk – Using MPI: Portable Parallel Programing, Third edition, Scientific and Engineering Computation,2022

Course Outcomes:

1. Understand the need for parallel programming (PO – 1, 2, PSO - 1)
2. Understand GPU programming and explain performance (PO - 1, 2, 4, 5, PSO - 1)

3. Apply MPI library and parallelize the suitable programs (PO – 1, 2, 3, 4, 5, PSO - 1)
4. Apply Open MP pragma and directives to parallelize C programs (PO - 1, 2, 3, PSO- 1)
5. Apply CUDA library and parallelize the given serial code (PO - 1, 2, 3, 4, 5, PSO - 1)

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Lab Evaluation(Record and Test)	10	CO1, CO2, CO3, CO4
Technical Paper Writing	10	CO1, CO2, CO3, CO4,CO5
Semester-End Examination (SEE)	100 (Scale down to 50 Marks)	CO1, CO2, CO3, CO4, CO5

INFORMATION SECURITY	
Course Code: IS72	Credits: 3:0:0
Pre – requisites: Computer Networks	Contact Hours:42L
Course Coordinator: Dr. Geetha V	

Course Content

Unit-1

Symmetric Ciphers: Symmetric cipher model, cryptography, cryptanalysis, Substitution techniques, Transposition Techniques. **Block Ciphers and the Data Encryption Standard:** Simplified DES, Block Cipher Principles, DES, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher modes of operation.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links:

1. <https://guides.library.cmu.edu/c.php?g=572612&p=3948772>
2. <https://nptel.ac.in/courses/106104467>

Unit-2

Public Key Algorithms: Introduction, Modular Arithmetic, RSA, Diffie-Hellman, Digital Signature Standards, How Secure are RSA and Diffie-Hellman, Elliptic Curve Cryptography. **Hash and MAC Algorithms:** Secure Hash Algorithm, Whirlpool, HMAC and CMAC.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links:

1. <https://library.educause.edu/topics/cybersecurity/network-security>
2. <https://nptel.ac.in/courses/106106248>

Unit-3

Detecting Live Systems: Detecting Active Systems, Port Scanning, OS fingerprinting, Scanning countermeasures. **Entity Authentication:** Password based Authentication, Challenge Response Protocols, Zero Knowledge Protocols. **Key Management:** Symmetric key Distribution, Kerberos, Symmetric Key Agreement, Public Key Distribution.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links:

1. <https://www.youtube.com/watch?v=Q-HugPvA7GQ&list=PL71FE85723FD414D7>
2. <https://nptel.ac.in/courses/106105031>

Unit-4

Automated Attack and Penetration Tools: Why attack and penetration Tools are Important, Automated Exploit Tools, Determining Which Tools to use. **Defeating Malware:** Evolving threat, viruses, and Worms, Trojans. **Malicious Software:** Viruses and Related Threats, Virus Countermeasures, DDoS Attacks **Firewalls:** Firewall Design Principles, Trusted Systems.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links:

1. <https://nptel.ac.in/courses/106105162>
2. <https://nptel.ac.in/courses/106106221>

Unit-5

Securing Wireless Systems: Wi-Fi Basics, Wi-Fi Security, Wireless LAN threats, exploiting wireless networks, Securing wireless Networks

Intrusion Detection: Overview ID detection and Prevention, IDS Types and Components, an overview of Snort, Installing Snort on windows System, and Building snort rules and interface.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links:

1. <https://nptel.ac.in/courses/106106157>
2. <https://www.youtube.com/watch?v=9X1rSWLFhLY&list=PL9FuOtXibFjV77w2eyil4Xzp8eooqsPp8>

Text Books:

1. William Stallings, “Cryptography and Network Security principles and practices” 8th Edition PHI 2023.

Reference Books:

1. Michael Gregg, “Building your own Security LAB, A field Guide for Network Testing” Wiley India 2012.
2. Behrouz Forouzan, “Introduction to Cryptography and Network Security”, McGraw Hill, 2nd edition 2008.

Course Outcomes:

1. Apply symmetric and block cipher technique to provide message confidentiality. (PO-1,2) (PSO-2)
2. Apply asymmetric key algorithms to preserve message authentication and confidentiality. (PO-1,2) (PSO-2)
3. Understand the concepts of live systems, entity authentication and key management. (PO-1) (PSO-2)
4. Use the automated tools to detect various types of attacks. (PO-1,2,3,4,5,9,10,12) (PSO-2)
5. Understand the security concepts of wireless networks. (PO-1) (PSO-2)

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal Test-I	30	CO1, CO2, CO3
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Quiz	10	CO1, CO2, CO3, CO4,CO5
Project based learning	10	CO1, CO2, CO3, CO4,CO5
Semester-End Examination (SEE)	100 (Scale down to 50 Marks)	CO1, CO2, CO3, CO4, CO5

DEEP LEARNING	
Course Code: ISE731	Credits: 3:0:0
Prerequisites: Machine Learning	Contact Hours: 42L
Course Coordinator: Dr. Sumana M	

Course Content

UNIT-I

A review of Machine Learning: How can Machines Learn? biological inspiration, what is deep learning? How does machine learning work? Evaluating models. **Foundations of neural Networks and deep learning:** Neural Networks, Training Neural Networks, Activation Functions, Loss Functions, Hyper parameters.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: https://onlinecourses.nptel.ac.in/noc20_cs62/preview

<https://a.impartus.com/ilc>

UNIT-II

Fundamentals of Deep Networks: Defining Deep Learning, Common architectural principles of Deep Networks, Building Blocks of Deep Networks. **Major Architectures of Deep Networks:** Unsupervised Pretrained Networks, Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Recursive Neural networks.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: https://onlinecourses.nptel.ac.in/noc20_cs62/preview

<https://a.impartus.com/ilc>

UNIT-III

Building Deep Networks: Matching deep Networks to the Right Problem. **Tuning Deep Networks:** Basic concepts in Tuning Deep Networks, Matching Input data and Network Architectures, Relating model Goal and Output Layers. working with layer count, parameter count and memory, weight initialization strategies, using activation functions, Applying Loss functions, Understanding Learning Rates, How Sparsity Affects Learning.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: https://onlinecourses.nptel.ac.in/noc20_cs62/preview

<https://a.impartus.com/ilc>

UNIT-IV

Tuning Deep Networks: Applying methods of optimization, Using Parallelization and GPUs for faster training, Controlling Epochs and Mini Batch Size, How to use Regularization, working with Class-Imbalance, Dealing with Overfitting. **Tuning Specific deep network architecture:** CNN, RNN. VGGNet, GoogleNet, AlexNet, Capsule networks

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: https://onlinecourses.nptel.ac.in/noc20_cs62/preview

<https://a.impartus.com/ilc>

UNIT-V

Autoencoders: Undercomplete Autoencoders, Regularized Autoencoders, Stochastic Encoders and Decoders, Denoising Autoencoders, Contractive Autoencoders. **Deep Generative Models:** Boltzmann Machines, Restricted Boltzmann Machines, Deep Belief Networks, Deep Boltzmann Machines, Boltzmann Machines for Real-Valued Data, Convolutional Boltzmann Machines, Other Boltzmann Machines, Evaluating Generative Models.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: https://onlinecourses.nptel.ac.in/noc20_cs62/preview
<https://a.impartus.com/ilc>

Textbook:

1. Josh Patterson & Adam Gibson, Deep Learning – A Practitioners Approach, O'Reilly, 1st Edition 2017.
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

Reference:

1. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
2. Ravichandiran, S. (2019). Hands-On Deep Learning Algorithms with Python: Master deep learning algorithms with extensive math by implementing them using Tensor Flow. Packet Publishing Ltd.
3. <http://neuralnetworksanddeeplearning.com/>

Course Outcomes (COs):

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

1. Analyze and interpret the concepts of neural networks relating to artificial intelligence. (PO-1,2) (PSO-1, 3)
2. Illustrate the learning processes and their statistical properties. (PO-1, 2) (PSO-1, 3)
3. Analyze the tuning parameters while building deep learning models for better performance (PO-1,2,3,5,9,10,11,12) (PSO 1-3)
4. Assessing the various deep learning models through fine tuning the hyperparameters. (PO-1,2,3,5,9,10,11,12) (PSO-1, 3)
5. Develop and analyze the applications using Autoencoders and Generative models (PO-1,2,3,5,9,10,11,12) (PSO-1,3)

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning)

- Project based learning

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Problem statement implementation	10	CO1, CO2, CO3, CO4, CO5
Report with demo	10	CO1, CO2, CO3, CO4, CO5
Semester-End Examination (SEE)	100 (Scale down to 50 Marks)	CO1, CO2, CO3, CO4, CO5

PREDICTIVE ANALYTICS	
Course Code: ISE732	Credits: 3:0:0
Prerequisites: Machine Learning	Contact Hours: 42L
Course Coordinator: Dr. Anitha P	

Course Content

Unit-1

Overview of Predictive Analytics: What is Analytics and Predictive Analytics? Business Intelligence, Difference between Predictive Analytics and Business Intelligence, Predictive analytics vs Data mining, who uses predictive analytics? Challenges in predictive analytics.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: <https://nptel.ac.in/courses/110106072>

Unit-2

Setting up the problem: Predictive Analytics Processing steps: CRISP-DM, Business understanding, defining data for predictive model and target variable, defining measures of success for predictive models, Doing predictive modeling out of order, case study on fraud detection. **Data understanding:** Data visualization in one dimension.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: <https://nptel.ac.in/courses/110106072>

Unit-3

Data Preparation: Variable Cleaning, Feature creation. **Descriptive Modeling:** Data Preparation with Descriptive Modeling, Principal Component Analysis.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: https://onlinecourses.nptel.ac.in/noc23_ma46/preview

Unit-4

Itemsets and Association rules: Terminology, Parameter settings, How the data is organized, deploying association rules, problems with association rules, Building classification rules from association rules.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: https://onlinecourses.nptel.ac.in/noc23_ma46/preview

Unit-5

Assessing Predictive models: Batch approach to model assessment, assessing regression models. **Text Mining:** A predictive modeling approach to text mining, Data preparation steps, Text mining features.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: https://onlinecourses.nptel.ac.in/noc23_ma46/preview

Course outcomes

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

1. Understand the basic concepts and challenges in Predictive Analytics (PO-1,2) (PSO-3).
2. Analyze the working of the predictive model with a case study (PO-1,2,3,5) (PSO-3).
3. Describe the concepts of Data Preparation and Modeling (PO-1,2,3,5) (PSO-3).
4. Examine the predictive modeling algorithms (PO-1,2,3,5) (PSO-3).
5. Describe the assessment of Predictive models (PO-1,2,3,4,5) (PSO-3).

Suggested Learning Resources:

Text Book

1. Abbott, D. Applied predictive analytics: Principles and techniques for the professional data analyst. John Wiley & Sons, 2014.

References:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-Data Mining, Inference, and Prediction, Second Edition, Springer Verlag, 2009.
2. G. James, D.Witten, T.Hastie, R.Tibshirani - An introduction to statistical learning with applications in R, Springer,2013.

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Case study

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal Test-I	30	CO1, CO2, CO3
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Case study	10	CO1, CO2, CO3, CO4,CO5
MOOC course	10	CO1, CO2, CO3, CO4,CO5
Semester-End Examination (SEE)	100 (Scale down to 50 Marks)	CO1, CO2, CO3, CO4, CO5

QUANTUM COMPUTING	
Course Code: ISE733	Credits:3:0:0
Pre – requisites: Computer Networks	Contact Hours:42L
Course Coordinator: Dr. Geetha V	

Course Content

Unit-1

Quantum Building Blocks: Quantum mechanics of Photon Polarization, Single Quantum bits, Single Qubit Measurement, A Quantum key Distribution Protocol, State Space of a Single-Qubit System, Direct Sums and Tensor Products of Vector Spaces, State Space of an n-Qubit System, Entangled States, Multi-Qubit Measurement, QKD using Entangled states

- **Pedagogy/Course Delivery tools:** Chalk-and-talk , Power Point Presentations
- **Links:** <https://nptel.ac.in/courses/106106232>
<https://quantumindia.net/wp-content/uploads/2023/03/Quantum-Vibes-newsletter-March2023.pdf>

Unit-2

Multiple-Qubit States Measurements: Dirac's bra/ket Notation for Linear transformations, Projection operators, Hermitian Operator Formalism, Bell's Theorem.

- **Pedagogy/Course Delivery tools:** Chalk-and-talk , Power Point Presentations
- **Links:** <https://quantumindia.net/wp-content/uploads/2024/06/Quantum-Vibes-Q1-2024.pdf>
<https://quantumindia.net/wp-content/uploads/2025/05/Quantum-Vibes-Q1-2025.pdf>

Unit-3

Quantum State Transformations: Unitary transformations, Simple Quantum Gates, Pauli transformations, Hadamard Transformations, Multiple-Qubit Transformations, Controlled-NOT and other singly controlled gates, Applications of Simple Gates, Dense coding, Quantum teleportation

Pedagogy/Course Delivery tools: Chalk-and-talk , Power Point Presentations

Links: <https://nptel.ac.in/courses/106106241>
https://onlinecourses.nptel.ac.in/noc23_cs04/preview

Unit-4

Quantum Algorithms: Computing with Superpositions, Walsh-Hadamard transformation, Quantum Parallelism, Notions of Complexity, Query Complexity, Communication Complexity, Simple Quantum Algorithm

- **Pedagogy/Course Delivery tools:** Chalk-and-talk , Power Point Presentations
- **Links:** <https://www.youtube.com/watch?v=BQhZpcg0sc4>
<https://nptel.ac.in/courses/106106241>

Unit-5

Simon's And Grover's Algorithm: Classical reduction to Period-Finding, Example illustrating Simon's Algorithm, DLP and Hidden Subgroup Problems, Grover's Algorithm, Amplitude amplification

Pedagogy: Chalk-and-talk , Power Point Presentations

Links: <https://quantumindia.net/cdac-quantum-activities/>
<https://quantumindia.net/qc-workshops-events/>

Text Book:

1. Quantum Computing: A Gentle Introduction, Eleanor Rieffel and Wolfgang Polak, 2014, The MIT Press, ISBN 9780262015066.
2. An introduction to Quantum Computing, Phillip Kaye, Raymond Laflamme, Michele Mosca, Oxford University Press, 2007, ISBN-13: 978-0198570493, ISBN-10: 019857049X

Reference Books:

1. Quantum Computing for Computer Scientists, 1st Edition, Noson S. Yanofsky and Mirco A. Mannucci, Cambridge University Press, 2008, ISBN 978-0-521-879965
2. Quantum Computing for Everyone, Chris Bernhardt, MIT Press, 2019 ISBN: 9780262039253

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes attained
Internal Test-I	30	CO1, CO2, CO3
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Gate Based Aptitude Test	10	CO1, CO2, CO3, CO4,CO5
Programming Assignment	10	CO1, CO2, CO3, CO4,CO5
Semester-End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

SOFTWARE TESTING	
Course Code: ISE734	Credits: 3:0:0
Pre – requisites: Software Engineering	Contact Hours: 42L
Course Coordinator: Dr. Pushpalatha M N	

Course Content

Unit I

Basics of software testing: Definition, objectives, types of testing, importance of testing. Software development life cycle (SDLC) and its role in testing: Different phases, testing activities in each phase. Testing methodologies: Black-box testing, white-box testing, gray-box testing. Testing tools and techniques: Manual testing, automation testing, unit testing, integration testing, system testing, acceptance testing.

- **Pedagogy/Course Delivery tools:** Chalk-and-talk, PPT and Conceptual Learning using problem-solving sessions
- **Links:** https://nptel.ac.in/courses/noc22_cs6

Unit II

Equivalence partitioning: Basic concepts, guidelines, examples. Boundary value analysis: Basic concepts, guidelines, examples. Decision table testing: Basic concepts, guidelines, examples. Error guessing: Techniques and applications. Test case design approaches: Data-driven testing, keyword-driven testing, behavior-driven testing.

Pedagogy/Course Delivery tools: Chalk and talk, PPT and Analytical Learning through NPTEL videos and illustrative case problem

- **Links:** https://nptel.ac.in/courses/noc22_cs6

Unit III

Test execution process: Planning, setup, execution, reporting. Defect management: Bug reporting, tracking, and resolution. Testing tools and automation frameworks: Introduction to popular tools and frameworks for test execution and automation. Non-functional testing: Performance testing, Security testing, usability testing.

- **Pedagogy/Course Delivery tools:** Chalk-and-talk, PPT and Structure-oriented Learning using implementation exercises
- **Links:** https://nptel.ac.in/courses/noc22_cs6

Unit IV

Agile testing principles and practices: Test-driven development (TDD), continuous integration and continuous delivery (CI/CD), exploratory testing. API testing: Concepts, tools, and techniques. Mobile testing: Challenges and best practices for mobile app testing.

Security testing: OWASP Top 10, common vulnerabilities, and testing methodologies.

- **Pedagogy/Course Delivery tools:** Chalk-and-talk, PPT and Conceptual Learning using NPTEL video lectures and problem-solving sessions
- **Links:** https://nptel.ac.in/courses/noc22_cs6.

Unit V

Effective communication in testing: Reporting test results, defect documentation, communication with stakeholders. Test plan and test case documentation: Importance, structure, best practices. Quality assurance metrics and reporting: Code coverage, defect tracking metrics, test effectiveness reports.

- **Pedagogy/Course Delivery tools:** Chalk-and-talk, PPT and Real-world Case-based Learning with NPTEL content and scenario discussions
- **Links:** https://nptel.ac.in/courses/noc22_cs6

Text Book:

1. Paul C. Jorgensen and Byron DeVries, “Software Testing: A Craftsman’s Approach,” 5th Edition, Auerbach Publications, 2022.
2. Matthew Heusser and Michael Larsen, “Software Testing Strategies: A Testing Guide for the 2020s,” 1st Edition, Packt Publishing, December 2023

Reference Books:

1. Phillip Amman and Paul Underwood, Foundations of Software Testing, 6th Edition , Pearson Education, 2010
2. Lisa Crispin and Janet Gregory, Agile Testing: A Practical Guide for Testers and Agile Teams, Addison-Wesley Professional, 2009.

Self-Learning: Case Study

Course Outcomes(COs):

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

1. Understand the software development lifecycle (SDLC) and its relation to testing (PO -1, 4, 5 ; PSO- 1,2)
2. Apply various testing techniques and methodologies to different software types. (PO -1, 2, 3, 5 ; PSO- 1,2)
3. Analyze test results and identify potential defects. (PO -1, 2, 3, 5 ; PSO- 1,2)
4. Evaluate the effectiveness of different testing strategies. (PO -1, 2, 3, 5 ; PSO- 1,2)
5. Create test plans and documentation based on project requirements. (PO - 5,10 ; PSO- 1,2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes attained
Internal Test-I	30	CO1, CO2, CO3
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Quiz	10	CO1, CO2, CO3, CO4,CO5
Case Study	10	CO1, CO2, CO3, CO4,CO5
Semester-End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

BIG DATA LAB	
Course Code: ISL74	Credits: 0:0:1
Prerequisites: NIL	Contact Hours: 28
Course Coordinator: Mrs. Shanmuga Priya R	

Course Contents

PART-A

Write MapReduce programs for the following using Java:

1. To count the number of occurrences of each word in a given input text.
2. To read N natural numbers and display the sum along with Odd and Even count.
3. To analyse the given **Employee Data** and generate a statistics report with the total number of Female and Male Employees and their average Salary.
4. To analyse the **Titanic Ship Data** and find the average age of the people (both male and female) who died in the tragedy and also how many people are survived in each class.
5. To analyse the **Earthquake Data** and generate statistics with region and magnitude/region and depth/region and latitude/region and longitude.
6. To analyse the given **Sales Records** over a period of time and generate data about the country's total sales and the total number of products. Country's total sales and the frequency of the payment mode.

PART-B

1. Write a **Spark program using Python**, to count the number of lines and number of characters of each word in a given paragraph.
2. Write a **Spark program using Python**, to analyse the given **Weather Report Data** and to generate a report with cities having maximum and minimum temperature for a particular year.
3. Write a **Spark program using Python**, to analyse the given **Insurance Data** and generate a statistics report with the construction building name and the count of building/ county name and its frequency.
4. Write **Pig Latin scripts** for the following queries on **Crop Production Dataset**:
 - i. Calculate total production of each crop.
 - ii. Find the average production per year for each crop.
 - iii. Filter all crops grown in 'Karnataka'.
 - iv. Calculate the total area used for each crop in the year 2010.
5. Write **Pig Latin scripts** for the following queries on **Olympic Athletes and Hosts Dataset**:
 - i. Filter athletes participated in the "Tokyo 2020" games.
 - ii. Filter the games held in "China".
 - iii. Group games by season and count the number of games in each session.
 - iv. Filter games that occurred after the year 2000.
6. Write **Pig Latin scripts** for the following on **Online Retail Dataset**:
 - i. Total number of unique customers in the "United Kingdom".
 - ii. Find total invoices generated in the year 2009.

- iii. Generate the total revenue collected from Country="France".
- iv. Find the country in which the maximum number of items were sold.

Text Books:

1. "Hadoop: The Definitive Guide", Tom White ,4th Edition, O'Reilly Media, 2015.
2. "Learning Spark: Lightning-Fast Big Data Analysis", Holden Karau, Andy Konwinski, Patrick Wendell, and Matei Zaharia, O'Reilly Media, 2016.
3. "Programming pig: Dataflow scripting with Hadoop", Gates, Alan, and Daniel Dai. O'Reilly Media, 2016.

Reference Links:

1. <https://www.youtube.com/watch?v=u32ksikUX-M>
2. <https://www.youtube.com/watch?v=-5yf4vCUsbQ>
3. https://www.youtube.com/watch?v=Hve24pRW_Ps

Course Outcomes:

1. Explore Hadoop ecosystem and MapReduce programming model to develop and execute a range of applications for Big Data analytics. (PO-1, 2, 3, 5, 9, 10) (PSO- 1, 2)
2. Dissect Apache Spark, a faster alternative to MapReduce, by implementing and analysing large-scale data applications. (PO-1, 2, 3, 5, 9, 10) (PSO- 1, 2)
3. Analyse Big Data applications using Pig for efficient data processing and querying. (PO- 1, 2, 3, 5, 9, 10) (PSO- 1, 2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course Outcomes Attained
Internal Test	20	CO1, CO2, CO3
Other Components		
Weekly Evaluation- Lab Record	20	CO1, CO2, CO3
Quiz	10	CO1, CO2, CO3
The Final CIE out of 50 Marks = Marks Scored in Lab Test + Marks of Lab Record + Marks Scored in Quiz		
Semester-End Examination (SEE)	50	CO1, CO2, CO3

SKILL ENHANCEMENT LAB: GENERATIVE AI	
Course Code: ISL75	Credits : 0:1:1
Prerequisite: Nil	Contact Hours: 14T+14P
Course Coordinator: Mr. Shivananda S	

Course Contents

- Introduction to Generative AI
- Image and Video Generation Tools
- Copilot, Claude, BRAD, Educational generative AI.
- Preliminary Project Based Learning
- Large Language Models Prompt Engineering
- DNNs Tensor Flow
- Word Embedding's
- Hugging Face Models
- LangChain - Basics of Chains
- LangChain Model IO, LangChain - RAG
- LangChain – Memory, LangChain - Agents
- Recurrent neural network, Long Short-Term Memory
- Transformers
- Project Based Learning

The list of Laboratory Exercises formulated covering all the above topics are mentioned in the table below:

Expt. No.	Laboratory Exercises
1.	Using Generative AI tools, create a short story or poem (text generation) based on a chosen theme, then generate an image (text-to-image generation) and a 15–30 second sound or music clip (AI sound generation) that represent the same theme, and analyzing how well the text, image, and sound outputs align with each other while discussing the strengths, limitations, and ethical challenges of multimodal generative AI.
2.	Use word embeddings to improve prompts for Generative AI model. Retrieve similar words using word embeddings. Use the similar words to enrich a GenAI prompt. Use the AI model to generate responses for the original and enriched prompts. Compare the outputs in terms of detail and relevance.
3.	You are asked to develop a predictive model for academic performance. Build a DNN that predicts whether a student will pass or fail based on their study hours and attendance percentage.
4.	Build and train a Convolutional Neural Network (CNN) from scratch to classify images from a dataset such as MNIST (handwritten digits) or CIFAR-10 (colored objects). Experiment with different CNN architectures by changing the number of convolutional

	layers, filter sizes, and pooling operations. Train the model, evaluate its accuracy on the test set, and discuss CNN's performance, the effect of architectural choices, and possible improvements.
5.	Use dimensionality reduction (e.g., PCA or t-SNE) to visualize word embeddings for Q 1. Select 10 words from a specific domain (e.g., sports, technology) and visualize their embeddings. Analyze clusters and relationships. Generate contextually rich outputs using embeddings. Write a program to generate 5 semantically similar words for a given input.
6.	Train a custom Word2Vec model on a small dataset. Train embeddings on a domain-specific corpus (e.g., legal, medical) and analyze how embeddings capture domain-specific semantics.
7.	Install langchain , cohere (for key), langchain-community. Get the api key. Load a text document from the your google drive . Create a prompt template to display the output in a particular manner.
8.	Use a pre-trained Hugging Face model to analyze sentiment in text. Assume a real-world application, Load the sentiment analysis pipeline. Analyze the sentiment by giving sentences to input.
9.	Take the Institution name as input. Use Pydantic to define the schema for the desired output and create a custom output parser. Invoke the Chain and Fetch Results. Extract the below Institution related details from Wikipedia: The founder of the Institution. When it was founded. The current branches in the institution. How many employees are working in it? A brief 4-line summary of the institution.
10.	Build a chatbot for the Indian Penal Code. We'll start by downloading the official Indian Penal Code document, and then we'll create a chatbot that can interact with it. Users will be able to ask questions about the Indian Penal Code and have a conversation with it.
11.	Implement a Recurrent Neural Network (RNN) using the PyTorch framework.
12.	Build and train an LSTM-based text generation model using a dataset of your choice (e.g., Shakespeare's plays, song lyrics, or news articles). Preprocess the text into sequences, train the LSTM to predict the next character or word, and then generate new text by providing a starting seed phrase. Experiment with hyperparameters such as sequence length, number of LSTM units, and training epochs.

Text Book:

1. Venkata Reddy Konasani, Shailendra Kadre. Machine Learning and Deep Learning Using Python and TensorFlow 1st Edition, McGraw Hill, 2021
2. Raghav Bali. Generative AI with Python and TensorFlow 2. Packt Publishing, 2021.

Course Outcomes:

1. Apply fundamental concepts of Large Language Models (LLMs), Prompt Engineering, and Word Embeddings to optimize AI-driven text processing tasks. (PO – 1, 2, 3,4, 5, 9) (PSO – 2)
2. Implement and evaluate Artificial Neural Networks (ANNs), Deep Neural Networks (DNNs) using TensorFlow, and Gradient Descent techniques for efficient model training and performance tuning. (PO – 1, 2, 3,4, 5, 9) (PSO – 2)
3. Develop AI applications using Hugging Face Models, LangChain (Chains, Model

IO, RAG, Memory, Agents), RNNs, LSTMs, and Transformers to enhance intelligent system capabilities. (PO – 1, 2, 4, 5) (PSO – 2)

Continuous Internal Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Weekly Assessment	30	CO1, CO2, CO3
Project Evaluation (Internal)	20	CO1, CO2, CO3
Semester End Evaluation		
Project Evaluation (External)	50	CO1, CO2, CO3

Sl No	Evaluation Criteria for Project	Marks
1	Problem Definition & Motivation	5
2	Literature Review & Technology Selection	5
3	Design, Methodology & Implementation	15
4	Results, Evaluation & Analysis	10
5	Demo, Presentation & Documentation	10
6	Innovation & Creativity	5

INTRODUCTION TO ARTIFICIAL INTELLIGENCE	
Course Code: ISOE03	Credits: 3:0:0
Pre – requisites: NIL	Contact Hours:42L
Course Coordinator: Dr. Lincy Meera Mathews	

Course Content

Unit-1

Introduction: What is AI? Foundations of AI.

Intelligent Agents: Agents and Environment, Concept of rationality, The nature of environment, The structure of agents.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: <https://nptel.ac.in/courses/106102220>

Unit-2

Problem-solving: Problem-solving agents, Example problems, Searching for Solutions

Uninformed search strategies: breadth-first search, depth-first search, iterative search, Bi directional Search

Informed search and exploration: Heuristic functions, greedy algorithms, A* algorithm.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: <https://nptel.ac.in/courses/106102220>

Unit-3

Knowledge representation using logic: Knowledge-based agents, The Wumpus world, Propositional logic, Reasoning patterns in Propositional Logic

Inference in First-order Logic: Propositional vs. First-Order Inference, Unification and Lifting, forward chaining – First order Definite clauses, A simple forward chaining algorithm Backward chaining - A Backward Chaining Algorithm. Resolution

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: <https://nptel.ac.in/courses/106102220>

Unit-4

Forms of Learning: Supervised learning, Learning Decision trees, Evaluating and choosing the Best hypothesis, The Theory of Learning, Regression and Classification with linear models, Artificial neural Networks, Support Vector Machine, Ensemble Learning.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Links: <https://nptel.ac.in/courses/106102220>

Unit-5

Philosophical Foundations: Weak AI, Strong AI, Ethical considerations in AI: bias, privacy, accountability. AI, the Present and the Future, Future trends in AI and emerging technologies.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Recommended Resources / Links: <https://nptel.ac.in/courses/106102220>

Course outcomes

1. Identify the fundamental characteristics and challenging issues of Artificial Intelligence (AI) systems (PO-1,2,3,4,12, PSO-2)
2. Apply various general purpose search algorithms as solutions for various problem-solving agents (PO -1,2, 3, 4, 12, PSO-2)
3. Apply various symbolic knowledge representations to specify domains and reasoning tasks of a situated intelligent agent. (PO 4,5,9,12, PSO-2)
4. Apply an algorithmic approach to inference and learning. (PO-1,4,5,6,7, PSO-2)

5. Extract conclusions on learning and quantify the uncertainty in the conclusions obtained from uncertain knowledge. (PO-5,9, PSO-2)

Suggested Learning Resources:

Text Books:

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence, 4th Edition, Pearson, 2022

References:

1. Elaine Rich, Kevin Knight: “Artificial Intelligence”, 3rd Edition, Tata McGraw Hill, 2018,

Activity Based Learning:

- Programming Assignment/ Case Study/Project-Based Learning/MOOC-based learning /GATE-oriented aptitude test / Simulation
- Class assignment is provided twice within the semester.

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal Test-I	30	CO1, CO2, CO3
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Assignment	20	CO1, CO2, CO3, CO4, CO5
Semester-End Examination (SEE)	100 (Scale down to 50 Marks)	CO1, CO2, CO3, CO4, CO5

FUNDAMENTAL OF CLOUD COMPUTING	
Course Code: ISOE04	Credits: 3:0:0
Pre - requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr S R Mani Sekhar	

Course Content

Unit 1

Cloud computing, cloud computing reference model, Characteristics and benefits, Challenges
Historical developments: Distributed systems, Virtualization, Web 2.0, Service-oriented computing, Utility-oriented computing Building cloud computing environments: Application development, Infrastructure and system development, Computing platforms and technologies.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Recommended Resources / Links: https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Unit 2

Principles of Parallel and Distributed Computing: Eras of computing, Parallel vs. distributed computing, Elements of parallel computing, parallel processing, Hardware architectures for parallel processing, Approaches to parallel programming, Levels of parallelism Elements of distributed computing: Components of a distributed system, Architectural styles for distributed computing, Models for interprocess communication, Technologies for distributed computing.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Recommended Resources / Links: https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Unit 3

Virtualization: Characteristics of virtualized environments, virtualization techniques, Execution virtualization, other types of virtualization, Virtualization and cloud computing, Pros and cons of virtualization, Advantages and disadvantages of virtualization. Technology examples: Xen: para virtualization, VMware: full virtualization

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Recommended Resources / Links: https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Unit 4

Cloud Computing Architecture: The cloud reference model, Architecture, Infrastructure- and hardware-as-a-service, Platform as a service, Software as a service. Types of clouds: Public clouds, Private clouds, Hybrid clouds, Community clouds, Economics of the cloud. Open challenges: Cloud interoperability and standards, Scalability and fault tolerance, Security, trust, and privacy.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Recommended Resources / Links: https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Unit 5

Storage systems: evolution of storage technology, storage models, file systems, database, distributed file systems, general parallel file system, google file system, BigTable, Megastore.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Recommended Resources / Links:

https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Text Books:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi. Mastering Cloud Computing Foundations and Applications Programming, MK publications, Elsevier, 2013.
2. Dan C. Marinescu, "Cloud Computing Theory and Practice", Second Edition Copyright, Elsevier, 2018

Reference Books:

1. Buyya, Vecchiola, Selvi, Mastering Cloud Computing, First Edition, McGraw Hill Education, 2013.

Course Outcomes:

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

1. Describe the cloud computing reference model, its characteristics, benefits, and challenges in the context of evolving computing paradigms. (PO-1,2,7) (PSO 2,3).
2. Explain the evolution and fundamental differences between parallel and distributed computing systems. (PO-1,2,7,9,10,12) (PSO-2,3).
3. Illustrate different cloud resource virtualization strategies with case studies. (PO-1,7) (PSO 2,3).
4. Apply the concepts of cloud delivery models and services. (PO-1,2,7,9,10,12) (PSO-2,3).
5. Describe the evolution of storage technologies and analyze various cloud-based storage models, including distributed file systems and scalable databases (PO-1,2,7,9,10,12) (PSO-2,3).

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
MCQ	10	CO1, CO2, CO3, CO4, CO5
Tool	10	CO1, CO2, CO3, CO4, CO5
Semester-End Examination (SEE)	100 (Scale down to 50 Marks)	CO1, CO2, CO3, CO4, CO5

PROJECT WORK	
Course Code: ISP81	Credits: 0:0:13
Pre - requisites: Nil	Contact Hours: NA
Course Coordinator: Dr. Lincy Meera Mathews	

Course Content

Project Work-flow:

1. Students submit the initial details including broad area of work and choice of guide in a prescribed format.
2. The Project coordinators along with Head of the department finalize the guide allocation process.
3. Students are given an option to change the guide with mutual consent by applying through prescribed form.
4. Students submit the Project Work Book to guide on the day of registration.
5. Problem statement is submitted to Project Co-ordinator within one week of registration.
6. Students maintain a blog and update it on weekly basis about their work.
7. Weekly meeting with guide is recorded in the workbook.
8. Guide evaluates the student on a regular basis according to the rubrics defined in the
9. Workbook for total of 50 marks which constitutes the final CIE score.
10. At the end of the semester, an exam is conducted with one internal and one external examiner for 50 marks which constitutes the final SEE score.

Course Outcomes (COs):

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

1. Formulate the problem and schedule milestones & deliverables using appropriate project management techniques. (PO-2,9,11,12) (PSO-1).
2. Compare and contrast the available literature in the context of the project. (PO-2,4,9,12) (PSO-3)
3. Design and Develop the solution by applying the relevant guidelines (PO-1,2,3,4,5,6,7,9,11,12) (PSO-1,2,3)
4. Evaluate the quality of the solution with existing solutions. (PO-4,9) (PSO-1,2)
5. Document & demonstrate the solution and appraise its effectiveness (PO-8,9,10,11) (PSO-3)

PROJECT EVALUATION RUBRICS

Sl. No	Performance Indicators	Excellent (E)	Good (G)	Fair (F)	Poor (P)	PO's
1	Problem Definition & Motivation	Purpose is clear, strongly justified, with an in-depth review of existing systems.	Purpose explained well, with a reasonable study of current systems.	Purpose partly explained, study of systems is limited.	Purpose unclear, no meaningful review of systems.	2,9,11,12
2	Literature Review	Wide range of quality sources used, with strong conclusions drawn.	Several sources referred, with reasonable conclusions.	Few sources used, conclusions weak or incomplete.	Sources irrelevant or absent, no conclusions.	2,4,9,12
3	Design & Methodology	Objectives well defined, and methodology systematic and detailed.	Objectives mostly clear, methodology adequate but not detailed.	Only some objectives clear, methodology incomplete or vague.	Objectives missing or unclear, methodology absent.	1,2,3,4,5,6,7,9,11,12
4	Work Execution	Work completed fully as planned.	Work mostly completed with minor deviations.	Only part of the planned work is completed (about one-fourth to half).	Very little work completed (less than one-fifth).	4,9
5	Results & Outcomes	Results presented clearly, project summarized well, and future scope identified.	Results satisfactory, summary adequate, some mention of future scope.	Results unclear, weak summary, no clear future scope.	No proper results, no summary, no mention of scope.	8,9,10,11
6	Demo & Presentation & Ethics	Objectives achieved, modules fully functional, clear and confident presentation, professional conduct, and ethical issues well addressed.	Most objectives met, modules mostly working, presentation clear, ethics considered.	Few objectives achieved, modules incomplete, presentation weak, ethics poorly addressed.	Objectives unmet, modules non-functional, poor presentation, no ethical consideration.	8,9,10,11

RESEARCH / INDUSTRIAL INTERNSHIP	
Course Code: INT82	Credits: 0:0:5
Pre - requisites: Nil	Contact Hours: NA
Course Coordinator: Dr. Rajeshwari S B	

Course Content

Guidelines:

- The student can do the Internship during the summer semester between 4th-5th semesters or between 6th-7th semesters.
- The student should take prior permission from the department committee before carrying out the internship.
- The duration of the Internship should be 6 weeks to 8 weeks.
- The report of the Internship needs to be submitted to the department in the 8th semester.
- The department will constitute a committee for the evaluation of Internship of student.

Course Outcomes (COs):

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

1. Schedule milestones of deliverables and formulate the requirements of the proposed work. (PO-2,9,11,12) (PSO-1)
2. Apply the engineering knowledge to develop Solution in an industry environment. (PO- 1,2,3,4,5,6,7,9,12) (PSO-1,2,3)
3. Develop the inter-personal skills required to work in a professional team. (PO-8,9, 10, 11,12) (PSO-2, 3)
4. Engage in independent study of technology required for development of software. (PO-9,12) (PSO-2, 3)
5. Demonstrate and document the project and appraise its effectiveness (PO-8,9,10,12) (PSO-3)

INTERNSHIP EVALUATION RUBRICS

Performance Indicator	Poor	Fair	Good	Excellent	PO's
Requirement analysis and clarity on Problem Statement	Not properly understood the requirement and problem statement not defined properly	Understood the requirement and not defined properly	Requirement well understood but problem statement not well defined	Requirement well understood and problem statement well defined	2, 4

Relevance with real world problem	Irrelevant	Partially relevant	Relevant to real world with small modifications	Relevant	1, 2, 4, 7, 12
Project timeline scheduled	Not scheduled and not followed	Scheduled but not followed	Scheduled but not followed strictly	Scheduled and followed strictly	8, 11
Usage of latest application and software	No latest applications and software's used	Slightly Outdated	Moderate Usage of new technology	latest applications and software's are used	5
Design and code efficiency	Irrelevant design	Satisfactory design	Effective Design but all possible outcomes are not handled	Excellent Design of experiment and all possible outcomes are handled	3, 4
Proper documentation work	Poor Documentation	Average documentation	Good Documentation	Excellent Documentation	8, 10
Presenting skills, Fluency and Vocabulary	Poor Skills	Less confidence, vocabulary need to be improved	Good confidence, but lack of communication skills	Excellent communication skills	10
Slide Organization and contents time conscious	Poor Organization and least time management	Content is not organized properly	Content is organized properly but not effective time management	Content is organized properly and effective time management	10
Completion and meeting the requirements	Requirements and deadlines are not met completely	Only few requirements and deadlines are met	Requirements and deadlines are met with slight deviation	all requirements and deadlines are met	6, 7, 8, 9