RAMAIAH
Institute of Technology

CURRICULUM

Academic year 2023 – 2024

INFORMATION SCIENCE AND ENGINEERING

VII & VIII SEMESTER B.E.

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

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 17 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 67% 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. **Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 107 & world ranking 600 for the year 2022.**

The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology is recognized by Atal Ranking of Institutions on Innovation Achievements (ARIIA), MoE, Govt. of India.** 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, Ramaiah Institute of Technology has achieved 78th rank among 1314 top Engineering Institutions & 23rd Rank for School of Architecture in India for the year 2023.

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 Science (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

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations
- 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:

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

Semester / Course Category	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Total Credits
Basic Sciences (BSC)	9	8	4	4					**25**
Engineering Sciences (ESC)	11	10							**21**
Humanities, Social Sciences and Management (HSMC)	2	2			3		3		**10**
Professional Courses – Core (PCC)			21	21	15	11	10		**78**
Professional Courses– Elective (PEC)					3	6	6		**15**
Other Open Elective Courses (OEC)					3	3			**6**
Project Work (PROJ), Internship (IN)						4	1	15	**20**
Total Credits	**22**	**20**	**25**	**25**	**24**	**24**	**20**	**15**	**175**

SCHEME OF TEACHING

VII SEMESTER

Sl. No.	Course Code	Course	Category	Credits				Contact Hours
				L	T	P	Total	
1	IS71	Data Science	PC-C	4	0	0	4	04
2	IS72	Distributed Storage Technologies	PC-C	3	0	0	3	03
3	IS73	Management and Entrepreneurship	PC-C	3	0	0	3	03
4	ISE74X	Professional elective - 4	PC-C	3	0	0	3	03
5	ISE75X	Professional elective - 5	PC-C	3	0	0	3	03
6	ISL76	Data Science Lab	PC-E	0	0	1	1	02
7	ISL77	Parallel Programming Lab	PC-E	0	1	1	2	04
8	ISSE	Seminar	PC-E	0	0	1	1	-
			Total	**16**	**1**	**3**	**20**	**22**

Professional Electives:

1	ISE741	Deep Learning
	ISE742	Virtual and Augmented Reality
	ISE743	Soft Computing
	ISE744	Business Analytics

2	ISE751	Information Security
	ISE752	Bioinformatics
	ISE753	Bio-Inspired Computing
	ISE754	Big Data Computing

AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years degree program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the course. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fail to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

SCHEME OF TEACHING
VIII SEMESTER

Sl.No	Course Code	Course	Category	Credits				Contact Hours
				L	T	P	Total	
1	ISIN	Internship/NPTEL Course	IN	0	0	3	3	-
2	ISP	Project work	PROJ	0	0	12	12	-
			Total	**0**	**0**	**15**	**15**	**-**

AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years degree program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the course. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fail to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

VII Semester

DATA SCIENCE

Course Code: IS71 **Credit: 4:0:0**
Prerequisite: Nil **Contact Hours: 56L**
Course Coordinator: Dr. P M Krishna Raj

Course Content

UNIT-I

Introduction to Big Data Analytics: Big Data Overview, Data Structures, Analyst Perspective on Data Repositories, State of the Practice in Analytics, BI Versus Data Science, Current Analytical Architecture, Drivers of Big Data, Emerging Big Data Ecosystem and a New Approach to Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics. Data Analytics Lifecycle: Data Analytics Lifecycle Overview, Key Roles for a Successful Analytics Project, Background and Overview of Data Analytics Lifecycle, Six phases in Data Analytics lifecycle. Case study.

UNIT-II

Introduction To Data Science: The data science process, The roles in a data science project, Stages of a data science project, Setting expectations. Loading data into R: Working with data from files, working with relational databases. Exploring data: Using summary statistics to spot problems, Spotting problems using graphics and visualization, managing data: Cleaning data, Sampling for modeling and validation

UNIT-III

Modeling Methods using R: Choosing and evaluating models: Mapping problems to machine learning tasks, Evaluating models, Validating models, Memorization methods: Building single-variable models, Building models using many variables.

UNIT-IV

Linear and logistic regression: Using linear regression, Using logistic regression, Unsupervised methods: Cluster analysis, Association rules, Exploring advanced methods: Using bagging and random forests to reduce training variance, Using bagging to improve prediction, Using random forests to further improve prediction.

UNIT-V

Delivering Results: Documentation and deployment: The buzz dataset, Using knitr to produce milestone documentation, Using comments and version control for running documentation, Deploying models, Producing effective presentations, Presenting your results to the project sponsor, Presenting your model to end users, Presenting your work to other data scientists

Text Books:

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. John Wiley & Sons, 2015.
2. Zumel, N., & Mount, J. “Practical data science with R”, 2014.

Reference Books:

1. Data Mining: Concepts and Techniques Jiawei Han, Micheline Kamber and Jian Pei Third Edition 2012.
2. Machine Learning: A Probabilistic Perspective Kevin P. Murphy 2013.
3. Machine Learning with R Brett Lantz, Packt Publisher, 2013.

Course Outcomes (COs):

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

1. Solve problems in datascience by using statistical techniques (PO-1,2,4,5,9,10,11,12) (PSO-3)
2. Apply techniques of Exploratory Data Analysis for data science process (PO-1,2,3,4,5,9,10,11,12) (PSO-3)
3. Analyze various machine learning algorithms for a given scenario. (PO-1,2, 4,5,9,10,11,12) (PSO-3)
4. Illustrate the process of feature generation and selection for data analysis. (PO- 1,4,5,9,10,11,12) (PSO-3)
5. Apply appropraite visualization techinques for data exploration. (PO-1,2,3,4, 5,9,10,11,12) (PSO-3)

DISTRIBUTED STORAGE TECHNOLOGIES

Course Code: IS72 **Credit: 3:0:0**
Prerequisite: Computer Networks **Contact Hours: 42L**
Course Coordinator: Dr. Geetha V

Course Content

UNIT-I

Introduction: Information Storage, Evolution of Storage Architecture, Data Centre Infrastructure, Virtualization and Cloud Computing.
Data Centre Environment: Application, DBMS, Host, Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application, Disk Native Command Queuing, Introduction to Flash Drives.

UNIT-II

Data Protection: RAID Implementation Methods, Array Components, Techniques, Levels, Impact on Disk Performance, Comparison, Hot Spares.
Intelligent Storage System: Components, Storage Provisioning, Types.

UNIT-III

Fibre Channel Storage Area Networks: FC Overview, Evolution, Components, FC Connectivity, Ports, FC Architecture, Fabric Services, Login Types, Zoning, FC Topologies, Virtualization in SAN. **IP SAN and FCoE:** iSCSI, FCIP, FCoE.

UNIT-IV

Network-Attached Storage: Benefits, Components, NAS I/O Operation, Implementations, File Sharing Protocols, Factors Affecting NAS Performance, File-Level Virtualization.
Object Based and Unified Storage: Object Based Storage Devices, Content Addressed Storage, CAS Use Cases, Unified Storage.

UNIT-V

Business Continuity: Information Availability, Terminology, Planning Lifecycle, Failure Analysis, Impact Analysis, Solutions.
Cloud Computing: Cloud Enabling Technologies, Characteristics, Benefits, Service Models, Deployment Models, Infrastructure, Challenges, Adoption Considerations.

Securing the Storage Infrastructure: Framework, Risk Triad, Domains.
Managing the Storage Infrastructure: Monitoring, Management Activities, Management Challenges, Information Lifecycle Management, Storage Tiering.

Text Book:

1. Somasundaram G, Alok Shrivastava, (EMC Education Services), Information Storage and Management, 2e, Wiley India, 2012, ISBN 9788126537501.

References:

1. Robert Spalding; Storage Networks: The Complete Reference, Tata McGraw Hill, 2003.
2. https://education.emc.com/ISMbookv2/resources_content.aspx

Course Outcomes (COs):

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

1. Understand the architecture and components of storage subsystem. (PO-1,2,9,10,12) (PSO-2,3)
2. Describe different RAID levels and components of intelligent storage systems (PO-1,2,9,10,12) (PSO-2,3)
3. Illustrate various storage network technologies (PO-1,9,10,12) (PSO-2,3)
4. Understand the concept of NAS and object based unified storage. (PO-1,9,10,12) (PSO-2,3)
5. Describe business continuity, cloud computing, storage security, storage monitoring and management activities. (PO-1,9,10,12) (PSO-2,3)

MANAGEMENT AND ENTREPRENEURSHIP

Course Code: IS73 **Credit: 3:0:0**
Prerequisite: Nil **Contact Hours: 42L**
Course Coordinator: Mr. Suresh Kumar K R

Course Content

UNIT-I

MANAGEMENT: Nature and Functions of Management, Importance, Definition, Management Functions, Levels of management, Roles of a Senior Manager, Managerial Skills, **Development of Management Thought** – Early Classical approaches-Scientific Management, Administrative Management, Bureaucracy.

UNIT-II

PLANNING: Nature, Importance, Types of plans (Definitions and Meaning only), Steps in planning, strategic planning process, **DECISION MAKING:** Meaning, Types, Steps in rational decision making, difficulties in decision making, **COORDINATION:** Need for Coordination, Requisites for Excellent Coordination, and types of Coordination.

UNIT-III

DIRECTION AND SUPERVISION: Requirements of Effective Direction, Giving Orders, Motivation- Meaning, Nature, Motivation Theories-Maslow's Theory, Herzberg's Theory, McClelland's Need for Achievement Theory, **ORGANISATION:** Meaning, Characteristics, Typology, Process, Principles, **MANAGERIAL CONTROL:** Steps in a Control Process, Need for Control System, Benefits of Control, Essentials of Effective Control System.

UNIT-IV

COMMUNICATION: Purposes, Formal Communication, Forms of Communication, Informal communication, barriers to communication, **LEADERSHIP:** Difference between a Leader and a Manager, Characteristics of Leadership, Functions of a Leader; **ENTREPRENEURSHIP**: Importance of entrepreneurship, Concepts, Characteristics of a Successful Entrepreneur, Creative process, capacity building for entrepreneurship. **Case Study:** Profiles of successful entrepreneurs

UNIT-V

SETTING UP A SMALL BUSINESS: Formalities of Setting a Small Business Enterprise – Flowchart, Selection of Project, Product of Service Selection, Project Feasibility Study (flow chart and explanation), Business Plan Preparation, Decide on the Constitution, Registration, Project Report Preparation, Implement the Project and obtain Final Clearances, **Case Study:** Support to entrepreneurs through MSME, KSSIDC, KIADB, KSFC and TECKSOK

Text Books:

1. P.C. Tripathi, P.N.Reddy, Principles of Management, 5th Edition, Tata McGraw-Hill, 2012
2. Poornima M Charanthimath, Entrepreneurship Development Small business enterprises, Pearson Education, 2008

References:

1. Ramesh B Rudani, Principles of Management, Tata McGrawHill, 2013
2. Robert Lusier, Management Fundamentals – Concepts, Application, Skill Development, 5th Edition, Cengage Learning, 2012
3. S.S. Khanka, Entrepreneurial Development, S. Chand & Company Limited, 2012, ISBN 10: 8121918014 / ISBN 13: 9788121918015
4. Kanishka Bedi, Management and Entrepreneurship, Oxford University Press-2017

Course Outcomes (COs):

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

1. Understand the various approaches of management (PO- 8, 11) (PSO-1)
2. Describe the administrative skills of planning, decision making and coordinating (PO-8, 11) (PSO-1)
3. Interpret motivational theories to direct and supervise subordinates. (PO-8) (PSO-1)
4. Understand effective communication and leadership skills (PO-8, 9, 10, 12) (PSO- 1)
5. Identify the skills required to become a successful entrepreneur. (PO-8, 9,10,12) (PSO- 1)

DATA SCIENCE LABORATORY

Course Code: ISL76 **Credit: 0:0:1**
Prerequisite: Nil **Contact Hours: 14P**
Course Coordinator: Ms. Savita Shetty

Course Content

PART - A

1. Write a program to implement Random Forest using any data sets
2. Write a program to demonstrate association analysis
3. Implement any clustering technique.
4. Implement linear and logistic regression.
5. Implement a Map reduce program that processes a weather data set.
6. Data analytics: write a program that transposes the original data set, find all pairs products reviewed together; Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.

PART –B

Implement a mini project using data science life cycle.

Course Outcomes (COs):

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

1. Design the experiment for the given problem using various Data Analytic approaches. (PO1,2,3, 5,9,10,12) (PSO 3)
2. Develop the solution for the given real world problem. (PO1,2,3, 4,59,10,12) (PSO 3)
3. Analyze the results and produce substantial written documentation. (PO1,2,4,9,10) (PSO 3)

PARALLEL PROGRAMMNG LABORATORY

Course Code: ISL77 **Credit: 0:1:1**
Prerequisite: Nil **Contact Hours: 14T + 14P**
Course Coordinator: Mr. Shashidhara H S

Course Content

Tutorials:

- Modern Computer Architecture
- Types of Parallelism
- Interconnection Networks
- Performance Metrics
- Shared memory programming (OpenMP)
    - Parallel pragma
    - Parallel for loops
    - Distributing iterations among threads
    - Schedule directive
    - Running independent tasks in parallel
    - Synchronization
- Distributed Memory Programming (MPI)
    - Message Passing Interface
    - Making your computer ready for MPI programing
    - General MPI program structure
    - MPI Datatypes
    - Running and Configuring MPI process
    - Basic MPI operations
    - Non-blocking communication
    - Collective MPI communication
    - Communication and Computation overlap
    - MPI communicators

Lab:

Part-A

1. Programs to demonstrate parallel and for directives.
2. Programs to demonstrate task and sections directives.
3. Programs to demonstrate collapse class.
4. Programs to demonstrate schedule directive.
5. Programs to demonstrate critical and atomic directives.
6. Programs to demonstrate reduction clause.

Part-B

1. Programs to demonstrate Blocking send and receive functions.
2. Programs to demonstrate non-blocking functions.

3. Programs to demonstrate deadlock and implement a solution to avoid deadlock
4. Programs to demonstrate Scatter and Gather operation.
5. Programs to demonstrate Broadcast and Reduce operation.
6. Programs to demonstrate operations related to communicator.

Text Book:

1. Calvin Lin, Lawrence Snyder, "Principles of Parallel Programming", 1st Edition, 2009, Pearson Education, Inc. New Delhi.

References:

1. OpenMP Spec 3.0 handbook available on the Web
2. Lecture Notes & Web Reference Books

Course Outcomes (COs):

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

1. Develop parallel application using OpenMP programmiing directives. (PO-1,2,3,4,5,7,9,10) (PSO-2)
2. Apply MPI programming constructs to build parallel applications to the given problem. (PO-1,2,3,4,5,7,9,10) (PSO-2)
3. Develop solution for the given problem using Pthreads. (PO-1,2,3,4,7,9,10) (PSO-2)
4 Analyze the results and produce substantial written documentation (PO-1,2,4,9,10) (PSO-2)

SEMINAR

Course Code: ISSE **Credit: 0:0:1**
Prerequisite: Nil

Students have to study recent literature in Information Technology or learn a new technology prevalent in the IT field and demonstrate the knowledge in 2 seminars.
A mentor shall be assigned from the department to monitor the progress regularly.

Course Outcomes (COs):

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

1. Demonstrate the empirical knowledge of the literature/technology chosen. (PO – 1, 2, 8,10,12) (PSO – 1, 2,3)
2. Demonstrate the ability to communicate effectively and potentiality of lifelong learning. (PO – 9,10, 12) (PSO – 3)

DEEP LEARNING

Course Code: ISE741 **Credit: 3:0:0**
Prerequisite: Machine Leaning **Contact Hours: 42L**
Course Coordinator: Dr. Vijaya Kumar B P

Course Content

UNIT-I

Introduction: Human brain, neuron models, Neural nets as directed graphs, Feedback, Neural architectures, Knowledge representation, Connection to artificial intelligence.

UNIT-II

Learning Process: Error-correction learning, Memory based learning, Hebbian learning, Competitive learning, Boltzmann learning, Credit assignment, Learning with and without a teacher, Learning tasks, Memory and statistical learning theory.

UNIT-III

Modern practical deep neural networks: Deep feedforward networks, Regularization for deep learning, convolutional Networks, Neuro-scientific basis for convolutional operation.

UNIT-IV

Sequence Modelling: Recurrent and recursive nets - Unfolding Computational Graphs, Recurrent neural Networks (RNN), Bidirectional RNNs, Encoder-Decoder, Deep recurrent networks, Recursive neural networks. Practical Methodology, Applications of Deep learning.

UNIT-V

Deep Learning Research: Linear factor models, Autoencoders - Under complete, Regularized, De-noising Autoencoders, Manifolds with Auto encoders; Stochastic encoder and decoder; Deep generative models: Restricted Boltzmann machine, Generative adversarial networks.

Text Book:

1. Simon Haykin, Neural networks: A comprehensive foundation, Second Edition, Prentice Hall, New Delhi, 1999, ISBN-81-203-2373-4.
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. Josh Patterson & Adam Gibson, Deep Learning – A Practitioners Approach, O'Reilly, 1st Edition 2017.

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. Build deep learning models using regularization and convolutional operations. (PO-1,2,3,5,9,10,11,12) (PSO 1-3)
4. Analyze sequential data to build recurrent and recursive models. (PO-1,2,3,5,9,10,11,12) (PSO-1, 3)
5. Develop and analyze the applications using Autoencoders (PO-1,2,3,5,9,10,11,12) (PSO-1,3)

VIRTUAL AND AUGMENTED REALITY

Course Code: ISE742 **Credit: 3:0:0**
Prerequisite: Computer Graphics **Contact Hours: 42L**
Course Coordinator: Mr. Prashanth Kambli

Course Content

UNIT-I

Virtual Reality and Virtual Environments:
Human factors: Eye: accommodation, to Stereopsis, Visual field, Synthetic images versus reality. Ear: sound perception to Sound direction and stage, Head- related transfer functions, Measuring HRTFs, Ambisonics. The somatic senses: Tactile and Haptic technology. Virtual reality hardware& software: Sensor hardware, Head coupled displays, Acoustic Hardware, Integrated VR systems. Modeling Virtual worlds, Physical simulation, VR toolkits.

UNIT-II

Input Devices & Output Devices, Requirements for VR: Virtual databases, Real time image generation, database interaction, Physical simulation, Immersive and Non-Immersive VR systems, Hybrid VR systems, the cave, benefits of virtual reality. 3D Viewing Process- A Review, Examples of 3D viewing, A Simple Graphics Package, Segmented Display Files, Display File Compilation, Geometric Models, Picture Structure. Graphical Input techniques, Input Functions and Event Handling.

UNIT-III

The generic VR system: Virtual Environment, Computer environment, VR Technology, Modes of Interaction, VR Systems. Computing Architectures for VR: The Rendering Pipeline, PC Graphics Architecture, Workstation-Based Architectures, Distributed VR Architectures.

UNIT-IV

Modeling: Geometric Modeling, Kinematics Modeling, Behavior Modeling, Model Management. Conventional and Computer-Assisted Animation, Animation Languages, Methods of Controlling Animation, Basic Rules of Animation, Problems Peculiar to Animation. Animating the Virtual Environment, The dynamics of numbers: Linear interpolation, Non-linear interpolation, parametric interpolation.

UNIT-V

Animation: The animation of objects: Linear translation, Non-linear translation, Linear and Non-linear angular rotation. Shape, object parametric line/surface patch Inbetweening. Free-form deformation, Particle systems. Physics based modeling and simulation. Animating Objects in the Unity Editor.

Text Books:

1. Virtual Reality Technology, 2nd edition, Grigore C. Burdea, Philippe Coffet, A John Wiley & Sons, Inc., Publication.
2. Virtual Reality Systems, John Vince, Published by Dorling Kindersley (India) pvt ltd., licensees of Pearson Education in south Asia.
3. Principles of Interactive computer graphics, second edition, William M Newman & Robert F. Sproull, McGraw-Hill International student edition.

References:

1. Computer Graphics, second Edition in C, James. D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Kindle edition.
2. Virtual Reality & Augmented Reality in Industry by Dengzhe Ma,Jürgen Gausemeier, Xiumin Fan, Michael Grafe By : Springer publications.
3. Computer Vision and Augmented Reality by Kerdvibulvech Chutisant, Publisher: LAP Lambert Academic Publishing, Edition: 2013
4. Principles and practice: Augmented Reality, By: Dieter Schmalstieg, Tobias Hollerer, Addison-Wesley Professional.

Course Outcomes (COs):

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

1. Understand the concepts of Computer Graphics with respect to AR & VR requirements (PO-1,9,10,12) (PSO-1)
2. Analyze the 3D viewing process & pipelines related to AR & VR models. (PO-1,2,9,10,12) (PSO-1)
3. Understand Computer Architecture and contextual knowledge of AR & VR system (PO-1,9,10,12) (PSO-1)
4. Illustrate the knowledge of Modeling and VR Programming for multidisciplinary areas. (PO-1,9,10,12) (PSO-1)
5. Analyze the various Animation techniques for designing the solutions of real world problem. (PO- 1,2,9,10,12) (PSO- 1)

SOFT COMPUTING

Course Code: ISE743 **Credit: 3:0:0**
Prerequisite: Nil **Contact Hours: 42L**
Course Coordinator: Mr. Shashidhara H S

Course Contents

UNIT-I

Introduction: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems, **Artificial Neural Networks:** Fundamental concept, Evolution, Basic model of ANN, Important terminologies of ANN, MP neuron, Hebb Network

UNIT-II

Supervised Learning Network: Perceptron Networks, Adaptive linear neuron, multiple adaptive linear neurons, Back propagation Network.

UNIT-III

Introduction to Fuzzy logic, classical sets and fuzzy sets: Classical sets, Fuzzy sets. **Classical relations and fuzzy relations:** Cartesian product of relation, Classical relation, Fuzzy relations, Tolerance and equivalence relations. **Membership functions**: Features, Fuzzification, methods of membership value assignments.

UNIT-IV

Defuzzification: Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods. Fuzzy decision making: Individual, multiperson, multiobjective, multiattibute, and fuzzy Bayesian decision making

UNIT-V

Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA, General genetic algorithms, the schema theorem, Genetic programming, applications.

Text Books:

1. Principles of Soft computing, S N Sivanandam, Deepa S. N, Wiley, India, (Chapters 1, 2, 3(Up to 3.5), 7, 8, 9, 10, 13, 15 (up to 15.6 & 15.9,15,10).
2. Neuro-fuzzy and soft computing, J.S.R. Jang, C.T. Sun, E. Mizutani, PHI (EEE edition) ISBN: 978-81-203-2243-1

Course Outcomes (COs):

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

1. Understand soft computing techniques in building intelligent machines. (PO1) (PSO-1)
2. Understand the concepts of supervised learning.(PO1,2) (PSO-1)
3. Illustrate the features of fuzzy relationships and membership functions. (PO1,2,3,5,9,11) (PSO-1)
4. Illustrate the process of de-fuzzification and fuzzy decision making (PO1,2,3,5,9,11) (PSO-1)
5. Understand the concepts and building blocks of genetic algorithm. (PO1,2,3,5,9,11) (PSO-1)

BUSINESS ANALYTICS

Course Code: ISE744 **Credit: 3:0:0**
Prerequisite: Nil **Contact Hours: 42L**
Course Coordinator: Karthik V

Course Contents

UNIT-I

Business Analytics: Why Analytics, Business Analytics: The Science of data driven decision making, Descriptive Analysis, Predictive Analytics, Prescriptive Analytics, Big Data Analytics, Web and Social Media Analytics, Machine Learning Algorithms, Framework for data driven decision making, Analytics Capability Building, Roadmap, Challenges, Types (Descriptive, Predictive and Prescriptive).

UNIT-II

Descriptive Analytics: Data Types and Scales, Types of Data Measurement Scales, Population and Sample, Measures of Central Tendency, Percentile, Decile, and Quartile, Measures of Variation, Measures of Shape −Skewness and Kurtosis, Data Visualization

UNIT-III

Data Warehousing: Introduction to warehousing, data Mart, Online Analytical Processing-Tools, data Modelling, OLAP and OLTP, Schema – Star and snowflake. Modeling Methods using python: Choosing and evaluating models: Mapping problems to machine learning tasks, Evaluating models, Validating models.

UNIT-IV

Data Analytical Process: Introduction to analytical process, Types of analytical techniques in BI- Descriptive, Predictive, Perspective, social media analytics, Behavioral, Iris datasets.

UNIT-V

Implementation of Analytical Process: Business activity monitoring, complex Event Processing, Business process management, metadata, root cause analysis.

Text Books:

1. U. Dinesh Kumar, “Business Analytical – The science of data driven decision making”, Wiley 2017
2. Carlo-Vercellis, “Business intelligence datamining and optimization for decision making”, First Edition.

Course Outcomes (COs):

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

1. Understand various elements of analytics: business context, technology and data science. (PO-1, 2, 3, 12) (PSO-2)
2. Understand the emergence of analytics as a competitive strategy. (PO-1, 2, 3, 12) (PSO-2)
3. Analyse effective communication using analytics. (PO-1, 2, 3, 4, 12) (PSO-2)
4. Analyse various tools and techniques in analytics with business applications. (PO-1, 2, 3, 4, 5, 12) (PSO-2)
5. Design and develop techniques to solve problems from different industries such as aerospace, banking and finance, healthcare, insurance, manufacturing, pharmaceutical, retail, services, software, sports, etc. (PO-1, 2, 3, 4, 5, 10, 11, 12) (PSO-2)

INFORMATION SECURITY

Course Code: ISE751 **Credit: 3:0:0**
Prerequisite: Nil **Contact Hours: 42L**
Course Coordinator: Mrs. Evangeline D

Course Content

UNIT-I

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.

UNIT-II

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.

UNIT-III

Passive information Gathering: starting at the source, Mining Job ads and analyzing Financial Data, Using Google to Mine sensitive information, Exploring Domain Ownership. **Detecting Live Systems:** Detecting Active Systems, Port Scanning, OS fingerprinting, Scanning countermeasures. **Enumerating systems:** Enumerating systems, Advanced Enumeration.

UNIT-IV

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

UNIT-V

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.

Text Books:

1. William Stallings, “Cryptography and Network Security principles and practices” 4th Edition PHI.
2. Charlie Kaufman et. al, Network Security, 2nd Edition PHI.
3. Michael Gregg, “Building your own Security LAB, A field Guide for Network Testing” Wiley India 2012.

Reference:

1. Forouzan, “Cryptography and Network Security” 3rd Edition, Tata McGraw Hill

Course Outcomes (COs):

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

1. Apply symmetric and block cipher technique to provide message confidentialy. (PO-1,2) (PSO-2)
2. Apply asymmetric key algorithms to preserve message authentication and confidentiality. (PO-1,2) (PSO-2)
3. Understand the different passive information gathering techniques. (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)

BIOINFORMATICS

Course Code: ISE752 **Credit: 3:0:0**
Prerequisite: Nil **Contact Hours:42L**
Course Coordinator: Mr. Shashidhara H S

Course Content

UNIT-I

The genetic material, gene structure and information content, protein structure and function, chemical bonds, molecular biology tools

UNIT-II

Dot plots, simple alignments, gaps, scoring matrices, the Needleman and Wunsch algorithm, semiglobal alignments, the Smith and Waterman algorithm, database searches – BLAST and FASTA

UNIT-III

Patterns of substitutions within genes, estimating substitution numbers, molecular clocks Molecular phylogenetics, phylogenetic trees, distance matrix methods, maximum likelihood approaches

UNIT-IV

Parsimony, Inferred Ancestral Sequences, strategies for fast searches – branch and bound and heuristic searches, consensus trees, tree confidence, molecular phylogenies Genomics – 1: Prokaryotic genomes, prokaryotic gene structure, GC content and prokaryotic genomes, prokaryotic gene density, eukaryotic genomes

UNIT-V

Genomics – 2: Eukaryotic gene structure Open reading frames, GC contents in eukaryotic genomes, gene expression, transposition, repetitive elements Amino acids, polypeptide composition, secondary structure, tertiary and quaternary structures, algorithms for modeling protein folding.

Text Books:

1. Dan E. Krane, Michael L. Raymer, Fundamental Concepts of Bioinformatics, Pearson Education, 2008

References:

1. T K Attwood, D J Parry Smith, Introduction to Bioinformatics, Pearson Education,2004
2. Gary B. Fogel, David W. Corne, Evolutionary Computation in Bioinformatics, Morgan Kaufmann Publishers

Course Outcomes (COs):

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

1. Explain all the available molecular biology tools. (PO 1, 5, 10) (PSO 3)
2. Solve sequence alignment problems with/without gap penalty. (PO 1, 2, 3, 4, 5) (PSO 1, 2)
3. Explain the pattern of substitution within genes. (PO 1, 5, 10) (PSO 3)
4. Distinguish between character based and distance based phylogeny. (PO 2, 4) (PSO 1, 2)
5. Identify different parts of prokaryotic and Eukaryotic Genes (PO 1, 2, 4, 5) (PSO 1, 2)

BIOINSPIRED COMPUTING

Course Code: ISE753 **Credit: 3:0:0**
Prerequisite: Nil **Contact Hours: 42L**
Course Coordinator: Dr. S R Mani Sekhar

Course Content

UNIT-I

Introduction: Evolutionary Systems, Pillars of Evolutionary Theory, Genotype, Gene Expression, Genetic Mutations, Nongenic DNA, Artificial Evolution, Discrete Representations, Real-Valued Representations

UNIT-II

Representations: Tree-Based Representations, Fitness Functions, Genetic Operators, Crossover, Mutation, Cellular Systems- Basic Ingredients, Neural Systems- Computational neuroscience, Neural engineering, Biological Nervous Systems

UNIT-III

Developmental Systems: Introduction, Developmental Representation Advantages, L-Systems, Turtle Graphics, Immune Systems- Innate Immune System, Limits of Innate Immunity

UNIT-IV

Behavioral Systems**:** Cognitive Science Behavior, Artificial Intelligence Behavior, Collective Systems- Biological Self-Organization: Aggregation, Clustering, Nest Construction, Foraging, Division of Labor

UNIT–V

Particle Swarm Optimization, Ant Colony Optimization, Swarm Robotics, Firefly algorithm, Bat algorithm

Text Books:

1. Dario Floreano and Claudio Mattiussi Bio-Inspired Artificial Intelligence- Theories, Methods, And Technologies, The MIT Press, 2008
2. Xin-She Yang. Nature-Inspired Optimization Algorithms, Elsevier, 2014

References:

1. Eiben, A.E., Smith,James E, "Introduction to Evolutionary Computing", Springer 2015
2. Marco Dorigo and Thomas Stützle, Ant Colony Optimization MIT Press, 2004.

Course Outcomes (COs):

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

1. Illustrate the concepts of Evolutionary Systems. (PO 1, 2, 4, 10) (PSO 3)
2. Apply the different representations techniques on information. (PO 2, 3, 4, 5) (PSO 2)
3. Identify and utilize the concepts of Developmental System. (PO 1, 2, 4, 5) (PSO 1, 2)
4. Understand the Bio-Science Behavior. (PO 1, 7) (PSO 1)
5. Apply the Bio-inspired algorithm to solve real word problem. (PO 1, 2, 3, 4, 5) (PSO 1, 2, 3)

BIG DATA COMPUTING

Course Code: ISE754 **Credit: 3:0:0**
Prerequisite: Nil **Contact Hours: 42L**
Course Coordinator: Dr. S R Mani Sekhar

Course Content

UNIT-I

Types of Digital Data: Classification of Digital Data. **Introduction to Big Data:** Introduction to Big Data, Characteristics of Data, Definition of Big Data, Challenges with Big Data, Characteristics of Data Which are not Definitional Traits of Big Data, Need of Big Data, Traditional Business Intelligence (BI) versus Big Data. **Big Data Analytics:** What is Big Data Analytics?, What Big Data Analytics Isn't?, Classification of Analytics, Greatest Challenges that Prevent Businesses from Capitalizing on Big Data, Top Challenges Facing Big Data, Big Data Analytics Important, Basically Available Soft State Eventual Consistency (BASE)

UNIT-II

The Big Data Technology Landscape: NoSQL (Not Only SQL), Hadoop.
Introduction to Hadoop: Introducing Hadoop, Why Hadoop?, Why not RDBMS?, RDBMS versus Hadoop, Distributed Computing Challenges, History of Hadoop, Hadoop Overview, Use Case of Hadoop, Hadoop Distributors, HDFS (Hadoop Distributed File System), Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet Another Resource Negotiator), Interacting with Hadoop Ecosystem

UNIT-III

Introduction to Hive: What is Hive?, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, User-Defined Function (UDF).

UNIT-IV

Introduction to Pig: What is Pig?, The Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use Case for Pig: ETL Processing, Pig Latin Overview, Data Types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User-Defined Functions (UDF), Parameter Substitution, Diagnostic Operator, Word Count Example using Pig, When to use Pig?, When not to use Pig?, Pig at Yahoo!, Pig versus Hive.

UNIT-V

Introduction to Cassandra: Apache Cassandra – An Introduction, Features of Cassandra, CQL Data Types, CQLSH, Keyspaces, CRUD (Create, Read, Update, and Delete) Operations, Collections, Using a Counter, Time to Live (TTL), Alter Commands, Import and Export, Querying System Tables, Practice Examples.

Text Books:

1. Big Data Analytics, Seema Acharya and Subhashini Chellappan. Wiley India Pvt. Ltd. 2015.

References:

1. Network Data Analytics, Siddesh G M et.al., Springer, 2018.

Course Outcomes (COs):

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

1. Understand the requirements for and constraints in Big Data ecosystem. (PO-1,2,9,10,12) (PSO-2,3)
2. Apply concepts of Hadoop/Map-reduce framework for solving typical Big data problems. (PO-1,2,9,10,12) (PSO-2,3)
3. Usage of Hive platforms to manage Big data. (PO-1,2,9,10,12) (PSO-2,3)
4. Apply Pig Latin for solving big data challenges (PO-1,2,9,10,12) (PSO-2,3)
5. Apply Cassandra query language in handling Big data storage. (PO-1,2,9,10,12) (PSO-2,3)

VIII SEMESTER

INTERNSHIP

Course Code: ISIN **Credit: 0:0:3**

Course Coordinator: Ms. Rajeshwari S B

Guidelines:

- The student can do the Internship during the summer semester between 4^{th}-5^{th} semesters or between 6^{th}-7^{th} semesters.
- The student should take prior permission from the department committee before carrying out the internship.
- The duration of the Internship is one month.
- The report of the Internship needs to be submitted to the department in the 8^{th} 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)

SENIOR PROJECT

Course Code: ISP **Credit: 0:0:12**

Course Coordinators: Dr. Lincy Meera Mathews

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 workbook for total of 50 marks which constitutes the final CIE score.
9. 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)
6. Work effectively which contributes to team success. (PO-9,10) (PSO-3)