RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2020 – 2021

INFORMATION SCIENCE AND ENGINEERING

III & IV Semester M. Tech (Software Engineering)

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 13 UG programs and 15 PG programs. All these programs are approved by AICTE. All the UG programs & 09 PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with 'A' grade by NAAC in 2014. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs till the year 2029. 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 60% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility to 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 & Schneider Centre of Excellence. **M S Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 65 & world ranking 578 for the year 2020.**

The Centre for Advanced Training and Continuing Education (CATCE), and Entrepreneurship Development Cell (EDC) have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology secured All India Rank 8th for the year 2020 for Atal Ranking of Institutions on Innovation Achievements (ARIIA), an initiative of Ministry of Human Resource Development (MHRD), 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. MSRIT is a member of DELNET, CMTI and VTU E-Library Consortium. MSRIT has a modern auditorium and several hi-tech conference halls with video conferencing facilities. It 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, MHRD, Government of India, M S Ramaiah Institute of Technology has achieved 59th rank among 1071 top Engineering institutions of India for the year 2020 and 1st rank amongst Engineering colleges (VTU) in Karnataka.

About the Department

Information Science and Engineering department is established in the year 1992 with an objective of producing high-quality professionals to meet the demands of the emerging field of Information Science and Engineering. Department also started M.Tech program in Software Engineering in the year 2004 and has been recognized as R&D center by VTU in 2012. The department is accredited by the NBA in 2001, 2004, 2010, 2015 and reaccredited in 2018 under Tier-1 till 2021. Department has highly qualified and motivated faculty members and well equipped state of the art laboratories. All faculty members are involved in research and technical papers publications in reputed journals, conferences across the world. Strong collaboration with industries and high profile institutions is in place for curriculum updates, more hands on training, practical's, project based learning, EPICS, expert lectures, partial course deliveries by industry experts and student interns to enhance the skills in emerging areas to keep an inclusive and diverse academic environment. Department is successfully conducting seminars, conferences and workshops for students and academicians in the emerging areas of Information Technology. Introduced EPICS in senior projects. Some of the laboratories have also been set up in collaboration with industries such as Intel, Microsoft, Apple, SECO, Honeywell, EMC^2, NVIDIA, IBM, Green Sense Werks, Tech Machinery Labs, Sesovera Tech Pvt. Ltd., and Ramaiah Medical College (Emergency department). Also, an echo system is built to initiate start-ups at the department level along with the mentorship. All the above potential activities have 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 M. S. 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

- To provide a conducive environment that offers well balanced Information Technology education and research.
- To provide training and practical experience in fundamentals and emerging technologies.
- To nurture creativity for overall personality development.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Contribute in the area of Software Engineering development, maintenance and research in social-technical system

PEO2: Exhibit the Software Engineering skills for analysis, design and testing using modern tools and technologies within or outside discipline.

PEO3: Act according to professional ethics and communicate effectively with various stakeholders by demonstrating leadership qualities.

PROGRAMME OUTCOMES (POs)

PO1: An ability to independently carry out research/investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report/document.

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO4: An ability to analyze, design, verify, validate, implement, apply and maintain software systems

PO5: A recognition of the need for, and an ability to apply, professional and ethical responsibilities

Curriculum Course Credits Distribution

Semester	Humanities & Social Sciences (HSS)	Basic Sciences / Lab (BS)	Engineering Sciences/ Lab (ES)	Professional Courses - Core (Hard core, soft core, Lab) (PC-C)	Professional Courses- Electives (PC-E)	Other Electives (OE)	Project Work/Internship (PW /IN)	Extra & Co-curricular activities (EAC)	Total credits in a semester
First				14	8				22
Second				14	8				22
Third				1	4		17		22
Fourth				2			20		22
Total									88

SCHEME OF TEACHING

III SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1	MSWEEX	Elective – E	PC-E	4	0	0	0	04	04
2	MSWE31	Internship/Industrial Training	IN	0	0	4	0	04	08
3	MSWE32	Project Preliminaries	PW	0	3	10	0	13	26
4	MSWE33	Technical Seminar	PC-C	0	1	0	0	01	02
			Total	**4**	**4**	**14**	**0**	**22**	**40**

Elective- E

MSWEE1	Deep Learning
MSWEE2	Bioinformatics
MSWEE3	Software mining and analysis

IV SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits				Contact Hours
				L	T	P	Total	
1	MSWE41	IPR and cyber security laws	PC-C	0	2	0	02	04
2	MSWE42	Project-2	PW	0	0	20	20	40
			Total	**0**	**2**	**20**	**22**	**44**

DEEP LEARNING

Course Code: MSWEE1 **Credit: 4:0:0**
Prerequisite: NIL **Contact Hours: 56L**
Course Coordinator: Mr Rajaram M Gowda

Course Content:

Unit I

Introduction: Human brain, neuron models, neural nets as directed graphs, feedback, neural architectures, knowledge representation, Learning Process, Learning Tasks.

Unit II

Multilayer Perceptrons: Introduction, Some Preliminaries, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR Problem, Heuristics for Making the Back-Propagation Algorithm Perform Better, Back Propagation and Differentiation, The Hessian and Its Role in On-Line Learning, Cross-Validation, Virtues and Limitations of Back-Propagation Learning.

Unit III

Convolutional Neural Networks: - The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks.

Unit IV

Sequence Modeling: Recurrent and Recursive Nets, Unfolding Computational Graphs, Recurrent Neural Networks Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, The Long Short-Term Memory and Other Gated RNNs.

Unit V

Autoencoders: Under complete Autoencoders, Regularized Autoencoders, Denoising Autoencoders, Learning Manifolds with Autoencoders, Contractive Autoencoders, Predictive Sparse Decomposition Applications of Autoencoders.

Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications, Deep Belief Networks, Learning Vectorial Representations of Words.

References:

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.
3. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
4. Josh Patterson & Adam Gibson, Deep Learning – A Practitioners Approach, O'Reilly, 1st Edition 2017.

Course Outcomes (COs):

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

1. Explain knowledge representation and learning in neural networks. (PO-3, 4)
2. Design the back-propagation algorithm, its virtues and limitations, and understand its role as an optimum method for computing partial derivations. (PO-3,4)
3. Demonstrate construction of convolutional neural networks for images.
4. Design and develop recurrent neural networks for processing sequential data (PO-1, 3,4)
5. Illustrate autoencoder neural networks to perform unsupervised learning by applying backpropagation.

BIOINFORMATICS

Course Code: MSWEE2 **Credit: 4:0:0**
Prerequisite: NIL **Contact Hours: 56L**
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

References:

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

2. T K Attwood, D J Parry Smith, Introduction to Bioinformatics, Pearson Education, 2004
3. 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	Recognize the role of Genetic Material in living organisms and the ways of acquiring DNA sequence using Molecular Biology Tools (PO-2)
2	Solve sequence alignment problems using dynamic programming methods (PO-1, 4)
3	Model the pattern of substitution within homologs (PO-1, 2, 4)
4	Solve phylogenetic problems using character based and distance based phylogeny (PO-1, 4)
5	Identify different parts of prokaryotic and Eukaryotic Genes **(**PO-1,2)

SOFTWARE MINING AND ANALYSIS

Course Code: MSWEE3 **Credit: 4:0:0**
Prerequisite: NIL **Contact Hours: 56L**
Course Coordinator: Mrs. Pushpalatha M N

Course content:

Unit I

Introduction: Categories of Software Mining, Software engineering tasks that benefit from data mining: Development tasks, Management tasks, Research tasks, Mining software engineering data: the road from here - Targeting software tasks intelligently, lowering the barrier of entry, a word of caution.

Unit II

Specification Mining: A concise Introduction- Introduction, categorization, Mining Finite State Machines, Mining value-based Invariants, Mining Patterns and Rules, Mining Sequence Diagrams.

Unit III

Bug Report Mining: Bug report structure, Bug life cycle, Empirical studies on different types of bug reports, Studies on reproducibility of bug reports, Non-reproducible bugs- Why bugs are marked as NR, Developer's behaviour towards NR bugs, Why NR bugs get fixed, Research methodology- Subject systems, Bug type classification, Approach

Unit IV

Mining Source Code Repositories: Introduction, language models for programming languages- n-Gram Language Models, Information Theory & Language, the github java corpus, properties of a large source code corpus- Predicting Identifiers, Learnability of Identifiers, code analysis using giga-scale models- n-gram Log Probability as a Data-driven Code Complexity Metric, Log Probabilities at a Project Level, Entropy and the Rhino Project: A Case Study

Unit V

Mining Temporal Rules from Program Execution Traces : Introduction, Semantics of Mined Rules, Mining Algorithm- Challenges and Solutions, Algorithm Sketch, Case Studies- JBoss AS Transaction Component, CVS on Jakarta Commons Net.

Reference Books:

1. Mining Software Specifications: Methodologies and Applications edited by David Lo, Siau-Cheng Khoo, Jiawei Han, Chao Liu, CRC Press.
2. Manoel Mendonca, Nancy L. Sunderhaft, “Mining Software Engineering Data: A Survey”, A DACS State-of-the-Art Report.
3. Goyal, Anjali & Sardana, Neetu. (2019). An empirical study of non-reproducible bugs. International Journal of System Assurance Engineering and Management. 10. 10.1007/s13198-019-00850-5.
4. Taylor, Quinn & Giraud-Carrier, Christophe. (2010). Applications of data mining in software engineering. International Journal of Data Analysis Techniques and Strategies. 2. 243-257. 10.1504/IJDATS.2010.034058.
5. M. Allamanis and C. Sutton, "Mining source code repositories at massive scale using language modeling," 2013 10th Working Conference on Mining Software Repositories (MSR), San Francisco, CA, 2013, pp. 207-216, doi: 10.1109/MSR.2013.6624029.
6. Lo, David & Khoo, Siau-cheng & Liu, Chao. (2007). Mining temporal rules from program execution traces.

Course Outcomes (COs):

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

1. Describe the Concepts of Software Mining. (PO- 1, 3)
2. Explain Specification Mining. (PO- 1, 3)
3. Describe concepts of Bug Report Mining and Analyze the Bug Repositories (PO- 1, 3)
4. Analyze and Mine Source code repositories. (PO- 1,3)
5. Analyze program execution traces and mine temporal rules. (PO- 1,3)

INTERNSHIP / INDUSTRIAL TRAINING

Course Code: MSWE31 **Credit: 0:0:4**
Prerequisite: NIL **Contact Hours: 112P**
Course Coordinator: Dr. Sumana M

Internship Work-flow

1. Students submit the initial details including broad area of work and choice of guide in a prescribed format
2. The PG Coordinator along with Head of the department finalizes 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 Internship Workbook to guide on the day of registration
5. Problem statement is submitted to PG Coordinator within one week of registration
6. Students update the workbook 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
10. Evaluation is based on following criteria
    - Project Management – 15 marks
    - Literature Survey – 10 marks
    - System Analysis – 15 marks
    - Software Design - 15
    - Implementation / simulation - 20
    - Testing / Validation - 15
    - Speaking and Writing Skills – 10 marks
    - Total – 100 marks

Course Outcomes (COs):

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

1. Schedule milestones and deliverables using appropriate project management techniques (PO- 1)
2. Formulate the requirements for the proposed system (PO- 3,4)
3. Design, implement and validate the system according to the plan (PO- 1,3,4)
4. Select effective communication strategies within and outside the team (PO- 2)

PROJECT PRELIMINARIES

Course Code: MSWE32 **Credit: 0:3:10**
Prerequisite: NIL **Contact Hours: 84T+280L**
Course Coordinator: Dr. Sumana M

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 Coordinator along with Head of the department finalizes 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 Workbook to guide on the day of registration.
5. Problem statement is submitted to Project Coordinator 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.
10. Evaluation is based on following criteria

    - Project Management – 15 marks
    - Literature Survey – 10 marks
    - System Analysis – 15 marks
    - Speaking and Writing Skills – 10 marks
    - Total – 50 marks

Course Outcomes (COs):

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

1. Schedule milestones and deliverables using appropriate project management techniques (PO- 1)
2. Compare and contrast the available literature in the context of the project (PO- 3,4)
3. Formulate the requirements for the proposed system (PO-3,4)
4. Select effective communication strategies within and outside the team (PO- 2)

TECHNICAL SEMINAR

Course Code: MSWE33 **Credit: 0:1:0**
Prerequisite: NIL **Contact Hours: 28T**
Course Coordinator: Dr. Sumana M

Seminar Workflow:

1. Each student is allotted a guide by Coordinator in consultation with Head of the Department.
2. The individual guides decide the topic for seminar during the first week of the semester.
3. The student undergoes a semester long independent study of the topic.
4. During the end of the semester, the student gives an oral presentation on the topic.
5. The student also presents a written report to the guide.
6. Evaluation is based on following criteria
    - Relevance of the topic – 20 marks
    - Background Research – 20 marks
    - Quality of Presentation – 20 marks
    - Speaking Skills – 20 marks
    - Writing Skills – 20 marks
    - Total – 100 marks

Course Outcomes (COs):

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

1. Study an emerging topic in software engineering and allied areas (PO - 1)
2. Demonstrate an ability to undertake a lifelong, independent study of a topic (PO – 3,4)
3. Communicate effectively among peers and general public in oral and written forms. (PO - 2)

IPR AND CYBER LAWS

Course Code: MSWE41 **Credit: 0:2:0**
Prerequisite: NIL **Contact Hours: 56T**
Course Coordinator: Dr Naresh E

Tutorial Topics:

1. Copyright law in software
2. Application of Patent laws to software
3. Trademarks and other IPR applicable to software
4. IPR related policies by government
5. International treaties governing IPR
6. IT ACT 2000 and its amendments
7. Software related case-laws
8. Cyber crimes
9. Laws applicable to cyberspace
10. Laws related to m-commerce

References:

1. Dr. B. L. Wadhera, Law Relating to Intellectual Property, Universal law Publishing Co. Ltd. 2009.
2. Joan Ruttenberg, Paige von Mehren, Julie Yen, "Intellectual Property and Cyberlaw", Harvard Law School, 2013.
3. Cybercrime law and practice from the institute of company secretaries of India, 2016.
4. Case studies from internet sources.

Course Outcomes (COs):

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

1. Describe the evolution of IPR issues in software (PO-5)
2. Infer the socially relevant issues related to software like liberty and privacy (PO-5)
3. Sketch the process of protecting the IPR issues in software (PO-5)
4. Interpret the risks and liabilities of software in context of computer crimes (PO -5)
5. Critique the ethical issues arising from new areas of software usage (PO -3,5)

PROJECT WORK

Course Code: MSWE42 **Credit: 0:0:20**
Prerequisite: Project Preliminaries **Contact Hours: 560P**
Course Coordinator: Dr. Sumana M

Project Work-flow:

1. The work done in the previous semester (MSWE32) is continued
2. Students maintain a blog and update it on weekly basis about their work
3. Weekly meeting with guide is recorded in the workbook
4. 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
5. 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
6. Evaluation is based on following criteria
    - System Design – 15 marks
    - Coding – 15 marks
    - Testing – 10 marks
    - Speaking and Writing Skills – 10 marks
    - Total – 50 marks

Course Outcomes (COs):

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

1. Design the software by applying the relevant guidelines. (PO- 3,4)
2. Develop the software by implementing the design. (PO- 1,3,4)
3. Evaluate the quality of software by testing using appropriate techniques. (PO- 4)
4. Demonstrate the project before general public and appraise its effectiveness. (PO- 5)