Hindi Vidya Prachar Samiti's

Ramniranjan Jhunjhunwala College

of Arts, Science & Commerce

(Autonomous College)

Affiliated To

UNIVERSITY OF MUMBAI

Syllabus for the M.Sc.

Program: COMPUTER-SCIENCE

Program Code: RJSPCS

(CBCS 2022-2023)

THE PREAMBLE

Why Computer Science ?

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Sustained initiatives are required to reform the present higher education system for improving and upgrading the academic resources and learning environments by raising the quality of teaching and standards of achievements in learning outcomes.

Why Computer Science at R J College?

The Computer Science department was established in the year 1999 with strength of 60 Students and M.Sc CS with strength of 40 Seats was introduced in the year 2001. Today the strength has reached to 120 at UG level and 48 at PG level. The department offers both UG and PG programs in the subject of CS and is affiliated to, and recognized by the University of Mumbai. College facilitate departmental library with near about 1200+ books. There are 3 dedicated well-upgraded laborites for CS department. With the management extensive support, department believes in "**1 Student 1 PC policy**" which helps students to rigorous practice and focus. Projects, hands on training sessions, guest lectures, laboratory experimentation, lecture-based learning, industry visits etc. motivate students to explore more in terms of applications of the subject. Under autonomy, the department has made curriculum more robust by incorporating skill-based learning and value added course that imparts practical knowledge of the subject to the students. Department of CS (DBT), New Delhi has identified CS Department of R J College as DBT Star College Department which has further strengthened our hands in being able to provide hands on training to the students to satisfy their curiosity.

Our Curriculum, Your Strength

This syllabus is an honest attempt to include following ideas, among other things, into practice:

- Bring a new approach to syllabus, not a revision of the existing syllabus.

- Create a unique identity for MSC in Computer Science distinct from similar degrees in other related subjects.

- Offers focus on core Computer Science subjects.

- Incorporate advanced and most recent trends.

- Identify and nurture research temper among students.

- Offer provision for internship with industry at semester IV.

- Focus, as far as possible, only on open source software.

This syllabus for the semester I and semester II have initiated steps to meet these goals. By extending the syllabus to semester III and semester IV, it is assumed that these goals will be met to a larger extent. In order to give an impetus to research among students, one of the courses in semester - I gives an overview on how to do research in Computer Science. In a nutshell, the core philosophy of the syllabus is to - (i) Give strong foundation on core Computer Science subjects (ii) expose the student to emerging trends in a gradual and incremental way (iii) create a research temper among students in the whole process (v) Prepare student community for the demands of ICT industry. We hope that the student and teaching community will appreciate the thrust, direction and treatment given to the courses in the syllabus. We sincerely believe that a student who takes up this course will be better fit for industry as he or she will have strong foundation on fundamentals and exposure to advanced and emerging trends. We earnestly believe that by focusing on student driven research, learning will be more interesting and stimulating.

DISTRIBUTION OF TOPICS AND CREDITS
M.Sc. COMPUTER-SCIENCE SEMESTER I

Course	Nomenclature	Credits	Topics
RJSPCS301	Machine And Deep Learning	04	1. Introduction To M/C learning. 2. Unsupervised , Reinforcement learning Distance / Similarity. 3. Deep Learning 4. Deep Learning RNN (Recurrent neural n/w)
RJSPCS302	Cyber Forensics And Laws	04	1. Computer Forensic Fundamentals. 2. Data backup and Recovery and Network forensics. 3.Cyber Laws. 4. Information Technology Act 2000.
RJSPCS303	Operation Research	04	1. Introduction to OR. 2. Linear Programming 3. Transportation Problem 4. Sequence Problem
RJSPCS304	Robotics	04	1 Introduction to Robotics 2. Control Techniques 3. Control Architectures in Robotics 4. Artificial Intelligence and it's usage in Robotics.
RJSPCSP301	Machine And Deep Learning (RJSPCS301) And Cyber Forensics And Laws (RJSPCS302)	04	Unsupervised, Reinforcement learning Distance / Similarity, Deep Learning, Forensic Fundamentals, Network Forensic, Cyber Laws.

		04	Linear Programming, Transportation Problem, Sequence Problem Control Techniques, Control Architectures in Robotics, Artificial Intelligence and it's usage in Robotics.
RJSPCSP302	Operation Research (RJSPCS303) and Robotics (RJSPCS304)		

M.Sc. COMPUTER-SCIENCE SEMESTER II

Course	Nomenclature	Credits	Topics
RJSPCS401	Research based project	12	Project Documentation and implementation.
RJSPCS402	Internship With Industry	12	6 month of internship with industry.

SEMESTER III (THEORY)		L	Cr
Paper-I: Machine And Deep Learning	**Paper Code: RJSPCS301**	60	4
UNIT I		15	
INTRODUCTION TO M/C LEARNING			
1	**AI :** Application Area, What is AI, ML, DL ; Comparison of AI, ML, DL. **ML :** Introduction, Applications, Types of ML : Supervised, Unsupervised and Reinforcement Learning.		
2	**Regression :** Simple, multiple, polynomial Regression ; Support vector Regression ; Decision Tree Regression ; Random Forest Regression.		
3	**Classification :** Logistic Regression ; K-NN ; Support vector machine ; Naïve Bayse ; Decision Tree classification ; Random Forest classification ; Document classification ; Text classification.		
UNIT II		15	
UNSUPERVISED , REINFORCEMENT LEARNING DISTANCE / SIMILARITY			
1	**Partitional Algorithm :** K-means , K-Medoid ; **Hierarchical Algorithm :** Agglomerative (AGNES) ; Divisive ; Density based clustering (DBSCAN).		
2	**Dimensionality Reduction :** Introduction to Eigenvalues and Eigenvectors of Symmetrics ; PCA Genetic Algorithm ; Transfer Learning, Reinforcement Learning ; Overfitting ; underfitting ; confusion matrix.		
UNIT III		15	
DEEP LEARNING			

1	**DL :** Introduction of DL; Objective of DL ; Categories of DL ; Biological and ANN ; Difference between ML and DL **ANN :** The neuron ; The Activation Function ; How does NN work? How do NN Learn? Gradient Descent ; Stochastic Gradient Descent ; Back propagation**.**		
2	**CNN :** (Convolutional Neural N/W) : What is CNN? ; convolutional operation ; ReLU Layer ; Pooling ; Flattering ; Full Connection ; summary .		
	UNIT IV	15	
	DEEP LEARNING RNN (RECURRENT NEURAL N/W)		
1	**Deep Learning RNN (Recurrent neural n/w) :** What is RNN? ; Representation of RNN; Examples. **SOM (Self organizing map) :** What is SOM? ; How does SOM work? ; K- means clustering; How do SOM Learn? ; Example.		
2	**Boltzmann machine:** working ; Example. **AutoEncoders :** Introduction ; Why AutoEncoders; Example ; Training an AutoEncoder; Types of AutoEncoder..		

M.Sc	Semester III Theory
RJSPCS301 Paper I **Machine And Deep Learning**	**Course Outcomes 3.1:** 1. This course provides a broad introduction to machine learning and statistical pattern recognition. 2. It offers some of the most cost-effective approaches to automated knowledge acquisition in emerging data-rich disciplines and focuses on the theoretical understanding of these methods, as well as their computational implications. 3. To understand the basic concepts of Deep Learning, networks and the real time applications behind it.

Learning Outcomes:
On completion of this course, the students will be able to:

1. Analyze methods and theories in the field of machine learning and provide an introduction to the basic principles, techniques, and applications of machine learning, classification tasks, decision tree learning and clustering.
2. Apply decision tree learning, Bayesian learning and artificial neural network in real world problems.
3. Understand the use of genetic algorithms and genetic programming.
4. Apply inductive and analytical learning with perfect domain theories.
5. Critically evaluate and compare different learning models and learning algorithms and be able to adapt or combine some of the key elements of existing machine learning algorithms to design new algorithms as needed.
6. Students will be able to design deep learning problems, create and implement deep network and validate, test and re-configure the network if needed be

SEMESTER III (THEORY)		L	Cr
Paper-II: Cyber Forensic	**Paper Code: RJSPCS302**	60	4
UNIT I		15	
INTRODUCTION TO CYBER FORENSIC			
1	**Computer Forensic Fundamentals:** Introduction to Computer Forensics and objective, the Computer Forensics Specialist, Use of Computer Forensic in Law Enforcement, Users of Computer Forensic Evidence, Case Studies, Information Security Investigations.		
2	**Types of Computer Forensics Technology:** Types of Military Computer Forensic Technology, Types of Law Enforcement Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data, Spyware and Adware, Encryption Methods and Vulnerabilities, Protecting Data from Being		

	Compromised, Internet Tracing Methods, Security and Wireless Technologies.		
3	**Types of Computer Forensics Systems: Study different Security System:** Internet, Intrusion Detection, Firewall, Storage Area, Network Disaster Recovery, Public Key Infrastructure, Wireless Network, Satellite Encryption, Instant Messaging (IM), Net Privacy, Identity Management, Biometric, and Identity Theft.		
	UNIT II	15	
	NETWORK FORENSIC		
1	**Network Forensics:** Introduction to Network Forensics Sources of Network Based Evidence, Principles of Internetworking, Internet Protocol Suite. **Data Recovery:** Data Recovery and Backup, Role of Data Recovery, Hiding and Recovering Hidden Data. **Evidence Collection:** Need to Collect the Evidence, Types of Evidence, The Rules of Evidence, Collection Steps. **Computer Image Verification and Authentication:** Special Needs of Evidence Authentication. **Identification of Data:** Time keeping, Forensic Identification and Analysis of Technical Surveillance Devices, **Reconstructing Past Events:** How to Become a Digital Detective, Useable File Formats, Unusable File Formats, and Converting files.		
2	**Computer Image Verification and Authentication:** Special Needs of Evidence Authentication. **Identification of Data:** Time keeping, Forensic Identification and Analysis of Technical Surveillance Devices. **Reconstructing Past Events:** How to Become a Digital Detective, Useable File Formats, Unusable File Formats, and Converting files.		
	UNIT III	15	

	CYBER LAWS		
1	Fundamentals of Cyber Law: Regulation of Information Society, Need for Cyber Laws, ICANN, UNCITRAL, Indian Scenario in regulation, Investigation and Ethics: Cyber Crime, Information Security and Law, Types & overview of Cyber Crimes, Cyber Law Issues in E-Business Management, Indian IT Act, Digital signature in IT act.		
2	Intellectual property rights and types, Cyber squatters and Copy Right Protection , Patents, Data privacy and protection, Domain Name, Software piracy, Plagiarism, Issues in ethical hacking.		
	UNIT IV	15	
	INFORMATION TECHNOLOGY ACT 2000		
1	**Information Technology Act 2000:** Information Technology Act-2000-1 (Sec 1 to 13), Information Technology Act-2000-2 (Sec 14 to 42 and Certifying authority Rules), Information Technology Act-2000-3 (Sec 43 to 45and Sec 65 to 78), Information Technology Act-2000-4(Sec 46 to Sec 64 and CRAT Rules)Information Technology Act-2000-5 (Sec 79 to 90),Information Technology Act-2000-6 (Sec 91-94) Amendments in 2008.		

M.Sc	Semester III Theory
RJSPCS302 Paper II **Cyber Forensics and Laws**	**Course Outcomes 3.2:** 1.Analyze an understanding of Computer forensics fundamentals. 2.Study various computer forensics technologies. 3.Study computer forensics systems . 4.Study methods for data backup and recovery. 5.Study the methods for preservation of digital evidence. 6.Introduction to various cyber laws. **Learning Outcomes:** 1.Understand the definition of computer forensics fundamentals. 2. Describe the types of computer forensics technology. 3. Analyze various computer forensics systems. 4. Illustrate the methods for data recovery, evidence collection and data seizure. 5. Summarize duplication and preservation of digital evidence. 6. Summarize Different cyber laws.

SEMESTER III (THEORY)		L	Cr
Paper-III: Operation Research	**Paper Code: RJSPCS303**	60	4
UNIT I		15	
INTRODUCTION TO OR			
1	**Nature of Operation Research :** History ,Nature of Operation Research ,Impact of Operation Research, Application Areas.		
2	**Overview of Modeling Approach :** Formulating the problem, Constructing a mathematical model, Deriving a solution, Testing a model and the solution, Establishing control over the solution, Implementation issues.		
UNIT II		15	
LINEAR PROGRAMMING			
1	**Linear Programming :** Introduction ,Graphical solution, Graphical sensitivity analysis, The standard form of linear programming problems, Basic feasible solutions, Simplex algorithm, Artificial variables, Big M and two phase method, Solution to Problems based on Degeneracy, Alternative optima, Unbounded solution, Infeasible solutions.		
2	**Dual Problem :** Relation between primal and dual problems, Dual simplex method, Sensitivity analysis.		
UNIT III		15	

	TRANSPORTATION PROBLEM		
1	**Transportation Problem :** Starting solutions. North-west corner Rule –least cost methods –Vogel's approximation method, MODI Method, Minimization and Maximization problem		
2	**Assignment Problem & Travelling Salesman Problem :** Assignment Problem: Traveling Salesman Problem: Branch & Bound technique, Hungarian method.		
	UNIT IV	15	
	SEQUENCING PROBLEM		
1	**Sequencing Problem :** Two machines n jobs , three machines n jobs, n machines m jobs		
2	**Integer Programming :** Branch and Bound Algorithm, Cutting plane Algorithm.		

M.Sc	Semester III Theory
RJSPCS303 Paper III **Operation Research**	**Course Outcomes 3.3:** 1. Study formulation, analysis and solving science, engineering and business problems. 2. Study mathematics and mathematical modeling using computers to forecast the implications of various choices. 3. Study the selection of the best alternatives from the available choices. **Learning Outcomes:**

	1. Apply Operations research methodology to a broad range of problems in business and industry. 2. Use mathematics and mathematical modeling using computers to forecast the implications of various choices. 3. Solve optimization problems. 4. Think of new methods for solving optimization problems.

SEMESTER III(THEORY)		L	Cr
Paper-IV: Robotics	**Paper Code: RJSPCS304**	60	4
UNIT I		15	
INTRODUCTION TO ROBOTICS			
1	**Introduction to Robotics :** What is a Robot? Definition, History of Robots: Control Theory, Cybernetics, Grey Walter Tortoise, Analog Electronic Circuit, Reactive Theory, Braitenberg's Vehicle, Artificial Intelligence, Vision Based Navigation, Types of Robot Control.		
2	**Robot Components:** Embodiment, Sensors, States, Action, Brains and Brawn, Autonomy, Arms, Legs, Wheels, Tracks, and What really drives them effectors and actuators: Effector, Actuator, Passive and Active Actuation, Types of Actuator, Motors, Degree of freedom Locomotion: Stability, Moving and Gaits, Wheels and Steering, Staying on the path. Manipulators: Endeffectors, Teleoperation, Why is manipulation hard?		
UNIT II		15	
CONTROL TECHNIQUES AND IMPLEMENTATION IN ROBOTICS			
1	Sensors: Types of Sensors, Levels of Processing, Passive and Active sensors, Switches, Light sensors, Resistive position sensor. Ultrasonic and Sonar sensing, Specular Reflection, Laser Sensing, Visual Sensing, Cameras, Edge Detection, Motion Vision, Stereo Vision, Biological Vision, Vision for Robots.		
2	Feedback or Closed Loop Control: Example of Feedback Control Robot, Types of feedback control, Feed forward or Open loop control.		

	UNIT III	15	
	CONTROL ARCHITECTURES IN ROBOTICS		
1	Algorithm, Architecture, The many ways to make a map, What is planning, Cost of planning, Reactive systems, Action selection, Subsumption architecture, How to sequence behavior through world.		
2	hybrid control, Behavior based control and Behavior Coordination, Behavior Arbitration.		
	UNIT IV	15	
	ARTIFICIAL INTELLIGENCE AND IT'S USAGE IN ROBOTICS		
1	**Artificial Intelligence and it's usage in Robotics** When the Unexpected Happens: An Example: Emergent Wall-Following ,Components of Emergence, Expect the Unexpected , Predictability of Surprise , Good vs. Bad Emergent Behavior , Architectures and Emergence. Navigation.		
2	Reinforcement Learning , Supervised Learning , Learning by Imitation/From Demonstration , Learning and Forgetting. The Future of Robotics.		

M.Sc	Semester III Theory
RJSPCS304 Paper IV **ROBOTICS**	**Course Outcomes 3.4:** This course introduces fundamental concepts in robotics. The objective of the course is to provide an introductory understanding of robotics. Students will be exposed to a broad range of topics in robotics with

1	emphasis on basics of manipulators, coordinate transformation and kinematics, trajectory planning, control techniques, sensors and devices, robot applications. **Learning Outcomes:** At the end of the course unit students will be able to: 1. Undertake kinematics analysis of robot manipulators. 2. Understand the importance of robot dynamics. 3. Have an understanding of the functionality and limitations of robot actuators and sensors. 4. Understand and be able to apply a variety of techniques to solve problems in areas such as robot control and navigation. 5. Describe different mechanical configurations of robot manipulators. 6. To be able to program a robot to perform a specified task (e.g obstacle avoidance or wall following) in a target environment. Understand how simulations of robots work, where they can be useful and where they can break down.

SEMESTER IV		**L**	**Cr**
Paper-II: Project Implementation	**Paper Code: RJSPCS401**	400 To 500 Hours	12
1	**Project Implementation**: The syllabus introduces a project proposal (RJSPCS401) as initial step. As per this, a student is expected to select a topic for project, based on any subject covered in syllabus of any semester. Project topic should be research oriented. Students are expected to implement some unique idea. It will be well appreciated if project gives comfortable digitized solution to any real life problem which might focus on certain group of society. The proposal will contain introduction, related works, objectives and methodology. The		

	implementation, experimental results, analysis and actual implementation will be part of the Project implementation. A student is expected to make a project implementation report and appear for a project viva. He or she needs to spend around 500 hours for the project implementation, which fetches 12 credits.		
2	A Student should submit project implementation documentation with following details : • **Title:** Title of the project. • **Literature survey:** Theoretical description about selected area or topic or algorithm of particular subject. • **Tools:** Description of hardware, software's or any other third party tools used. • **Implementation details:** A description of how the project has been implemented. It may be description of flow chart or various modules or steps. • **Experimental set up and results:** A detailed explanation on how experiments were conducted, what software used and the results obtained. Details like screen shots, tables and graphs can come here. • **Analysis of the results:** A description on what the results means and how they have been arrived at. Different performing measures or statistical tools used etc may be part of this. • **Conclusion:** A conclusion of the project performed in terms of its outcome.		

• **Future enhancement:** A small description on what enhancement can be done when more time and resources are available. • **References:** List of books, research papers or links which is being referred. • **Program code:** The program code may be given as appendix		

SEMESTER IV		**L**	**Cr**
Paper-II: Internship	**Paper Code: RJSPCS402**	800 To 900 Hours	12

1	**Guidelines for internship in Semester - IV**
	
	• Internship should be of 5 to 6 months with 20 to 24 weeks duration.
	
	• A student is expected to find internship by himself or herself. However, the institution will assist students in getting internship in good organizations.
	
	• The home institution cannot be taken as the place of internship.
	
	• A student is expected to devote at least 800 hours physically at the organization.
	
	• Internship can be on any topic covered in the syllabus mentioned in the syllabus.
	
	• Internship can be done, in one of the following, but not restricted to, types of organizations:
	
	  ➢ Software development firms
	  ➢ Hardware/ manufacturing firms o Any small scale industries, service providers like banks.
	  ➢ Clinics/ NGOs/professional institutions like that of CA, Advocate etc
	  ➢ Civic Departments like Ward office/post office/police station/ punchayat.
	  ➢ Research Centers/ University Depts/ College as research Assistant for research projects or similar capacities.

2	**Guidelines for Documentation of Internship Report** A student is expected to make a report based on the internship he or she has done in an organization. It should contain the following: • **Certificate:** A certificate in the prescribed Performa (given in appendix 1) from the organization where the internship done. • **Evaluation form:** The form filled by the supervisor or to whom the intern was reporting, in the prescribed Performa (given in appendix 2). • **Title:** A suitable title giving the idea about what work the student has performed during the internship. • **Description of the organization:** A small description of the organization where the student has interned. • **Description about the activities done by the section where the intern has worked:** A description about the section or cell of the organization where the intern actually worked. This should give an idea about the type of activity a new employee is expected to do in that section of the organization. • **Description of work allotted and actually done by the intern:** A detailed description of the work allotted and actual work performed by the intern during the internship period. Intern may give a weekly report of the work by him or her if needed. • **Self assessment:** A self assessment by the intern on what he or she has learnt during the internship period. It shall contain both technical as well as inter personal skills learned in the process. The internship report may be around 15 pages and this needs to be submitted to the external examiner at the time of University examination.		

Apendix 1

(Note : Proforma for the certificate for internship in official letter head)

This is to certify that Mr/Ms_____of Ramniranjan Jhunjhunwala College, Ghatkopar(W), affiliated to University of Mumbai. worked as an intern as part of his / her MSc course in Computer Science. The particulars of internship are given below:

Internship starting date: _____

Internship ending date: _____

Actual number of days worked: _____

Tentative number of hours worked:_____Hours

Broad area of work:

A small description of work done by the intern during the period:

_____

_____

_____

_____

Signature:

Name: Designation:

Contact Number:

Email:

(seal of the organization)

Appendix 2

(Note : Proforma for the Evaluation of the intern by the supervisor / to whom the intern was reporting in the organization)

Professional Evaluation of intern

Name of intern:

College/institution: Ramniranjan Jhunjhunwala College, Ghatkopar(W)

[Note: Give a score in the 1-5 scale by putting V in the respective cells]

Sr. No	Particular	Excellent	Very Good	Good	Moderate	Satisfactory
1.	Attendance					
2.	Punctuality					
3.	Adaptability					
4.	Ability to shoulder Responsibility					
5.	Ability to work in a team					
6.	Written and oral communication skills					
7.	Problem solving Skills					
8.	Ability to grasp new concepts					
9.	Ability to complete task					
10.	Quality of work Done					

(Seal of the organization)

Semester I (PRACTICALS)	
Practical-I: **Machine and Deep Learning + Cyber Forensics And Laws**	**Paper Code:** **RJSPCSP301 (RJSPCS301 + RJSPCS302)**
Machine and Deep Learning	
1 Write a program to implement Simple Linear Regression	
2 Write a program to implement multiple Linear Regression	
3 Write a program to implement K-nearest Neighbors (K-NN)/SVM	
4 Write a program to implement Naïve Bayse / DT	
5 Write a program to implement K-means clustering.	
6 Write a program to implement Hierarchical clustering.	
7 Write a program to build ANN.	

8	Write a program to build CNN.
	Cyber Forensics And Laws
1	Create a java application to send encrypted message from sender and decrypted message at receiver end.
2	Write a program for creating log files
3	Write a java program for searching file in given directory.
4	Write a java program to Search a particular word in a file.
5	create a virus for eating space of particular drive
6	Use DriveImage XML to image a hard drive
7	Create forensic images of digital devices from volatile data such as memory using Imager for Computer System
8	Recovering and Inspecting deleted files (use Autopsy)
9.	Registry Editor

Practical-II: Operation Research + Robotics	Paper Code: RJSPCSP302 (RJSPCS303 + RJSPCS304)
Operation Research	

1	LPP for maximization /minimization of an objective function and graphical representation of feasible solution.
2	LPP by using simplex method I.
3	LPP by using simplex method II(Big-M).
4	LPP by using Dual simplex method.
5	Transportation problem by using North West corner rule.
6	Transportation problem by using VOGEL methods.
7	Assignment problem and Traveling salesman problem as its special case.
8	MONTE CARLO method of simulation.
	Robotics
1	Study components of real robot and its DH parameter.
2	Perform forward and inverse kinematics.
3	Design a Robot to pick up and place an object.
4	Design a Robot to draw a flower.
5	Design a Robot to perform Drilling.
6	Design a Robot to perform Handshaking.
7	Write a program to register obstacles.
8	Demonstrate Image Processing and color and shape detection in Robot.
9	Positioning and Orientation of robot arm.
10	Design a Robot to follow a particular path.

MSc	Semester III (Practical)
RJSPCSP3 01 (RJSPCS30 1+ RJSPCS302)	**Machine and Deep Learning :** Course outcome : 1. Understand machine and deep learning algorithms to analyse data. Learning outcome : 1. The students will get knowledge about data analysis on large dataset using machine learning algorithms. 2. The students will have demonstration of deep learning algorithms like ANN, CNN etc. on large dataset and also get knowledge about how machine will learn using deep learning algorithms. **Cyber Forensics and Laws** Course Outcomes: 1. Understand the definition of computer forensics fundamentals. 2. Describe the types of computer forensics technology and tools. 3. Analyze various computer forensics cryptography tools, pattern searching techniques. 4. Illustrate the tools for data recovery from deleted files. 5. Illustrate the tools for data Backup and recovery. Learning outcomes: 1. After completion of the course the students will be able to learn investigation tools and techniques. 2. Analysis of data to identify evidence, Technical Aspects & Legal Aspects related to cyber crime. 3. Study the tools used for data Backup and recovery. 4. Study the tools used for recovery of deleted file.

RJSPCSP302 (RJSPCS303+ RJSPCS304)	**Course Outcomes:** 1. Understand the mathematical tools that are needed to solve optimization problems. 2. Use mathematical software with python as well as R to solve the proposed models. **Learning outcomes:** 1. After completion of Operation Research Practicals students will be able to develop a report that describes the model and the solving technique, analyze the results and propose recommendations in language understandable to the decision-making processes . **Robotics:** **Course Outcomes:** 1. To develop the student's knowledge in various robot structures and their workspace. **Learning outcomes:** 1. After completion of Robotics Practical Students will be able to design, construction, operation, and use of robots.

References:

2. Mitchell T.M., Machine Learning, McGraw Hill (1997).
3. Alpaydin E., Introduction to Machine Learning, MIT Press (2010).
4. Fundametals of Deep Learning:Designing next-generation machine intelligence algorithm.
5. Bishop C., Pattern Recognition and Machine Learning, Springer-Verlag (2006).
6. Michie D., Spiegelhalter D. J., Taylor C. C., Machine Learning, Neural and
7. Statistical Classification. Overseas Press (2009).
8. Computer Forensics Computer Crime Scene Investigation, John R. Vacca, Second Edition, 2005.
9. Network Forensics, Sherri Davidoff, Jonathan HAM, Prentice Hall, 2012.
10. Mobile Phone Security and Forensic: A Practical Approach, Second Edition, Iosif I. Androulidkis, Springer, 2012.
11. Digital forensics: Digital evidence in criminal investigation", Angus M.Marshall, John - Wiley and Sons, 2008.
12. Computer Forensics with FTK, Fernando Carbone, PACKT Publishing, 2014.
13. Practical Mobile Forensics, Satish Bommisetty, Rohit Tamma, Heather Mahalik, PACKT Publishing, 2014.
14. Nina Godbole, Information System Security Wiley lndia, New Delhi. The Information technology Act, 2000; Bare Act- Professional Book publishers, New Delhi.
15. Operation Research: J K Sharma
16. Operation Research-An Introduction: Taha H. A., McMillan Publishing Company, NY
17. Introduction to Operation Research: Hillier F., and Lieberman G.J, Holden Day
18. Operations Research : P. K. Gupta & Hira, S. Chand
19. Operations Research Applications and Algorithms: Waynel L. Winston Thomson .
20. The Robotics Primer by Maja J Mataric, MIT press Cambridge, Massachusetts, London, England (2007).
21. A First course in Artificial Intelligence, Deepak Khemani, Tata McGraw Hill Education (India) private limited (2013).
22. Artificial Intelligence: A Modern Approach, 3e, Stuart Jonathan Russell, PeterNorvig, Prentice Hall Publications (2010).
23. Artificial Intelligence Illuminated, Ben Coppin, Jones and Bartlett Publishers Inc (2004)
24. Artificial Intelligence A Systems Approach, M Tim Jones, Firewall media, New Delhi (2008)
25. Artificial Intelligence -Structures and Strategies for Complex Problem Solving., 4/e, George Lugar, Pearson Education (2002).

Scheme of Examinations

1. Two Internals of 20 marks each. Duration 30min for each.

2. One External (Semester End Examination) of 60 marks. Duration 2 hours.

3. One Practical at the end of Semester consisting of Groups and each group have 2 practicals each of 50 marks but passing combined out of 100.

4. Minimum marks for passing Semester End Theory and Practical Exam is 40 %.

5. Student must appear for at least one of the two Internal Tests to be eligible for the Semester End Examination.

6. For any KT examinations, there shall be ODD-ODD/EVEN-EVEN pattern followed.

7. A candidate will be allowed to appear for the practical examinations if he/she submits a certified journal of M.Sc. Computer-Science or a certificate from the Head of the department / Institute to the effect that the candidate has completed the practical course of M.Sc. Computer-Science as per the minimum requirements.

8. In case of loss of journal, a candidate must produce a certificate from the Head of the department /Institute that the practicals for the academic year were completed by the student. However, such a candidate will be allowed to appear for the practical examination, but the marks allotted for the journal will not be granted.

9. HOD's decision, in consultation with the Principal, shall remain final and abiding to all.

Evaluation (Theory): Total marks per course - 100.
CIA- 40 marks
CIA 1: Written test -20 marks

CIA 2: Written Test / Assignment /mini project/ & Report -20 marks
Semester End Examination – 60 marks
Question paper covering all units

Evaluation of Practicals 100 marks /group (RJSPCSP301,RJSPCSP302)

Project and internship 300 marks each (RJSPCSP401, RJSPCSP402)

Course Semester End Examination in Semester1 and II Paper I
to IV (RJSPCS301 To RJSPCS304, RJSPCS401 To RJSPCS402)

Question	KNOWLEDGE	UNDERSTANDING	APPLICATION and ANALYSIS	TOTAL MARKS- Per unit
Unit 1	07	02	03	12
Unit 2	07	02	03	12
Unit 3	07	02	03	12
Unit 4	07	02	03	12
Short notes from topics covering all the units	07	02	03	12
-TOTAL- Per objective	35	10	15	**60**
% WEIGHTAGE	58	17	25	**100%**

Evaluation of Practicals 100 marks /group (RJSPCSP301,RJSPCSP302)

Project and internship 300 marks each (RJSPCSP401, RJSPCSP402)

Continuous Evaluation of components which require adequate duration for completion of
the task, observation and interpretation: 25%
Course end Practical Evaluation of skills of students in terms of skill, analysis, interpretation and conclusion.

Sr. No	Semester	Course Code	Particular	Total Marks
1	IV	RJSPCS401	NPTEL COURSE	100
			PROJECT GUIDE	50
			QUALITY & RELEVANCE	40
			DOCUMENTATION	30
			PRESENTATION	30
			VIVA	50
			TOTAL	300
2	IV	RJSPCS402	QUALITY & RELEVANCE	80
			DOCUMENTATION	60
			PRESENTATION	60
			VIVA	100
			TOTAL	300

Mini Project :

Dept.of_____CourseCode_____Date_____

UIDNo_____RollNo_____Marks

_____Name of student: _____

Title Assignment:
_____

Assessment Grid : PlACE one tick in eACH APpropRIATE row. OveRALl mArk should reflect the positions of ticks in the individuAl rows. In boxes THAt HAVe more tHAn one set of mArks, CANCEL out the mArks thAt ARE not APplICABLe And circle the correctmArks.

Project work and report (Parameters)	Marks	80 – 100% Excellent	60 - 80% Good	40 – 60% Satisfactory	20 – 40% Average
Project work done	10	10 / 9	8 / 7	6 / 5	4 /3

COMPUTER SCIENCE
Mapping of the courses to employability / entrepreneurship / skill development

Class	Course Name	Course Code	Unit No. And topics focusing on Employability / Entrepreneurship / Skill development	Employability / Entrepreneurship / Skill development
		MSC SEM III		
MSC	Machine And Deep Learning	RJSPGCS301	**Employability** Unit 1 : Machine Learning and Supervised Learning AI , Regression, Classification Unit 2 : Unsupervised , Reinforcement learning Distance / Similarity Partitional Algorithm, Hierarchical Algorithm, Dimensionality Reduction Unit 3 : ANN, CNN Unit 4 : RNN ,SOM,Botlzmann machine	Employability in the field of AI, machine learning, Data Scientist, data engineer
MSC	Cyber Forensics And Laws	RJSPGCS302	**Employability** Unit 1 : Computer Forensic Fundamentals, Types of Computer Forensics Technology, **Unit 2 :** Data Recovery, Evidence Collection, Computer Image Verification and Authentication, Identification of Data, Reconstructing Past Events Unit 3 : Fundamentals of Cyber Law, Investigation and Ethics **Unit 4 :** Information Technology Act 2000	Employability in the field of security

MSC	Operation Research	RJSPGCS303	**Entrepreneurship** **Unit 1 :** Overview of Modeling Approach **Unit 2 :** Linear Programming & dual problem	Employability in the field of management
			Unit 3 : Transportation , Assignment &Travelling Salesman Problem **Unit 4 : Sequencing & Integer programming Problem**	
MSC	**Robotics**	**RJSPGCS304**	**Employability** **Unit 1 : Robot introduction & Components** **Unit 2 : Control Techniques and implementation in Robotics Unit 3 : Control Architectures in Robotics** **Unit 4 : Artificial Intelligence and** **it's usage in Robotics**	Employability in the field of robotics design & implementation
		MSC SEM IV		
MSC	Research based project	RJSPGCS401	**Employability**	
MSC	Internship With Industry	RJSPGCS402	**Employability**	

Comments:

Name and Signature of Faculty .

Mini Project Post graduate level

Dept.of _____ CourseCode _____ Date _____

UIDNo _____ RollNo _____ Marks

_____ /20 Name ofstudent: _____

Title of Assignment:

_____

Assessment Grid : PlACE one tick in eACH APpropRIATE row. OveRALl mArk should reflect the positions of ticks in the individuAl rows. ln boxes THAt HAVe more tHAn one set of mArks

CANCEL out the mArks thAt ARE not ApplICABLe And circle the correct mArks.

Project work and report (Parameters)	Marks	80 – 100% Excellent	60 - 80% Good	40 – 60% Satisfactory	20 – 40% Average
Project work done	10	10 / 9	8 / 7	6 / 5	4 /3

CANCEL out the mArks thAt ARE not ApplICABLe And circle the correct mArks.

Project work and report (Parameters)	Marks	80 – 100% Excellent	60 - 80% Good	40 – 60% Satisfactory	20 – 40% Average
Project work done	10	10 / 9	8 / 7	6 / 5	4 /3