RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

Scheme of Teaching & Examination of Bachelor of Technology

VII Semester B.Tech. (Robotics & Artificial Intelligence)

Sr. No.	Course Code	Category	Course Name	Hours/ Week			Credits	Maximum Marks					Minimum Passing Marks	
								Theory		Practical		Total		
				L	T	P		Internal	University	Internal	University		Theory	Practical
1	BTechRAI701T	Professional core courses	Robot Programming	3	0	0	3.00	30	70	-	-	100	45	
2	BTechRAI701P	Professional core courses	Robot Programming Lab	0	0	2	1.00			25	25	50		25
3	BTechRAI702T	Professional core courses	Data Analytics	3	0	0	3.00	30	70	-	-	100	45	
4	BTechRAI702P	Professional core courses	Data Analytics Lab	0	0	2	1.00			25	25	50		25
5	BTechRAI703T	Professional Elective Course	Elective-III	3	0	0	3.00	30	70	-	-	100	45	
6	BTechRAI704T	Open Elective	Open Elective-II	3	0	0	3.00	30	70	-	-	100	45	
7	BTechRAI705P	Project Work	Project		0	6	3.00	-	-	50	50	100		50
	Total			12	0	10	17.00	120	280	100	100	600		

Elective III: 1. Digital Signal Processing for Robotics 2. Embedded Robotics 3. Decision Making and Expert system 4. Computer Vision

Open Elective II : 1. Industrial Robotics 2. Machine Learning for Robotics

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Scheme of Teaching & Examination of Bachelor of Technology

VIII Semester B.Tech. (Robotics & Artificial Intelligence)

Sr. No.	Course Code	Category	Course Name	Hours/ Week			Credits	Maximum Marks					Minimum Passing Marks	
								Theory		Practical		Total		
				L	T	P		Internal	University	Internal	University		Theory	Practical
1	BTechRAI801T	Professional Elective Course	Elective-IV	3	0	0	3.00	30	70	-	-	100	45	
2	BTechRAI802T	Professional Elective Course	Elective-V	3	0	0	3.00	30	70	-	-	100	45	
3	BTechRAI803P	Project Work	Project	0	0	16	8.00			100	100	200		100
Total				6	0	16	14.00	60	140	100	100	400		

Elective VI: 1. Cloud Computing 2. Robotics & Industrial Applications 3. Medical Robotics 4. Basics of 3D Printing and Additive Manufacturing

Elective VI: 1. Cognitive Robotics 2. Reinforcement learning 3. Big Data Analytics using Hadoop 4. Software Engineering

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

SEMESTER: VII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject: Robot Programming Subject Code: **BTechRAI-701T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs/week	**03**	**30**	**70**	**100**

Aim: Student should understand the functionality of ROS

Prerequisite(s): Python or C

Course Objectives:

1	To introduce students the fundamentals of robotic programming
2	To introduce students the criteria for selecting a sensor and actuator for a particular application.
3	To understand the Robot Operating System (ROS) fundamentals
4	To introduce students the criteria for selecting a sensor and actuator for a particular ROS robotic application

Course Outcomes:

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

CO1	Understand the robotics design and implementation.
CO2	Gain the knowledge on fundamentals of robotic programming
CO3	Comprehend, classify and analyze the behavior of different types of sensors and actuators
CO4	Understand the ROS fundamentals
CO5	Design robotic applications using ROS

Syllabus

UNIT-I- Robotics Introduction **[6 Hours]**

Robot Introduction- Seven Criteria of Defining a Robot, Robot Controllers-Major Components, Robot Vocabularies- Robotics Middleware Basics.

UNIT-II- Programming the Robot's Sensors **[7 Hours]**

A close look at Sensors, Programming the Robot's Sensors, Programming the Actuators, Building Robot's Softbot

UNIT-II- Robot Operating System (ROS) **[8 Hours]**

ROS Basics-ROS Equation, History of ROS, Sensors and Robots Supporting ROS, ROS Architecture and Concepts, ROS Filesystem Level, ROS Computation Graph Level, ROS Community Level

UNIT-IV- ROS Fundamentals **[8 Hours]**

Ubuntu Linux for Robotics-Ubuntu Graphical User Interface, Shell Commands, C++ and Python for Robotic Programming- Basic Concepts with Examples

UNIT-V - ROS Programming **[7 Hours]**

Creating ROS Workspace and Package, Using ROS Client Libraries, Programming Embedded Board using ROS-Interfacing Arduino with ROS, ROS on a Raspberry Pi.

Text Books:

1. Lentin Joseph, Robot Operating System (ROS) for Absolute Beginners: Robotics Programming Made Easy, 1 st Edition, APress, 2018.

2. Jonathan Cacace; Lentin Joseph, Mastering ROS for Robotics Programming: Design, build, and simulate complex robots using the Robot Operating System, 2nd Edition, Packt Publishing, 2018.

Reference Books:

1 Hughes, C. and Hughes, T., Robot programming: a guide to controlling autonomous robots. Que Publishing, 2016

2 Quigley, M., Gerkey, B. and Smart, W.D., Programming Robots with ROS: a practical introduction to the Robot Operating System. " O'Reilly Media, Inc.", 2015

3. Anil Mahtani, Luis Sanchez, Enrique Fernandez, Aaron Martinez, Lentin Joseph. ROS Programming: Building Powerful Robots. Packt Publishing, 2018.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

SEMESTER: VII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject : Robot Programming Subject Code: **BTechRAI-701P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week (Practical)	1	25	25	50

Prerequisite(s): Python or C

Course Objectives:

1	To understand the Robot Operating System (ROS) fundamentals
2	To introduce students the criteria for selecting a sensor and actuator for a particular ROS robotic application

Course Outcomes:

At the end of this course Student are able to:

CO1	Understand the ROS fundamentals
CO2	Design robotic applications using ROS
CO3	Design products by suitable integration of Arduino and Raspberry Pi boards with ROS

List of Practicals

1. Simulating Robotics arm using ROS
2. Visualizing Robotic Sensor Data using ROS
3. Arduino-ROS: Working with path planning.
4. Interfacing Raspberry Pi Board to ROS for path planning application
5. ROS Navigation- path planning, motion planning of robot – software requirement and configuration.
6. Creating differential wheeled Robot-using ROS

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

SEMESTER: VII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject: **Data Analytics** Subject Code: **BTechRAI-702T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs/week	03	30	70	100

Aim: Students should be able to perform Exploratory Data Analysis (EDA)

Prerequisite(s): Python Data structure - list, tuples, dictionary, sets & loops.

Course Objectives:

1	To understand data analytics as the next wave for businesses looking for competitive advantage
2	To understand how python library Numerical Python (NumPy) is being used to handle large data set
3	To understand how python library Pandas is being used to handle large data set
4	To understand how python libraries Matplotlib and seaborn is used for visualization
5	To understand the basis principles of Exploratory Data analysis

Course Outcomes:

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

CO1	Students will understand the business value importance of data analysis
CO2	Students will be able to manipulate the data using Numerical Python (NumPy)
CO3	Students will be able to manipulate the data using python library Pandas
CO4	Students will be able to visualize data using python libraries Matplotlib and seaborn
CO5	Students will be able to draw insights out of a dataset using EDA principles.

Syllabus

UNIT-I - Introduction to Analytics

[08 Hours]

Analytics life cycle - Business analytics - lending analytics- recommendation analytics, Healthcare Analytics, financial analytics, supply chain analytics, Marketing analytics, sports analytics.

UNIT- II - Numerical Python (NumPy)

[07 Hours]

Introduction to Numerical python, 1-D array, multidimensional array, creating a NumPy array, mathematical operations on NumPy

UNIT- III - Pandas

[07 Hours]

Introduction to Pandas, Pandas Rows and Columns, operations on data frame, Groupby and aggregate functions, Merging data frames, Pivot tables

UNIT -IV- Visualization – matplotlib & seaborn

[07 Hours]

Bar graph, scatter plot, line plot, boxplot, histogram, subplots and how to choose a plot type for a given dataset.

UNIT – V - Exploratory data Analysis

[07 Hours]

Principles of Exploratory Data Analysis- Data sourcing, data cleaning, data analysis- univariate, bivariate, multivariate

Textbooks:

1. Data Science for Business: What You Need to Know About Data Mining and Data-Analytic Thinking" by Provost, Foster, and Tom Fawcett. Data Science for Business: What You Need to Know About Data Mining and Data-Analytic Thinking. O'Reilly Media, Inc., 2013.
2. McKinney, Wes. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython. O'Reilly Media, Inc., 2012.
3. Maheshwari, Anil. Data Analytics Made Accessible. Apress, 2016.

Reference books:

4. Knaflic, Cole Nussbaumer. Storytelling with Data: A Data Visualization Guide for Business professionals. John Wiley & Sons, 2015.
5. Ohlhorst, Frank J. Big Data Analytics: Turning Big Data into Big Money. John Wiley & Sons, 2012.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

SEMESTER: VII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject: **Data Analytics Lab** Subject Code: **BTechRAI-702P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week (Practical)	1	25	25	50

Aim: To familiarize the students with different libraries of python to make them able to do the Exploratory Data Analysis process by applying its principles

Course Objectives:

1	To understand how python library Numerical Python (NumPy) is being used to handle large data set
2	To understand how python library Pandas is being used to handle large data set
3	To understand how python libraries Matplotlib and seaborn is used for visualization
4.	To understand the basis principles of Exploratory Data analysis

Course Outcomes:

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

CO1	Students will be able to manipulate the data using Numerical Python (NumPy)
CO2	Students will be able to manipulate the data using python library Pandas
CO3	Students will be able to visualize data using python libraries Matplotlib and seaborn
CO4	Students will be able to draw insights out of a dataset using EDA principles.

List of Practical's:

1. NumPy case study 01
2. NumPy case study 02
3. Pandas case study 01
4. Pandas case study 02
5. Matplotlib visualization case study
6. Seaborn visualization case study
7. EDA case study

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

SEMESTER: VII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject: **Digital Signal Processing for Robotics(Elective – III)** Subject Code: **BTechRAI-703.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs/week	**03**	**30**	**70**	**100**

Aim: Students will proficiently design, simulate, implement, and test analog and digital filters, integrating signal processing and automatic controls concepts to enhance engineering problem-solving skills.

Prerequisite(s): Basic concepts of circuit theory, electronics, signal processing

Course Objectives:

1	To understand the basic notions for the design of analog (both passive and active) and digital filters tailored for processing sensor measurements in robotic applications.
2	To implement simulation and the hardware realization of filters.

Course Outcomes:

At the end of this course students are able to:

CO1	To understand and Apply signal-processing chain in robotics, design anti-aliasing filters,
CO2	To Understand filter synthesis, including frequency transforms and adaptation techniques, for analyzing and designing filters in diverse domains.
CO3	To Proficiently design passive and active filters implementation, and optimization in analog applications.
CO4	To understand and Design FIR, IIR, and adaptive filters using MATLAB
CO5	To Analyze, design, implement, and evaluate switched-capacitor filters, demonstrating theoretical understanding and practical proficiency across various applications.

Syllabus

UNIT-I **[07 Hours]**

Signal-processing in robotics applications.
The boundary between analog and digital blocks: The Nyquist–Shannon sampling theorem.,Anti aliasing filters.

UNIT- II **[08 Hours]**

General concepts about filter synthesis

FIR filter,successive approximation A/D Converter,dsp chips,programmable FPGA/CPLD

UNIT- III **[07 Hours]**

Design of analog filters:
Design of doubly-terminated passive filters: Butterworth, Chebyschev, Elliptic and Bessel filters (design techniques, HW lab activity). Design of RC active filters (design techniques, HW lab activity)

UNIT -IV **[07 Hours]**

Design of Digital filters:
Digital filter, FIR filters,Matched filter working types ,advantages and application- IIR filters (design techniques, Matlab activity,Adaptive filters (design techniques, Matlab activity)

UNIT – V **[07 Hours]**

Design of integrated filters:

Switched-capacitor filters,necessary ,functions ,principle (principles, HW lab activity)

Text Books

- Digital Signal Processing and the Microcontroller: By Dale Grover and John R. Deller, with illustrations by Jonathan Roth
- Digital Signal Processing: Principles, devices and applications (Control, Robotics and Sensors)

Reference Books

- Understanding Digital Signal Processing: By Richard G. Lyons
- The Scientist and Engineer's Guide to Digital Signal Processing: By Steven W. Smith

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

SEMESTER: VII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject: **Embedded Robotics (Elective III)** Subject Code: **BTechRAI-703.2T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs/week	3	30	70	100

Aim: The aim of the course is to provide students with a comprehensive understanding of Embedded Systems and Robotics, covering their principles, applications, and practical implementations in industrial automation.

Prerequisite(s): Basic knowledge of electronics,fundamental of embedded system and basic of Robotics with programming concepts would be beneficial for better comprehension of the course content.

Course Objectives:

1	To introduce students to Embedded Systems, Robotics, and Basic Electronics, and demonstrate how Embedded Systems are applied in Robotics, covering topics such as communication protocols, sensor interfacing, motor control, and mobile robot development
2	To understand motor driver configurations, speed control, programming tools, and sensor technologies for real-time image processing and wireless communication in robotics applications.

Course Outcomes

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

CO1	To Understand Embedded Systems, Robotics, and Basic Electronics.
CO2	To Understand Application of Embedded Systems in Robotics and Autonomous Robot Design.
CO3	To Understand Communication Protocols, Sensor Interfacing, Motor Control, and Mobile Robot Development.
CO4	To Understand Motor Driver Configurations, Speed Control, and Programming Tools.
CO5	To Understand Sensor Technologies, Real-Time Image Processing, and Wireless Communication in Robotics.

Syllabus

UNIT I **[07 Hrs]**

Introduction about Embedded system and Robotics, Role of Embedded Systems in Robotics, Benefits of Embedded Systems in Robotics, industrial automation, Introduction about Basic Electronics

UNIT II **[07 Hrs]**

Robotics- Pattern recognition and robots, Use of Embedded Systems in Robotics, Robots and Computer Vision, relationship between embedded system and robotics, Introduction to Autonomous Robots Robot Chassis Designing, 1 Robot with steering wheel: Robot with differential drive:

UNIT III **[08 Hrs]**

Communication in Automation development, Introduction about, Sensors Interfacing with controller, Logical Conditioning Programming, Introduction about Motors, Motor Control based on sensors input, Mobile robot development, Line follow and obstacle avoid conditions in mobile robot, Graphical programming software in Embedded System Development Introduction about Industrial automation and Robotics

UNIT IV **[06 Hrs]**

Motor Driver **H- Bridge,** Difference between L293 and L298, Speed Control, Velocity control of motor using PWM, Introduction, Programming Tools, Robot Operating System, Multitasking, Actuators, Control,

UNIT V : Sensors- Analog Sensor, Digital IR Sensor - TSOP Sensor, Real-Time Image Processing, Wireless Communication **[08 Hrs]**

Text Books

1.Embedded Systems: Architecture, Programming and Design" by Raj Kamal

2. "Robotics: Modelling, Planning and Control" by Bruno Siciliano and Oussama

3."Communication Systems: Analog and Digital" by Sanjay Sharma

Reference Books

1. Introduction to Robotics: Mechanics and Control" by John J. Craig

2."Embedded Robotics: Mobile Robot Design and Applications with Embedded Systems" by Thomas Braunl

3. "Robotics: Everything You Need to Know About Robotics from Beginner to Expert" by Peter Mckinnon

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

SEMESTER: VII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject: : **Decision Making Experts System(Elective III)** Subject Code: **BTechRAI-703.3T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs/week	**03**	**30**	**70**	**100**

Prerequisite(s): Student should have basic knowledge of Artificial Intelligence

Course Objectives:

1	To understand intelligence by building computer programs that exhibit intelligent behaviour. □
2	To learn a variety of reasoning, optimization, and decision-making techniques for developing expert systems.
3	To understand how Expert Systems are used for solving real-life complex problems.

Course Outcomes:

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

CO1	Understand Expert Systems
CO2	Design intelligent machines which emulate the decision-making ability of a human expert
CO3	Understand basic components of expert systems
CO4	Implement the basic algorithms in reasoning, optimization and learning.
CO5	Understand the application of Expert System

Syllabus

UNIT-I : Introduction: [6 Hours]

What is an Expert System?Why should we use Expert Systems? History of Expert Systems.

UNIT-II : Expert system architecture: [8 Hours]

Knowledge base, working memory, inference engine, and system analysis, graphic and other software and user interface.

UNIT-III : Knowledge base: [7 Hours]

Priori knowledge, Posteriori knowledge, Rules, Semantic nets, Frames, Scripts.

UNIT-IV : Inference engine: [7 Hours]

Forward chaining (Bottom – up reasoning), Backward chaining (Top-down reasoning), Abduction, Reasoning under uncertainty.

UNIT-V : Learning by induction: [8 Hours]

Learning by observation, Learning by discovery, Supervised learning, Learning from examples, Unsupervised learning, Application of Expert systems: RADEX.

Text Books:

1. J. Giarratano and G. Riley, "Expert Systems -- Principles and Programming". 4th Edition, PWS

2. Publishing Company, 2004.

3. Decision Support and Expert Systems: Management Support Systems, Efriam urban, 4th Edition, 1995, Prentice-Hall.

Reference Books: Suggested Self Readings

1. Robert I. Levine, Diane E. Drangand Berry Edelson; A Comprehensive Guide to AI and Expert Systems, McGraw

2. Turban, E. and J. Aronson, Decision Support Systems and Intelligent Systems

3. "Introduction To Expert Systems", Peter Jackson, Addison Wesley.

4."Decision support systems and intelligent systems", Efraim Turban, Jay E. Aronson, Ting-Peng Liang, Prentice-Hall.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

SEMESTER: VII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject: **Computer Vision (Elective III)** Subject Code: **BTechRAI-703.4T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs/week	**03**	**30**	**70**	**100**

Aim: To learn various aspects of computer vision

Prerequisite(s): Student should have basic knowledge of Calculus, Linear algebra, Probability, Programming knowledge

Course Objectives:

1	To learn basic principles of image formation, image processing algorithms
2	To understand recognition from single or multiple images (video).
3	To understand applications of object recognition, image analysis, image retrieval and object tracking

Course Outcomes:

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

CO1	Learn fundamentals of computer vision and its applications
CO2	Understand the basic image processing operations to enhance, segment the images.
CO3	Understand the analyzing and extraction of relevant features of the concerned domain problem.
CO4	Understand and apply the motion concepts and its relevance in real time applications
CO5	Apply the knowledge in solving high level vision problems like object recognition, image classification etc.

Syllabus

UNIT-I Overview of computer vision and its applications [6 Hours]

Image formation and representation: Imaging geometry, radiometry, digitization, cameras and Projections, rigid and affine transformation

UNIT-II Image Processing [7 Hours]

Pixel transforms, color transforms, histogram processing, histogram equalization, filtering, convolution, Fourier transformation and its applications in sharpening, blurring and noise removal.

UNIT-III Feature detection [8 Hours]

Edge detection, corner detection, line and curve detection, active contours, SIFT and HOG descriptors, shape context descriptors, Morphological operation.

UNIT-IV Segmentation [8 Hours]

Active contours, split & merge, watershed, region splitting, region merging, graph-based segmentation, mean shift and model finding, Normalized cut.

UNIT-V Camera callibration [7 Hours]

camera models; intrinsic and extrinsic parameters; radial lens distortion; direct parameter calibration; camera parameters from projection matrices; orthographic, weak perspective, affine, and perspective camera models.

Text Books:

1.Computer Vision: Algorithms and Applications, R. Szeliski, Springer, 2011.
2.Introductory techniques for 3D computer vision, E. Trucco and A. Verri, Prentice Hall, 1998.

Reference Books:

1.Computer vision: principles, algorithms, applications, learning by E.R. Davies.
2.Computer Vision and Image Processing. by S. Nagabhushana

SEMESTER: VII (C.B.C.S)
Branch: Robotics & Artificial Intelligence

Subject: Industrial Robotics (Open Elective-II) **Subject Code: BTechRAI704.1T**

Load	Credits	College Assessment marks	University Evaluation	Total marks
3 Hrs/Week	03	30	70	100

Prerequisites: Knowledge of Basic Concepts of Robotics

Course Objectives:

1	To gain knowledge about industrial robotics
2	To know about various industrial applications of robot

Course Outcomes:
After successful completion of this course the student will be able to:

CO1	Identify various kinds of robots used in industrial sector
CO2	Learn the importance of various types of tactile sensors used in robots
CO3	Learn the importance of non-tactile sensors used in robots.
CO4	Understand the work of the End effectors, Grippers
CO5	Know various industrial applications of robot.

Syllabus

UNIT-I **[8 Hours]**
Fundamentals of Robotics: Introduction, Definition, Functions, Advantages, Disadvantages, applications, robotic components, classification of robots, Robotic specifications.

UNIT-II **[7 Hours]**
Tactile Sensors: Introduction, characteristics of sensing devices, sensors classification, touch or tactile sensors, position sensors, velocity sensors, acceleration sensors.

UNIT-III **[8 Hours]**
Non-Tactile Sensors: Introduction, types of proximity sensors, Non-contact proximity sensor, working principle of Optical, Ultrasonic, Inductive, Hall-effect proximity sensors, advantages and disadvantages of proximity-sensors.

UNIT-IV **[7 hours]**
Robot End-Effectors: Introduction of general aspects, types of end effectors, end effectors as tool, end effectors as gripper.

UNIT-V **[6 Hours]**
Industrial applications of robots: Introduction, Industrial applications of robots in material transfer, assembly, spray painting, Arc welding, its advantages and disadvantages of each application.

Text Books:

1. .J.Craig, —Introduction to Roboticsl, Pearson Education, 2005.
2. Mikell P. Groover,"Automation, Production Systems, and Computer Integrated Manufacturing", 2nd Edition, John Wiley & sons, Inc, 2007

Reference Books:

1. James A Rehg, "Introduction to Robotics in CIM Systems", Prentice Hall of India, 2002.
2. Grover, Wiess, Nagel, Oderey, —Industrial Robotics: Technology, Programming and Applicationsl, McGraw Hill, 1986.

SEMESTER: VII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject: Machine Learning for Robotics (Open Elective-II)
Subject Code: BTechRAI704.2T

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs/week	03	30	70	100

Prerequisite(s): Knowledge of programming, basic probability theory and statistics

Course Objectives:

1	To provide an introduction to the basic principles, techniques, and applications of ML.
2	To explain the strengths and weaknesses of different machine learning algorithms
3	To be able to adapt or combine some of the key elements of existing machine learning algorithms to design new algorithms as needed
4	To analyze and interpret machine learning results and make data-driven decisions.

Course Outcomes:

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

CO1	Gain a broad understanding of machine learning algorithms and their use in data-driven knowledge discovery and program synthesis.
CO2	Identify, formulate and solve machine learning problems that arise in practical applications
CO3	Obtain an understanding of the current state of the art in machine learning and be able to begin to conduct original research in machine learning.
CO4	Explore advanced topics such as deep learning, reinforcement learning, and natural language processing to stay at the forefront of the rapidly evolving field.
CO5	Apply machine learning principles to diverse domains, fostering the ability to analyze and interpret results, and make informed decisions based on model outcomes.

Syllabus

UNIT-I Introduction [6 Hours]

What and Why? Types of machine learning problems: classification, regression, sequence modelling. Introducing prerequisites of ML

UNIT-II Linear classifier and classification [7 Hours]

Linear classifier and classification problem, Gradient descent algorithm, Under-fitting vs Over-fitting problem, Training, Testing and Validation Process.

UNIT-III Supervised and Unsupervised Learning **[8 Hours]**

Supervised vs unsupervised classification, Bayesian classifier: decision boundaries; nearest neighbour methods, and support vector machine (SVM); Unsupervised learning: k-means and hierarchical clustering

UNIT-IV Feature extraction and feature selection **[8 Hours]**

Feature extraction and feature selection, Dimensionality reduction techniques: PCA, LDA and ICA.

UNIT-V Introduction to Neural Networks: **[7 Hours]**

Introduction to Neural Networks, Modelling and applica- tions to logic gates. Back-propagation learning algorithm: training and testing

Text Books:

1.Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

2. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.

Reference Books:

1. Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

2. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

SEMESTER: VIII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject: Cloud Computing(Elective IV) Subject Code: BTechRAI801.1T

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs/week	03	30	70	100

Prerequisite(s): Student should have basic Strong understanding of networking, virtualization, and distributed systems.

Course Objectives:

1	To Understand the fundamental concepts of cloud computing.
2	To Understand needs, virtualization, scalability, and elasticity.
3	Learn about different cloud service models (IaaS, PaaS, SaaS)
4	To managing and optimizing cloud resources, including cost-effective provisioning

Course Outcomes:

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

CO1	Describe architecture and underlying principles of cloud computing.
CO2	Explain need, types and tools of Virtualization for cloud.
CO3	Describe Services Oriented Architecture and various types of cloud services.
CO4	Explain Inter cloud resources management cloud storage services and their providers Assess security services and standards for cloud computing.
CO5	Analyze advanced cloud technologies.

Syllabus

UNIT-I Introduction to Cloud Computing [6 Hours]

Introduction To Cloud Computing: Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

UNIT-II Cloud Enabling Technologies Service Oriented Architecture [7 Hours]

REST and Systems of Systems – Web Services – Publish, Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.

UNIT-III Cloud Architecture, Services And Storage [8 Hours]

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

UNIT-IV Resource Management And Security In Cloud [8 Hours]

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

UNIT-V Cloud Technologies And Advancements Hadoop [7 Hours]

MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

Text Books:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security, CRC Press, 2017

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.

RASHTRASAANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech) DEGREE COURSE
SEMESTER: VIII (C.B.C.S)
Branch: Robotics & Artificial Intelligence

Subject: Robotics & Industrial Applications (Elective-IV) **Subject Code: BTechRAI801.2T**

Load	Credits	College Assessment marks	University Evaluation	Total marks
3 Hrs/Week	03	30	70	100

Prerequisites: Knowledge of Principles of Robotics

Course Objectives:

1	To select the robots according to usage
2	To know about various industrial applications of robot

Course Outcomes:
After successful completion of this course the student will be able to:

CO1	To gain knowledge about various types of industrial robots
CO2	To design automatic manufacturing cells with robotic control using the machine vision system.
CO3	Ability in selecting the required robot.
CO4	Apply the knowledge in handling the materials.
CO5	Know various industrial applications of robot.

SYLLABUS

UNIT-I **[8 Hours]**

Introduction: Types of industrial robots, Load handling capacity, general considerations in Robotics material handling, material transfer, machine loading and unloading, Robot centered cell.

UNIT-II **[7 Hours]**

Robots for inspection: Robotic vision systems, image representation, object recognition and categorization, depth measurement, image data compression, visual inspection.

UNIT-III **[8 Hours]**

Selection of Robot: Factors influencing the choice of robot, robot performance testing, economics of robot, impact of robot on industry and society.

UNIT-IV **[7 hours]**

Material Handling: Concepts of material handling, principles and considerations in material handling systems design, conventional material handling system- industrial trucks, monorails, rail guided vehicles, conveyor systems, cranes and hoists, advanced material handling system.

UNIT-V **[6 Hours]**

Industrial Applications: Applications of robots in continuous arc welding, Spot welding, Spray painting and assembly operation.

Text Books:

3. Richaerd D Klafter, Thomas Achmielewski and Mickael Negin, "Robotic Engineering – An integrated Approach" Prentice HallIndia, New Delhi, 2001.
4. Mikell P. Groover,"Automation, Production Systems, and Computer Integrated Manufacturing", 2nd Edition, John Wiley & sons, Inc, 2007

Reference Books:

3. James A Rehg, "Introduction to Robotics in CIM Systems", Prentice Hall of India, 2002.
4. Deb S R, "Robotics Technology and Flexible Automation", Tata McGraw Hill, New Delhi, 1994

RASHTRASAANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech) DEGREE COURSE
SEMESTER: VIII (C.B.C.S)
Branch: Robotics & Artificial Intelligence

Subject: Medical Robotics (Elective-IV) **Subject Code: BTechRAI801.3T**

Load	Credits	College Assessment marks	University Evaluation	Total marks
3 Hrs/Week	03	30	70	100

Prerequisites: Knowledge of Dynamics of Robotics

Course Objectives:

1	To understand design and control of robotics for medical applications
2	To know use of Robotics in surgery with introduction to other healthcare robots.

Course Outcomes: After successful completion of this course the student will be able to:

CO1	Know about kinematics of robots.
CO2	Design robot and know the concept of human machine interface.
CO3	Gain knowledge about medical imaging modalities.
CO4	Know about various types of planning
CO5	Know about various applications of robot in Biomedical Engineering

SYLLABUS

UNIT-I

Introduction to Medical Robotics: Basic kinematic concepts such as forward and inverse kinematics, basic control concepts such as impedance and admittance, surgery for engineers, interventional radiology for engineers. [8 Hours]

UNIT-II

Minimally Invasive Surgery (MIS): Human Machine interfaces, Teleoperation, Co-operative manipulation, Robot design concepts, Port placement for MIS, Video images in MIS. [7 Hours]

UNIT-III

Image-Guided Interventions: Medical imaging modalities (eg. MRI, US, X-ray , CT), Robot Compatibility with medical images, Image segmentation and modeling, Tracking Devices, Frames and Transformations, Surgical navigation, Calibration, Radiosurgery. [8 Hours]

UNIT-IV

Planning: Task Planning Task level programming, Uncertainty, Configuration, Space, Gross motion, Planning, Grasp Planning, Fine-motion planning, Simulation of planar motion, Source and Goal scenes, Task Planner simulation. [7 hours]

UNIT-V

Applications: Applications in Biomedical Engineering – Bio Engineering Biologically Inspired Robots, Neural Engineering, Application in Rehabilitation – Interactive Therapy, Bionic Arm, Clinical and Surgical – Gynaecology, Orthopaedics, Neurosurgery [6 Hours]

Text Books:

1. Robert Schilling, —Fundamentals of Robotics-Analysis and controll, Prentice Hall, 2003.
2. J.J.Craig, —Introduction to Roboticsl, Pearson Education, 2005.

Reference Books:

1. Grover, Wiess, Nagel, Oderey, —Industrial Robotics: Technology, Programming and Applicationsl, McGraw Hill, 1986.
2. Staugaard, Andrew C,—Robotics and Artificial Intelligence: An Introduction to Applied Machine Learningl, Prentice Hall Of India, 1987.

RASHTRASAANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech) DEGREE COURSE
SEMESTER: VIII (C.B.C.S)
Branch: Robotics & Artificial Intelligence

Subject: Basics of 3D Printing and Additive manufacturing **(Elective-IV)**

Subject Code: BTechRAI801.4T

Load	Credits	College Assessment marks	University Evaluation	Total marks
3Hrs/Week	03	30	70	100

Prerequisites: Knowledge of Product Design and Computer Aided Design

Course Objectives:

1	To impart students to fundamentals of 3D printing techniques
2	To understand the method of manufacturing of liquid based, powder based and solid based techniques.

Course Outcomes: After successful completion of this course the student will be able to:

CO1	To learn the basic prototyping fundamentals for 3D printing
CO2	To learn Liquid based 3D Printing concept in Stereo lithography apparatus
CO3	To learn Liquid based 3D Printing concept in Solid ground curing
CO4	To learn Solid Based 3D Printing in Laminated object manufacturing
CO5	To learn Solid Based 3D Printing in Fused Deposition Modeling

SYLLABUS

UNIT-I

Introduction: Introduction to design, Prototyping fundamentals. Introduction to 3D printing, its historical development, advantages. Commonly used terms, process chain, 3D modeling, Data Conversion, and transmission, Checking and preparing, Building, Post processing, RP data formats, Classification of 3D printing process, Applications to various fields. **[8 Hours]**

UNIT-II

Stereo lithography apparatus (SLA): Models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. **[7 Hours]**

UNIT-III

Solid ground curing (SGC): Models and specifications, process, working, principle, applications, advantages and disadvantages, case studies **[8 Hours]**

UNIT-IV

Laminated object manufacturing (LOM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies **[7 hours]**

UNIT-V

Fused Deposition Modeling (FDM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies, practical demonstration. **[6 Hours]**

Text Books:

1. Chua C.K., Leong K.F. and LIM C.S Rapid prototyping: Principles an Applications, World Scientific publications, 3rdEd., 2010
2. D.T. Pham and S.S. Dimov, "Rapid Manufacturing", Springer, 2001

Reference Books:

1. Paul F. Jacobs, " Rapid Prototyping and Manufacturing"–, ASME Press, 1996
2. Ian Gibson, Davin Rosen, Brent Stucker "Additive Manufacturing Technologies, Springer, 2nd Ed, 2014.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

SEMESTER: VIII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject: **Cognitive Robotics(Elective – V)** Subject Code: **BTechRAI-802.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs/week	**03**	**30**	**70**	**100**

Aim: To demonstrate the capabilities of cognitive robot and their driving requirements

Prerequisite(s): Machine Learning and its Applications

Course Objectives:

1	To comprehend the primary categories of cognitive robots, including those focused on vision, motor control, language, and social skills, it's essential to explore their distinct operational demands. These robots require specialized engineering operations to function effectively, along with capabilities for navigation and cooperation.
2	To understand advanced methods for creating highly capable cognitive robots
3	To delve into recent scholarly works and integrate their findings, we aim to comprehensively elucidate and assess the current advancements in cognitive robotics.
4	To implement one or more fundamental reasoning techniques in developing a basic agent, the emphasis lies on its responsiveness to goals or rewards as driving factors.

Course Outcomes:

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

CO1	To Explore the intersection of psychology and neuroscience with behavior and intelligence offers valuable insights that shape the design of robotics models and applications.
CO2	To Compare, choose, and implement various machine learning techniques for enabling intelligent behavior in robots.
CO3	To examine the methodologies and software/hardware technologies utilized in robotics research and applications.
CO4	To examine the current advancements in cognitive and intelligent robotics models and how they influence the conception and development of future robot

	applications.

Syllabus

UNIT-I - Introduction- Intelligent System Design and Cognition Development [8 Hrs.]

Defining Intelligence - Embodiment and Its Implications, Thinking, Cognition, and Intelligence, Synthetic Methodology for Intelligence

UNIT-II- Robot Cognition and Perception from a Cybernetic Perspective [07 Hrs.]

Introduction to the Model of Cognition, Visual Perception, Visual Recognition, Machine Learning, and Robot Cognition.

UNIT-III - Intelligent System Design, Cognition Development and control [07Hrs.]

Properties of Complete Agents, Agent Design Principle, Developmental Robot Design, Matching brain and Body Dynamics, Artificial Neural Networks (ANN), Fuzzy Logic, Genetic Algorithms and Other Nature Inspired Methods, Optimal Control using ANN.

UNIT-IV- Randomized Path Planning [06 Hrs.]

Introduction, Representation of the Robot's Environment, Review of configuration spaces, Visibility Graphs, Voronoi diagrams, Potential Fields and Cell Decomposition, Planning with moving obstacles, Probabilistic Roadmaps

UNIT-V - Simultaneous Localization and Mapping (SLAM) [08 Hrs.]

Problem Definition, Mathematical Basis, Examples: SLAM in Landmark Worlds, Taxonomy of the SLAM Problem, Extended Kalman filter, Graph-Based Optimization Techniques, ParticleMethods Relation of Paradigms.

TEXT BOOKS:

1. Patnaik, Srikanta, "Robot Cognition and Navigation - An Experiment with Mobile Robots", SpringerVerlag Berlin and Heidelberg, 2007

2. Howie Choset, Kevin LynchSeth Hutchinson, George Kantor, Wolfram Burgard, Lydia Kavraki, and Sebastian Thrun, "Principles of Robot Motion-Theory, Algorithms, and Implementation", MIT Press, Cambridge, 2005.

3 David Vernon,"Artificial Cognitive Systems: A Primer" ,The MIT Press, 1st Edition,2014

REFERENCE BOOKS:

1. HoomanSomani,"Cognitive Robotics", CRC Press, 2015 2. Jared Kroff,"Cognitive Robotics: Intelligent Robotic Systems", Wilford Press, 2016

2. Jared Kroff,"Cognitive Robotics: Intelligent Robotic Systems", Wilford Press, 2016

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

SEMESTER: VIII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject: Reinforcement learning(**Elective – V**) Subject Code: **BTechRAI-802.2T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs/week	**03**	**30**	**70**	**100**

Aim: To demonstrate the Reinforcement Learning

Prerequisite(s): Student should have basic understanding of machine learning algorithms and techniques. .

Course Objectives:

1	To Understand the Components of Reinforcement Learning.
2	Apply Random and Optimistic Exploration Strategies to make correct decision making
3	Apply different Prediction techniques.
4	To demonstrate various policy based Reinforcement Learning Algorithms

Course Outcomes:

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

CO1	Demonstrate various Components of Reinforcement Learning.
CO2	Make use of various exploration and exploitation strategies
CO3	Apply Model based and Model Free Prediction techniques.
CO4	Make use of different value based Reinforcement Learning Algorithms
CO5	Demonstrate various Policy based Reinforcement Learning Algorithms.

Syllabus

UNIT-I Introduction **[6 Hours]**

Deep Reinforcement Learning, Suitability of RL, Components of Reinforcement Learning -Agent, Environment, Observations, Actions, Agent-Environment interaction cycle, MDP (Markov Decision Process):

UNIT-II Planning, Exploitation and Exploration **[7 Hours]**

Planning: Objective of a decision making agent-environment, Plan, Optimal policy, Comparison of Policies, Bellman Equation/State-Value Function

Exploitation and Exploration of Reinforcement Learning: Bandits- Single-state decision problem(Multi-Armed Bandit(MAB) problem), The cost of exploration, Approaches to solve MAB environments, Greedy Strategy, Random Strategy, Epsilon-Greedy Strategy, Decaying Epsilon-Greedy Strategy

UNIT-III Model Free Reinforcement Learning **[8 Hours]**

Monte Carlo Prediction (MC), First-Visit MC (FVMC), Every-Visit MC (EVMC), Temporal Difference Learning (TD)

UNIT-IV Value Based Reinforcement Learning **[8 Hours]**

Deep reinforcement learning agents with sequential feedback, evaluative feedback, sampled feedback, Neural Fitted Q (NFQ), Deep Q-Network (DQN), Double Deep-Q Networks(DDQN), Dueling DDQN, Prioritized Experience Replay (PER)

UNIT-V Policy Based Reinforcement Learning **[7 Hours]**

Policy Gradient and Actor-Critic Methods—REINFORCE Algorithm and Stochastic Policy Search, Deep Deterministic Policy Gradient (DDPG), Twin-Delayed DDPG (TD3), Soft Actor-Critic (SAC), proximal policy optimization (PPO)

Text Books:

1. Miguel Morales, Grokking Deep Reinforcement Learning, Manning Publications, 2020.

Reference Books:

1. Richard S. Sutton and Andrew G. Barto, Reinforcement learning: An Introduction, Second Edition, MIT Press, 2019.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

SEMESTER: VIII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject: Big Data Analytics using Hadoop**(Elective – V)** Subject Code: **BTechRAI-802.3T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs/week	**03**	**30**	**70**	**100**

Aim: Understanding concept of big data & Hadoop

Prerequisite(s): Student should have basic knowledge of hould have the knowledge of Programming language, Practice of SQL, (queries an subqueris), Exposure to Linux environment.

Course Objectives:

1	Student should able to learn and understand the basic concept, characteristics application of big data.
2	To Learn the concept of Distributed file system and its applications.
3	Understand big data tools, and frameworks with map reduce.

Course Outcomes:

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

CO1	Understand the basic concept of data analytics with big data.
CO2	Build and maintain reliable, scalable, distributed systems.
CO3	To learn Hadoop Distributed file system and its location.
CO4	Apply ecosystem knowledge to real time applications.

Syllabus

UNIT-I Introduction to Data Analytics [6 Hours]

Data Analytics: An Overview Importance of Data Analytics ,Types of Data Aalytics Descriptive Analysis Diagnostic Analysis Predictive Analysis Prescriptive Analysis Benefits of Data Analytics .

UNIT-II Big data And Hadoop [7 Hours]

Data characteristics, types of digital data: Unstructured, semi structured, Structured ,Sources of data, working with Unstructured data,Challenges for processing big data, charceterstics & need of big data, History of Hadoop, use cases of Hadoop, RDBMS vs Hadoop

UNIT-III HDFS [8 Hours]

HADOOP distributed file System, significance of HDFS in Hadoop, Features of HDFS, Data Storage in HDFS: Introduction about Blocks, Data replication, Accessing HDFS: CLI (Command Line Interface) and admin commands, Java Based Approach, Fault tolranceDownload Hadoop, Installation and set-up of Hadoop, start-up & and shut down process.

UNIT-IV Map Reduce [7 Hours]

Map Reduce story, Map reduce architecture, How Map Reduce works, Developing Map Reduce, Map Reduce Programming Model, Different phases of Map Reduce algorithm, Different data types in Map Red

UNIT5: Nosql Databases: [7 Hours]

Schema less models, increasing flexibility of data manipulation,Key value stores, Document Datastores, Tabular stores, Object data stores, Analyzing Big data Nosql data base Architecture.

Text Books:

1.Tom White,"Hadoop: The definitive Guide", 3rd edition, O' Reilly Media.
2.Seema Acharya, Subhasini Chellppen, "Big data Analutics"Willey 2015
3.Big Data, Big Data Analytics by Micheal Minelli, <ichele Chambers, AmbigaDhira.

Reference Books:

1.V. Ankam, Big data Analytics, Packet pub. Ltd.
2.Michel Berkhold,David J. Hand,"Intelligent Data Analytics",Springer 2007.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

SEMESTER: VIII (C.B.C.S.)

BRANCH: Robotics & Artificial Intelligence

Subject: Software Engineering **Subject Code:** BTechRAI802.4

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs/week	03	30	70	100

Aim: Understanding software Engineering concepts

Prerequisite(s): NIL

Course Objectives:

1	To make students a successful professionals in the field with solid fundamental knowledge of software engineering.
2	To prepare students with strong communication and interpersonal skills, as well as professional and ethical principles when functioning as members and leaders of multi-disciplinary teams.
3	To teach students how to apply their foundations in software engineering to adapt to readily changing environments using appropriate theory, principles and processes

Course Outcomes:

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

CO1	Understand software engineering practices and various models.
CO2	Understand software development Life Cycle.
CO3	Understand software testing principles and techniques.
CO4	Understand various software project management tasks and methods to implement them..

Syllabus

UNIT-I- Introduction to Software Engineering: [6 Hours]

Software engineering principles, Software Myths, Software Engineering- A Layered Technology, Software Process Framework, Requirements Engineering Tasks, Requirement Engineering Process, Eliciting Requirement: Case Study Software Requirements Specification.

UNIT II Software Process Models :

The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Process Model, COCOMO Model, Agile Process Models, Agile metrics, Extreme Programming (XP), Software Deployment, Case Study.

UNIT III Basic concepts of testing :

Testing Life Cycle, Structural Testing, Functional Technique, Static testing, Dynamic testing, Unit Testing, Integration Testing, Validation Testing, System Testing, Debugging. Software Testing fundamentals, Black Box Testing, White Box Testing, Web Testing, Test case design, building, execution, Automated Testing.

UNIT IV Software Project management :

Plans, Methods and Methodology, The Business Case, Project Success and Failure, Project Evaluation, Cost-benefit evaluation technique, Project Planning-stepwise project Planning, Software Effort Estimation- Albrecht Function Point Analysis, COSMIC Function Point, Cost Estimation, Project Scheduling.

UNIT V An Overview :

Software Quality, A Framework for Product Metrics, Metrics for Analysis & Design Models, Metrics for Source Code, Metrics for Testing & Maintenance. Metrics for process & project - Software measurement, metrics for software quality, metrics for small organization, Managing people in software environment.

Text books

1. Roger Pressman; Software Engineering-A Practitioner's Approach; Sixth Edition, MaGraw Hill, 2010
2. Project Management by Clifford F. Gray, Erik W. Larson, McGraw Hill
3. Ian Somerville; Software Engineering; Seventh Edition; Pearson Education. 2008.

Reference books

1. Ethics in Information Technology, George W. Reynalds, 4th Edition, Cengage Leraning Publication
2. David Gustafsan, Software Engineering;Schaum's Series,Tata McGraw Hill,2002 6. Sanjay Mohapatra; Software Project Management, First Edition, Cengage Learning, 2011.
3. Rajib Mall, Software Project Management, 5th Edition, McGrawHill