MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

DEPARTMENT OF INFORMATION TECHNOLOGY

Syllabi
of
Departmental Elective (DE) Courses
B.Tech VII Semester
(Batch Admitted in 2020-21)
(Information Technology/ Internet of Things (IoT)/ Information Technology (Artificial Intelligence and Robotics))
[ITEM IT-3]

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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DEPARTMENT OF INFORMATION TECHNOLOGY

PATTERN RECOGNITION
160732/230733/240733

L	T	P	Total Credits
3	-	-	3

COURSE OBJECTIVE

- To analyse the usability of image processing application.
- To choose appropriate ML algorithms for specific application.
- To understand the implementation of python in the real-world application.

Unit-I

Introduction to pattern Recognition: Overview of Pattern Recognition, Applications of Pattern Recognition, Pattern Recognition Techniques, Challenges in Pattern Recognition.

Unit-II

Data Pre-processing Types of Data, Data Acquisition Techniques, Data Pre-processing Techniques, Image Enhancement Techniques, Feature Selection and Extraction Techniques, Feature Scaling and Transformation, Feature Extraction.

Unit-III

Introduction to Deep Learning, Neural Networks and Convolutional Neural Networks, Deep Learning, Transfer Learning, Feature Fusion Techniques, Hyper-parameter Optimization, Ensemble Methods in Pattern Recognition.

Unit-IV

Implementation: Overview of Object Detection and Segmentation, Feature-Based Object Detection, Deep Learning-Based Object Detection, Image Segmentation Techniques.

Unit-V

Application: Introduction to Time Series Analysis, Applications of Time Series Analysis in Real-world application, Time Series Analysis Techniques, Time Series Analysis.

RECOMMENDED BOOKS

- Pattern Recognition and Machine Learning by Christopher Bishop.
- Deep Learning by Ian Goodfellow, Yoshua Bengio Aaron Courville, 2016.
- Deep Learning with Python by Francois Chollet.

COURSE OUTCOMES

After completion of the course, students would be able to:

CO1. explain the basic principle of image processing

CO2. apply the advance pattern recognition algorithms on images

CO3. analyse the potential of basic image processing

CO4. compare different pattern recognition algorithms on different domain

CO5. develop the real world application of pattern recognition

CO6. design basic programming structure for image processing using python

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DEPARTMENT OF INFORMATION TECHNOLOGY

ROBOT OPERATING SYSTEM
240731

L	T	P	Total Credits
3	-	-	3

COURSE OBJECTIVES

- Use ROS to inspect and debug a robotics system.
- Prototype simple command and control applications for a simulated mobile robot.
- Integrate a new sensor into the robot's ROS ecosystem.
- Make use of sensor data to inform a robot's mission in real-time.

Unit-I

ROS Fundamentals: Introduction of Linux/UBUNTU, installation and use of virtual box machine, Linux file system and terminal, various commands, Remote Desktop access commands such as SSID, and use of Compiler/IDE in Linux, OOPs concepts with Linux terminal: C++ and Python in Ubuntu Linux, Introduction to Python Interpreter, review of fundamental of python such as functions, class.

Unit-II

ROS architecture and philosophy, installation, ROS master, nodes, and topics, Console commands, Catkin workspace and build system, Launch-files, Gazebo simulator, Programming Tools, ROS package structure, Integration and programming.

Unit-III

ROS C++ client library (roscpp), ROS subscribers and publishers, ROS parameter server, TF Transformation System, rqt User Interface, Robot models (URDF), Simulation descriptions (SDF).

Unit- IV

ROS services, ROS actions (actionlib), ROS time, ROS bags, debugging strategies, Introduction to ROS2, architecture & philosophy, master, nodes, and topics, Console commands, Catkin workspace and build system

Unit -V

ROS services, ROS actions (actionlib), ROS time, ROS bags, Debugging strategies, Introduction to ROS2. Case study: Using ROS in complex real-world applications such as ROS/Gazebo for Maritime Robotics, Home Robotics, UAVs.

RECOMMENDED BOOKS

- Robot Operating System for Absolute Beginners: Robotics Programming Made Easy.
- "Programming Robots with ROS" by Quigley, Gerkey and Smart.
- "The Linux Command Line" by William Shotts.
- "It-Yourself Guide to the Robot Operating System: Volumes" by Patrick Goebel.

COURSE OUTCOMES

After completion of the course students would be able to:

CO1. identify the fundamentals of operating system dedicated to Robots.

CO2. interpret various case studies of ROS application.

CO3. apply spatial transformation to obtain forward and inverse kinematics through programming.

CO4. determine the robot dynamics problems for path planning and Programming.

CO5. assess working principle of various ROS debugging process.

CO6. develop applications of robots in industry.

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DEPARTMENT OF INFORMATION TECHNOLOGY

HUMANOID ROBOTICS
240732

L	T	P	Total Credits
3	-	-	3

COURSE OBJECTIVES

- To understand and describe the state of the art of humanoid robot.
- To introduce students with mechanism and design of humanoid robot.
- To elucidate the technical challenges with humanoid robot.
- To discuss the potential roles of humanoid robots in society, w.r.t. social and ethical aspects, and applications.

Unit-I

Research on Humanoid Robot, Overview of ASIMO and its significance in humanoid robot research, Anatomy and structure of ASIMO, Design considerations for stability, mobility, and dexterity in ASIMO, Actuators, sensors, and hardware components used, Communication Capabilities of ASIMO, Introduction to NAO Humanoid Robotics, NAO Robot Vision and Perception, NAO robot features, capabilities and limitations of the NAO robot, Social and cognitive aspects of human-robot interaction.

Unit-II

Humanoid Mechanism and Design, Kinematics of a Humanoid Robot, Zero Moment Point (ZMP) overview, Measurement of ZMP, Dynamics of a humanoid robot.

Unit-III

Biped Walking, 2D and 3D walking pattern generation, ZMP-based walking pattern generation, Stabilizer, Additional methods for Biped control.

Unit-IV

Motion Planning and Control: Robot-Whole body motion, Whole body motion patterns to dynamically stable motion, remote operation of humanoid robot.

Unit-V

Application of Humanoids: Humanoid Robots for Entertainment-Theme park, Humanoid Robots in Education-Robots role in teaching, Humanoid-like robot in Special Education, Next generation Industrial Robot, Inclusion of Humanoid Robots in Human Society-Ethical issues.

RECOMMENDED BOOKS

- Kajita, Shuuji, Hirohisa Hirukawa, Kensuke Harada, and Kazuhito Yokoi. Introduction to humanoid robotics. Vol. 101. Springer Berlin Heidelberg, 2014.
- Nenchev, Dragomir N., Atsushi Konno, and Teppei Tsujita. Humanoid robots: Modeling and control. Butterworth-Heinemann, 2018.
- Burdet, Etienne, David W. Franklin, and Theodore E. Milner. Human robotics: neuromechanics and motor control. MIT press, 2013.
- Henze, Bernd. Whole-Body Control for Multi-Contact Balancing of Humanoid Robots: Design and Experiments. Vol. 143. Springer Nature, 2021.
- Lynch, Kevin M., and Frank C. Park. Modern robotics. Cambridge University Press, 2017.

COURSE OUTCOMES

After completion of the course students would be able to:

CO1. define the technical aspects of various types of humanoid robot.

CO2. explain the details of mechanism and design of humanoid robot.

CO3. interpret the ZMP and the dynamics of humanoid robot.

CO4. examine the Biped walking pattern.

CO5. determine the whole-body motion of humanoid robot.

CO6. develop the trends of humanoid robot in society.

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DEPARTMENT OF INFORMATION TECHNOLOGY

Syllabi
of
Open Category (OC) Courses
B.Tech VII Semester
(Batch Admitted in 2020-21)
(Information Technology/ Internet of Things (IoT)/ Information Technology (Artificial Intelligence and Robotics))
[ITEM IT-4]

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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DEPARTMENT OF INFORMATION TECHNOLOGY

IoT AND ITS APPLICATIONS

L	T	P	Total Credits
3	-	-	3

COURSE OBJECTIVES

- To understand basic terminology, concepts, structure, and protocols of IoT.
- To understand Sensors, Devices & Components.
- To attain knowledge of integrated development environment.
- To be able to organize and analyze the vast data of IoT
- To be able to develop different IoT applications.

UNIT I

Introduction to IoT and network architecture– Evolution of Internet of Things (IoT), IoT Components, Impact of IoT, Challenges and security issues in IoT. IoT World Forum (IoTWF) standardized architecture, Simplified IoT Architecture: Core IoT Functional Stack, IoT data management and compute stack (Cloud, edge, fog).

UNIT II

IoT Protocols: Communication Protocols: IEEE 802.15.4, Zigbee, 6LoWPAN, Z-Wave, Bluetooth, RFID. Networking Protocols: CoAP and MQTT.

UNIT III

Things in IoT: Sensor: light sensor, moisture sensor, temperature sensor, etc. Actuator: DC motor, different types of actuators. Controllers: microcontrollers and their role as a gateway to interfacing sensors and actuators.

IoT Platform overview: Raspberry pi, Arduino Board details, Introduction to Arduino IDE, Embedded 'C' Language basics, Interfacing sensors, LEDs.

UNIT IV

Cloud computing and data analytics in IoT: Introduction to Cloud Computing-Definition, Characteristics, Components, Cloud provider: Microsoft Azure, AWS, Google Cloud. Structured Versus Unstructured Data, Data in Motion versus Data at Rest, IoT Data Analytics Challenges, Data Acquiring, Organizing in IoT.

UNIT V

IoT Applications: Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance, Home Automation, Smart Agriculture, Examples for new trends – AI, ML penetration to IoT.

RECOMMENDED BOOKS

- IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.
- Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015.
- Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education.

COURSE OUTCOMES

At the completion of course, student will able to-

CO1. define basic understanding of IoT, its architecture.

CO2. compare the communication models and protocols for IoT.

CO3. implement hardware and software platforms for application in IoT.

CO4. examine the security issues involved in IoT.

CO5. choose appropriate data analytics and cloud offerings related to IoT.

CO6. develop IoT based applications for real world.

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DEPARTMENT OF INFORMATION TECHNOLOGY

SOFT COMPUTING

L	T	P	Total Credits
3	-	-	3

COURSE OBJECTIVES

- To provide the students the basic understanding of soft computational techniques like neural networks and fuzzy logic, program the related algorithms and design the related systems.
- To understand the theory and concepts of neuro-modelling, different neural paradigms and related applications.
- To understand the basics of evolutionary computing paradigms like genetic algorithm and its application to engineering optimization problems.

Unit I

Introduction to Soft Computing, Concept of computing systems, Soft computing versus Hard computing, Characteristics of Soft computing, Some applications of Soft computing techniques.

Unit II

Artificial Neural Networks- Biological neurons and its working, Simulation of biological neurons to problem solving, Different ANNs architectures, Training techniques for ANNs, Applications of ANNs to solve some real life problems.

Unit III

Genetic Algorithms- Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc., Solving single-objective optimization problems using GAs.

Unit IV

Fuzzy logic- Introduction to Fuzzy logic, Fuzzy sets and membership functions Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, de-fuzzification techniques, Fuzzy Inference System, realistic applications of Fuzzy logic.

Unit V

Introduction to Optimization Problem, Concept & types of optimization problems, defining an optimization problem, traditional approaches for solving optimization problem, limitations of traditional approaches, applications and examples.

RECOMMENDED BOOKS

- Principles of Soft Computing, S.N. Sivanandam & S.N. Deepa, John Wiley & Sons, 2007.
- Evolutionary Algorithm for Solving Multi-objective, Optimization Problems (2nd Edition), Collelo, Lament, Veldhnizer (Springer).
- Fuzzy Logic with Engineering Applications Timothy J. Ross (Wiley), 2005.
- Neural Networks and Learning Machines Simon Haykin (PHI), 3rd edition.

COURSE OUTCOMES

At the completion of course, student will able to-

CO1. define basic concepts of neural networks and fuzzy systems.

CO2. classify solutions by applying various soft computing approaches for a given problem.

CO3. identify soft computing methods to resolve realistic problems in varieties of application domains.

CO4. analyze artificial neural networks alongwith its applications.

CO5. categorize the basic computational methods as hard or soft.

CO6. determine appropriate soft computing models for solving various real world problems.

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DEPARTMENT OF INFORMATION TECHNOLOGY

SOFTWARE TESTING

L	T	P	Total Credits
3	-	-	3

COURSE OBJECTIVES

- To know about an introduction to software testing, focusing on the principles, techniques, and best practices used in the field.
- To become familiar with the fundamental concepts of software testing and gain practical skills in planning, designing, and executing software tests.
- To cover the various testing methodologies, test case creation, test automation, and defect tracking.

Unit I

Introduction to Software Testing: Importance and goals of software testing, Testing life cycle and its phases, Role of testing in the software development process, Testing principles and fundamentals, V & V Model.

Unit II

Testing Techniques: Black-box and white-box testing, Equivalence partitioning, Boundary value analysis, Decision table testing, State transition testing, Use case testing, Error guessing and exploratory testing.

Unit III

Test Case Design: Test case components, Test case design techniques, Test case prioritization, Test data management, Test coverage criteria, Traceability matrix.

Test Planning and Management: Test planning process, Test strategy and test plan development, Test estimation and scheduling, Test environment setup and management, Test metrics and reporting.

Unit IV

Specialized Testing: Unit testing, Integration testing, System testing, Acceptance testing, Regression testing, Performance testing, Security testing, Usability testing, Compatibility testing, localization testing.

Unit V

Quality Assurance and Best Practices: Quality assurance processes and activities, Code reviews and inspections, Static analysis and code coverage, Test-driven development and agile testing, Emerging trends in software testing

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RECOMMENDED BOOKS

- "Foundations of Software Testing: ISTQB Certification" by Dorothy Graham, Erik van Veenendaal, Isabel Evans, and Rex Black.
- "Software Testing: Concepts and Practices" by Srinivasan Desikan and Gopalaswamy Ramesh.
- "The Art of Software Testing" by Glenford J. Myers, Corey Sandler, and Tom Badgett.
- "Agile Testing: A Practical Guide for Testers and Agile Teams" by Lisa Crispin and Janet Gregory.
- "How Google Tests Software" by James A. Whittaker, Jason Arbon, and Jeff Carollo.

COURSE OUTCOMES

At the completion of course, student will able to-

CO1. understand the fundamental principles and concepts of software testing.

CO2. gain practical knowledge of different testing techniques and methodologies.

CO3. learn to create effective test cases and test plans.

CO4. develop skills in test execution, analysis, and defect tracking.

CO5. understand the role of test automation in software testing.

CO6. apply industry best practices for software testing.
