



MAHARASHTRA INSTITUTE OF TECHNOLOGY, AURANGABD
An Autonomous Institute Affiliated to Dr. Babasaheb
Ambedkar Marathwada University, Aurangabad,
Maharashtra (India)

Syllabus of Bachelor of Vocation

In

Artificial Intelligence and Robotics

Under Choice Based Credit System (CBCS)

Under Faculty of Science and Technology

(Effective from 2022-23 and onwards)

Master Copy

Curriculum for B. Voc AI & ROBOTICS

| NSQF Level -5 | | | | | | | | | | | Semester -I | |
|---|-------------|--|--------|---------------|-----------|-----|-------------------|-----|-------|-----|-------------|--|
| Sr. No. | Course Code | Course Title | Credit | Contact Hr/Wk | | | Evaluation Scheme | | | | ESE hour | |
| | | | | L | P | MSE | TA | ESE | Total | | | |
| Theory | | | | | | | | | | | | |
| 1. | VAI101 | Communicative English | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | | |
| 2. | VAI102 | Basics of Electronics | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | | |
| 3. | VAI103 | Fundamentals of Artificial Intelligence | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | | |
| 4. | VAI104 | Control System | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | | |
| Lab/Practical | | | | | | | | | | | | |
| 5. | VAI121 | Basics of Electronics Lab | 1.5 | - | 2 | - | 25 | 25 | 50 | - | | |
| 6. | VAI122 | Control System Lab | 1.5 | - | 2 | - | 25 | 25 | 50 | - | | |
| On Job Training (OJT)/Qualification Packs* | | | | | | | | | | | | |
| 7. | VAI131 | Technical support Engineer (SSC /Q5101) | 15 | - | 7-8 weeks | - | 50 | 150 | 200 | - | | |
| | VAI132 | Mechatronics Maintenance Specialist(ELE/Q7105) | | | | | | | | | | |

*Any one On-Job-Training as per guidelines of AICTE & SSC for the given skill sets for 150 Marks External Assessment by NSDC/SSC

| NSQF Level -5 | | | | | | | | | | | Semester -II | |
|---|-------------|--------------------------------------|--------|---------------|-----------|-----|-------------------|-----|-------|-----|--------------|--|
| Sr. No. | Course Code | Course Title | Credit | Contact Hr/Wk | | | Evaluation Scheme | | | | ESE hour | |
| | | | | L | P | MSE | TA | ESE | Total | | | |
| Theory | | | | | | | | | | | | |
| 1. | VAI151 | Programming in Python | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | | |
| 2. | VAI152 | Data Structure & Algorithms | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | | |
| 3. | VAI153 | Basics of robotics | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | | |
| 4. | VAI154 | Digital Electronics | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | | |
| Lab/Practical | | | | | | | | | | | | |
| 5. | VAI171 | Programming in Python Lab | 1.5 | - | 2 | - | 25 | 25 | 50 | - | | |
| 6. | VAI172 | Digital Electronics Lab | 1.5 | - | 2 | - | 25 | 25 | 50 | - | | |
| On Job Training (OJT)/Qualification Packs* | | | | | | | | | | | | |
| 7. | VAI181 | Industrial Auto Specialist IAS/Q8005 | 15 | - | 7-8 weeks | - | 50 | 150 | 200 | - | | |
| | VAI182 | Test Engineer (SSC/Q7001) | | | | | | | | | | |

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Chairman Academic Council
MIT Aurangabad
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| NSQF Level -6 | | | | | | | | | | | Semester -I |
|---|-------------|--|--------|---------------|-----------|-------------------|----|-----|-------|----------|-------------|
| Sr. No. | Course Code | Course Title | Credit | Contact Hr/Wk | | Evaluation Scheme | | | | ESE hour | |
| | | | | L | P | MSE | TA | ESE | Total | | |
| Theory | | | | | | | | | | | |
| 1. | VAI201 | Electrical Machine and Drives | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | |
| 2. | VAI202 | Neural Network and Fuzzy Logic | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | |
| 3. | VAI203 | Microcontroller for Robotics | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | |
| 4. | VAI204 | Sensors and Signal Conditioning | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | |
| Lab/Practical | | | | | | | | | | | |
| 5. | VAI221 | Electrical Machine and Drives Lab | 1.5 | - | 2 | | 25 | 25 | 50 | - | |
| 6. | VAI222 | Microcontroller for Robotics Lab | 1.5 | - | 2 | | 25 | 25 | 50 | - | |
| On Job Training (OJT)/Qualification Packs* | | | | | | | | | | | |
| 7. | VAI231 | Master Trainer for junior Software Developer (SSC/Q0509) | 15 | - | 7-8 weeks | -- | 50 | 150 | 200 | - | |
| | VAI232 | AI Data Quality Analyst (SSC/ Q8101) | | | | | | | | | |

*Any one On-Job-Training as per guidelines of AICTE & SSC for the given skill sets for 150 Marks External Assessment by NSDC/SSC

| NSQF Level -6 | | | | | | | | | | | Semester -II |
|---|-------------|---|--------|---------------|-----------|-------------------|----|-----|-------|----------|--------------|
| Sr. No. | Course Code | Course Title | Credit | Contact Hr/Wk | | Evaluation Scheme | | | | ESE hour | |
| | | | | L | P | MSE | TA | ESE | Total | | |
| Theory | | | | | | | | | | | |
| 1. | VAI251 | Mechatronics | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | |
| 2. | VAI252 | Machine Learning | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | |
| 3. | VAI253 | AI for Robotics | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | |
| 4. | VAI254 | R Language | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 | |
| Lab/Practical | | | | | | | | | | | |
| 5. | VAI271 | Machine Learning Lab | 1.5 | - | 2 | - | 25 | 25 | 50 | - | |
| 6. | VAI272 | R Language Lab | 1.5 | - | 2 | - | 25 | 25 | 50 | - | |
| On Job Training (OJT)/Qualification Packs* | | | | | | | | | | | |
| 7. | VAI281 | Master Trainer for soft Dev (SSC/Q0509) | 15 | - | 7-8 weeks | -- | 50 | 150 | 200 | - | |
| | VAI282 | RPA Implementation Specialist (SSC/Q8606) | | | | | | | | | |

*Any one On-Job-Training as per guidelines of AICTE & SSC for the given skill sets for 150 Marks External Assessment by NSDC/SSC

| NSQF Level -7 | | | | Semester -I | | | | | | |
|---|-------------|--|--------|---------------|-----------|-------------------|----|-----|-------|----------|
| Sr. No. | Course Code | Course Title | Credit | Contact Hr/Wk | | Evaluation Scheme | | | | ESE hour |
| | | | | L | P | MSE | TA | ESE | Total | |
| Theory | | | | | | | | | | |
| 1. | VAI301 | Embedded OS | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 |
| 2. | VAI302 | Wireless Sensor Network for Robotics | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 |
| 3. | VAI303 | Business Analytics | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 |
| 4. | VAI304 | Entrepreneurship Development | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 |
| Lab/Practical | | | | | | | | | | |
| 5. | VAI321 | Wireless Sensor Network for Robotics Lab | 1.5 | - | 2 | - | 25 | 25 | 50 | - |
| 6. | VAI322 | Business Analytics Lab | 1.5 | - | 2 | - | 25 | 25 | 50 | - |
| On Job Training (OJT)/Qualification Packs* | | | | | | | | | | |
| 7. | VAI331 | Associate Analytics (SSC/Q2101) | 15 | - | 7-8 weeks | -- | 50 | 150 | 200 | - |
| | VAI332 | Robotics Automation Lead (ELE/Q7106) | | | | | | | | |

*Any one On-Job-Training as per guidelines of AICTE & SSC for the given skill sets for 150 Marks External Assessment by NSDC/SSC

| NSQF Level -7 | | | | Semester -II | | | | | | |
|---|-------------|-------------------------------|--------|---------------|-----------|-------------------|-----|-----|-------|----------|
| Sr. No. | Course Code | Course Title | Credit | Contact Hr/Wk | | Evaluation Scheme | | | | ESE hour |
| | | | | L | P | MSE | TA | ESE | Total | |
| Theory | | | | | | | | | | |
| 1. | VAI351 | Deep Learning | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 |
| 2. | VAI352 | Mobile Robotics | 3 | 3 | - | 10 | 15 | 25 | 50 | 1.5 |
| Lab/Practical | | | | | | | | | | |
| 3. | VAI371 | Project | 9 | - | 4 | - | 100 | 100 | 200 | - |
| On Job Training (OJT)/Qualification Packs* | | | | | | | | | | |
| 4. | VAI381 | AI Data Engineer (SSC/Q8106) | 15 | - | 7-8 weeks | -- | 50 | 150 | 200 | - |
| | VAI382 | Software Engineer (SSC/Q4601) | | | | | | | | |

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| <small>G. S. Mandal's</small> Maharashtra Institute of Technology, Aurangabad. (An Autonomous Institute) B.Voc. (Artificial Intelligence and Robotics) | | | |
|---|--|-----------------------|-------------------------------|
| NSQF Level-6 | VAI201 : Electrical Machine and Drives | Semester-I | |
| Teaching Scheme | | Examination Scheme | |
| Lectures | 03 hrs/Week | MSE | 10 Marks |
| Practical | - | TA | 15 Marks |
| Credits | 03 | ESE | 25 Marks |
| | | Duration of ESE | 1.5 hours |
| Course Outcomes (CO) | | | |
| Students will be able to | | | |
| 1. | Examine various applications in industrial and domestic areas where use of electric drives are essential. | | |
| 2. | Classify types of electric drives systems based on nature of loads, control objectives, performance and reliability. | | |
| Unit | Course Content | Hours | |
| Unit 1 | DC machines: DC machines construction, working principle (motor & generator), EMF equation of DC Machine (motor and generator), Types and its characteristics of DC machines (motor and generator), back emf. | 06 | |
| Unit 2 | AC Motors Induction Motor: Construction, working principle, types, torque equation, torque slip characteristics, Synchronous motor: Construction, working principle, starting methods, applications. | 06 | |
| Unit 3 | Special Purpose Machines: Construction, working and application of stepper motor, variable reluctance motor, servo motor, FHP motor, hysteresis, repulsion, linear IM. | 06 | |
| Unit 4 | Electrical Drives Basic elements-types of electric drives-factors influencing electric drives-heating and cooling curves loading conditions and classes of duty-Selection of power rating for drive motors with regard to thermal overloading and load variation factors | 06 | |
| Text/Reference Books | | | |
| Sr. No. | Book | Author | Publisher |
| 1 | Ashfaqu Husain | Electrical Machines. | Dhanpatrai and publication |
| 2. | Abhijit Chakrabarti & Sudipta Debnath, | Electrical Machines | Tata McGraw-hill Publication. |
| 3. | B. L. Theraja, | Electrical technology | volume 2, S.Chand. |

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|---|--|--|-------------------------------|
| <p style="font-size: small;">G. S. Mandal's</p> <p>Maharashtra Institute of Technology, Aurangabad. (An Autonomous Institute) B.Voc. (Artificial Intelligence and Robotics)</p> | | | |
| NSQF Level-6 | VAI202-Neural Network and Fuzzy Logic | | Semester-I |
| Teaching Scheme | | Examination Scheme | |
| Lectures | 03 hrs/Week | MSE | 10 Marks |
| Practical | - | TA | 15 Marks |
| Credits | 03 | ESE | 25 Marks |
| | | Duration of ESE | 1.5 hours |
| Course Outcomes (CO) | | | |
| Students will be able to | | | |
| 1. | Comprehend the concepts of feed forward neural networks | | |
| 2. | Understand the concept of fuzziness involved in various systems and fuzzy set theory. | | |
| Unit | Course Content | | Hours |
| Unit 1 | Introduction to Neural Networks: Biological Neurons, neural networks-area of applications-typical Architecture-setting weights, common activations functions, Basic learning rules- Mcculloch-Pitts neuron- Architecture, Supervised learning, Unsupervised learning algorithm, applications-single layer net. | | 06 |
| Unit 2 | Basic Neural Networks Techniques: Back propagation-architecture algorithm-derivation of learning rules number of hidden layers, associative and other neural networks- hetro associative memory , auto associative net- Bidirectional associative memory-applications-Hopfield nets-Boltzman machine, Kohonensef organizing maps and applications, , application and analysis of ART1 | | 06 |
| Unit 3 | Fundamental of Fuzzy Logic Basic concepts: fuzzy set theory- basic concept of crisp sets and fuzzy sets-complements- unionintersection- combination of operation- .general aggregation operations- fuzzy relations-compatibility relations-orderings-morphisms- fuzzy relational equations-fuzzy set and systems | | 06 |
| Unit 4 | Fuzzy Logic Control: Membership function- Knowledge base-Decision making, logic Optimizations of membership function using neural networks- Adaptive fuzzy systems,comparison of fuzzy and neural systems. | | 06 |
| Text/Reference Books | | | |
| Sr. No. | Book | Author | Publisher |
| 1 | J.M.Zurada | Introduction to artificial neural systems. | Jaico Publication house,Delhi |
| 2. | Ahmad Ibrahim | 'Introduction to Applied Fuzzy Electronics' | PHI |
| | Rajsekaran VijaylakshmiPai S, | Neural Networks, Fuzzy Logic, and Genetic Algorithms | PHI |

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|---|--|---|-------------------------------|
| NSQF Level-6 | | VAI203 :Microcontroller For Robotics | |
| | | Semester-I | |
| Teaching Scheme | | Examination Scheme | |
| Lectures | 03 hrs/Week | MSE | 10 Marks |
| Practical | - | TA | 15 Marks |
| Total Credits | 03 | ESE | 25 Marks |
| | | Duration of ESE | 1.5 hours |
| Course Outcomes (CO) | | | |
| Students will be able to | | | |
| 1. | Describe the architecture of 8051 controllers | | |
| 2. | Classify different types of instruction set and addressing modes | | |
| Unit | Course Content | | Hours |
| Unit 1 | Introduction to Microcontrollers: Comparison of 8-bit microcontrollers - 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics - Role of microcontrollers in Robotic Systems. Overview of the 8051 family. | | 06 |
| Unit 2 | The 8051 Architecture: Internal Block Diagram - CPU - ALU - address - data and control bus - working registers - SFRs - Clock and RESET circuits - Stack and Stack Pointer - Program Counter - I/O ports - Memory Structures - Data and Program Memory - Timing diagrams and Execution Cycles. | | 06 |
| Unit 3 | Instruction Set and Programming: Addressing modes: Introduction - Instruction syntax - Data types - Subroutines Immediate addressing - Register addressing - Direct addressing - Indirect addressing - Relative addressing - Indexed addressing - Bit inherent addressing - bit direct addressing. 8051 Instruction set - Instruction timings. Data transfer instructions - Arithmetic instructions - Logical instructions - Branch instructions - Subroutine instructions - Bit manipulation instruction. Assembly language programs - C language programs. Assemblers and compilers. Programming and debugging tools. | | 06 |
| Unit 4 | Memory and I/O Interfacing: Memory and I/O expansion buses - control signals - memory wait states. Interfacing of peripheral devices such as General Purpose I/O - ADC - DAC - timers - counters - memory devices. External Communication Interface :Synchronous and Asynchronous Communication. RS232 - SPI - I2C | | 06 |
| Reference Book | | | |
| Sr. No. | Book | Author | Publisher |
| 1 | M. A.Mazidi R. D. McKinlay | "The8051Microcontroller and Embedded Systems: Using Assembly and C" | Pearson Education, 2007 |
| 2. | K. J. Ayala | "8051 Microcontroller" | Delmar Cengage Learning, 2005 |
| 3. | R. Kamal | "Embedded System" | McGraw Hill Education,2009. |

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| <small>G. S. Mandal's</small> Maharashtra Institute of Technology, Aurangabad. (An Autonomous Institute) B.Voc. (Artificial Intelligence and Robotics) | | | | | |
|---|---|--|--|------------|-------|
| NSQF Level-6 | | VAI204 : Sensors and Signal Conditioning | | Semester-I | |
| Teaching Scheme | | | Examination Scheme | | |
| Lectures | 03 hrs/Week | | MSE | 10 Marks | |
| Practical | - | | TA | 15 Marks | |
| Total Credits | 03 | | ESE | 25 Marks | |
| | | | Duration of ESE | 1.5 hours | |
| Course Outcomes (CO) | | | | | |
| Students will be able to | | | | | |
| 1. | Apply different methods for the measurement of length and angle | | | | |
| 2. | Ability to analyse, formulate and select suitable sensor for the given industrial applications | | | | |
| Unit | Course Content | | | | Hours |
| Unit 1 | Introduction: Introduction to sensor bases measurement systems: General concepts and terminology, sensor classification, primary sensors, material for sensors, micro sensor technology, magneto resistors, light dependent resistors, resistive hygrometers, resistive gas sensors, liquid conductivity sensors | | | | 03 |
| Unit 2 | Reactance Variation and Electromagnetic Sensors: Capacitive Sensors, Inductive Sensors, Electromagnetic Sensors. Signal Conditioning for Reactance Variation Sensors: Problems and Alternatives, ac Bridges Carrier Amplifiers, Coherent Detection, Specific Signal Conditioners for Capacitive Sensors, Resolver-to-Digital and Digital-to-Resolver Converters. | | | | 06 |
| Unit 3 | Digital and intelligent sensors: position encoders, resonant sensors, sensors based on quartz resonators, SAW sensors, Vibrating wire strain gages, vibrating cylinder sensors, Digital flow meters. | | | | 07 |
| Unit 4 | Sensors based on semiconductor junctions: Thermometers based on semiconductor junctions, magneto diodes and magneto transistors, photodiodes and phototransistors, sensors based on MOSFET transistors, charge-coupled sensors – types of CCD imaging sensors, ultrasonic-based sensors. | | | | 06 |
| Reference Book | | | | | |
| Sr. No. | Book | Author | Publisher | | |
| 1 | Ramon Pallas Areny, John G | Sensors and Signal Conditioning | 2nd edition, John Wiley and Sons, 2000 | | |

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| Maharashtra Institute of Technology, Aurangabad. | | | |
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| B.Voc. (Artificial Intelligence and Robotics) | | | |
| NSQF Level -6 | | VAI221 : Electrical Machine and Drives Lab | Semester-I |
| Teaching Scheme | | Examination Scheme | |
| Practical | 2 Hours/week | TA | 25 Marks |
| Credits | 1.5 | ESE/PE | 25 Marks |
| Sr.No. | List of Experiments | | |
| 1 | Study of DC Machine | | |
| 2 | Study Starter | | |
| 3 | Study of AC machines | | |
| 4 | Study of stepper motor. | | |
| 5 | Study of Drives. | | |
| 6 | Study of applications. | | |

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|--|---|--|--------------------|------------|--|----------|--|
| NSQF Level -6 | | VAI222: Microcontroller for Robotics Lab | | Semester-I | | | |
| Teaching Scheme | | | Examination Scheme | | | | |
| Practical | | 2 Hours/week | | TA | | 25 Marks | |
| Credits | | 1.5 | | ESE/PE | | 25 Marks | |
| Sr.No. | List of Experiments | | | | | | |
| 1 | Study of different arithmetic operations. | | | | | | |
| 2 | Study of sorting the numbers. | | | | | | |
| 3 | Study of concept of timer. | | | | | | |
| 4 | Study of interfacing of ADC, DAC. | | | | | | |
| 5 | Study of interface of stepper motor. | | | | | | |
| 6 | Study of PWM signal generation. | | | | | | |

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| NSQF Level -6 | On Job Training/Qualification Packs* | | Semester-I |
| Teaching Scheme | | Examination Scheme | |
| Practical | 7-8 weeks | TA | 50 Marks |
| Credits | 15 | ESE/PE | 150 Marks |
| VAI231 | Master Trainer for junior Software Developer (SSC/Q0509) | | |
| VAI232 | AI Data Quality Analyst (SSC/ Q8101) | | |
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| NSQF Level-6 | VAI251 : Mechatronics | Semester-II | |
| Teaching Scheme | | Examination Scheme | |
| Lectures | 03 hrs/Week | MSE | 10 Marks |
| Practical | - | TA | 15 Marks |
| Total Credits | 03 | ESE | 25 Marks |
| | | Duration of ESE | 1.5 hours |
| Course Outcomes (CO) | | | |
| Students will be able to | | | |
| 1. | Identification of key elements of mechatronics system and its representation in terms of block diagram | | |
| 2. | PID control implementation on real time systems | | |
| 3. | Development of PLC ladder programming and implementation of real life system. | | |
| Unit | Course Content | Hours | |
| Unit 1 | Introduction: Block Mechatronic diagram Of systems, elements, advantages; practical examples of Mechatronic systems. Sensor of Mechatronic system such as pressure sensors, temperature sensors, velocity sensors | 06 | |
| Unit 2 | Data Representation: Types of electronic signals, Need for signal processing, Operational amplifiers: Types, classification and applications, Opto-isolators, Protection devices, Interfacing devices, Electro-magnetic Relays. 130 Data representation systems, Displays, Seven segment displays, LCD displays, Printers, Data loggers, Data Acquisition Cards | 06 | |
| Unit 3 | Programmable Logic Controller: Introduction, Architecture, Types of inputs/outputs, Specifications, guidelines for Selection of PLCs, Programming: Ladder logic and FBD | 06 | |
| Unit 4 | Controller : On/Off controller, Proportional Control, Integral control, Derivative Control; PI, PD and PID Controllers, Introduction to control using state variable system models | 07 | |
| Reference Book | | | |
| Sr. No | Book | Author | Publisher |
| 1. | W. Bolton, | Mechatronics | Pearson Education Asia, 1999. |
| 2. | R. K. Rajput | A textbook of Mechatronics | S. Chand and Co., 2007 |
| 3. | D. A. Bradley, D. Dawson, N. C. Buru, A. J. Loader, | Mechatronics | Chapman and Hall, 1993. |

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| NSQF Level-6 | | VAI252: Machine Learning | | Semester-II |
| Teaching Scheme | | Examination Scheme | | |
| Lectures | 03 hrs/Week | MSE | 10 Marks | |
| Practical | - | TA | 15 Marks | |
| Total Credits | 03 | ESE | 25 Marks | |
| | | Duration of ESE | 1.5 hours | |
| Course Outcomes (CO) Students will be able to | | | | |
| 1. | Appreciate the importance of visualization in the data analytics solution | | | |
| 2. | Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory | | | |
| Unit | Course Content | | | Hours |
| Unit 1 | Data Science, AI & ML, Use Cases in Business and Scope, Data exploration (histograms, bar chart, box plot, line graph, scatter plot), Qualitative and Quantitative Data, Measure of Central Tendency (Mean, Median and Mode) | | | 06 |
| Unit 2 | Classification Vs Regression, Geometric Intuition, test evaluation, decision surface as k changes, cross validation, regression using KNN, balanced and imbalanced dataset, multiclass classification | | | 06 |
| Unit 3 | Data imbalance, null values, handling missing values, handling categorical features, Data Transformation (minmax, log transform), Classing and Standardization, Outlier/Noise, accuracy, Confusion Matrix, TPR, FPR, TNR,FNR, Precision, Recall, log loss, mean square error | | | 06 |
| Unit 4 | Logistic Regression: Geometric Intuition, sigmoid function, weight vector, L1 & L2 regularization, greed search, random search. Linear Regression: Geometric Intuition, Mathematical formulation Decision Tree: Geometric Intuition, entropy, KL divergence, information gain, Gini impurity | | | 06 |
| Reference Book | | | | |
| Sr. No. | Book | Author | Publisher | |
| 1 | Andreas C. Miller & Sarah Guido | IntroductiontoMac hine Learning withPython | O'Reilly | |
| 2. | Jonathan S. Walker | Machine Learning for Beginners | Dreamtech Press | |
| 3. | Andriy Burkov | The Hundred Page Machine Learning Book | Quality South Asia edition | |

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|--|--|--------------------------------|----------------------------|
| NSQF Level-6 | | VAI253: AI For Robotics | |
| | | Semester-II | |
| Teaching Scheme | | Examination Scheme | |
| Lectures | 03 hrs/Week | MSE | 10 Marks |
| Practical | - | TA | 15 Marks |
| Total Credits | 03 | ESE | 25 Marks |
| | | Duration of ESE | 1.5 hours |
| Course Outcomes (CO) | | | |
| Students will be able to | | | |
| 1. | Design an intelligent robot solution for a real-world problem. | | |
| 2. | Demonstrate Artificial Intelligence techniques in robotics | | |
| Unit | Course Content | | Hours |
| Unit 1 | INTRODUCTION: Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems- Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems- Hydraulic, Pneumatic and Electric system. | | 06 |
| Unit 2 | END EFFECTORS AND ROBOT CONTROLS: Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion | | 06 |
| Unit 3 | Scope of AI: Introduction to Artificial Intelligence. Applications- Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems. AI techniques- search knowledge, abstraction. | | 06 |
| Unit 4 | Introduction to Robotics: Fundamentals of Robotics, Robot Kinematics: Position Analysis, Dynamic Analysis and Forces, Robot Programming languages & systems: Introduction, the three levels of robot programming, requirements of a robot programming language, problems peculiar to robot programming languages. | | 06 |
| Reference Book | | | |
| Sr. No. | Book | Author | Publisher |
| 1 | N.J. Nilsson | "Principles of AI", | Narosa Publ. House, 1990. |
| 2. | John J. Craig | "Introduction to Robotics", | Addison Wesley publication |

G. S. Mandal's

| Maharashtra Institute of Technology, Aurangabad. (An Autonomous Institute) B.Voc. (Artificial Intelligence and Robotics) | | | | |
|--|---|--|---|-------------|
| NSQF Level-6 | | VAI254: R Language | | Semester-II |
| Teaching Scheme | | Examination Scheme | | |
| Lectures | 03 hrs/Week | MSE | 10 Marks | |
| Practical | - | TA | 15 Marks | |
| Credits | 03 | ESE | 25 Marks | |
| | | Duration of ESE | 1.5 hours | |
| Course Outcomes (CO) | | | | |
| Students will be able to | | | | |
| 1. | Explain critical R programming concepts | | | |
| 2. | Apply OOP concepts in R programming | | | |
| Unit | Course Content | | | Hours |
| Unit 1 | Introduction: Introducing to R – R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorized if-then else – Vector Equality – Vector Element names | | | 06 |
| Unit 2 | Matrices, Arrays And Lists: Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables – Other factors and table related functions - Control statements – Arithmetic and Boolean operators and values – Default values for arguments – Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and Simulations in R | | | 06 |
| Unit 3 | Data Frames: Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables – Other factors and table related functions - Control statements – Arithmetic and Boolean operators and values – Default values for arguments – Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and Simulations in R | | | 06 |
| Unit 4 | OOP: S3 Classes – S4 Classes – Managing your objects – Input/Output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensionalplots . | | | 06 |
| Text/Reference Books | | | | |
| Sr. No. | Book | Author | Publisher | |
| 1 | Norman Matloff | “The Art of R Programming: A Tour of Statistical Software Design”. | No Starch Press, 2011 | |
| 2. | Jared P. Lander | “R for Everyone: Advanced Analytics and Graphics” | Addison-Wesley Data & Analytics Series, 2013. | |

Master Copy

| G. S. Mandal's Maharashtra Institute of Technology, Aurangabad. (An Autonomous Institute) B.Voc. (Artificial Intelligence and Robotics) | | | | | |
|--|---|------------------------------|--------------------|-------------|--|
| NSQF Level-6 | | VAI271: Machine Learning Lab | | Semester-II | |
| Teaching Scheme | | | Examination Scheme | | |
| Practical | | 2 Hours/week | TA | 25 Marks | |
| Credits | | 1.5 | ESE/PE | 25 Marks | |
| Sr.No. | List of Experiments | | | | |
| 1 | Take a suitable dataset and plot line graph, bar graph, scatter plot, histogram & pie chart. | | | | |
| 2 | Take a suitable dataset, draw a box plot and compare the distribution. | | | | |
| 3 | Take a suitable dataset and show various preprocessing techniques. | | | | |
| 4 | Take a suitable dataset for diabetes and evaluate confusion matrix, TPR, TNR, FPR & FNR using KNN . | | | | |
| 5 | Implement Decision Tree model for COVID dataset. | | | | |

Master Copy

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|--|---|-----------------------|--------------------|-------------|--|
| NSQF Level -6 | | VAI272:R Language Lab | | Semester-II | |
| Teaching Scheme | | | Examination Scheme | | |
| Practical | 2 Hours/week | | TA | 25 Marks | |
| Credits | 1.5 | | ESE/PE | 25 Marks | |
| List of Experiments | | | | | |
| Sr.No. | | | | | |
| 1 | Write a code in R language to change a column name in dataframe | | | | |
| 2 | Write a code in R language to replace a specific value in a given column | | | | |
| 3 | Write a code in R language to create a dataframe from vectors | | | | |
| 4 | Write a code in R language to add elements in vector using append() method. | | | | |
| 5 | Write a code in R language to convert factor to numeric and numeric to factor | | | | |

G. S. Mandal's

Maharashtra Institute of Technology, Aurangabad.

(An Autonomous Institute)

B.Voc. (Artificial Intelligence and Robotics)

| NSQF Level -6 | | On Job Training/Qualification Packs* | | Semester-II | |
|--|---|--------------------------------------|--|-------------|--|
| Teaching Scheme | | Examination Scheme | | | |
| Practical | 7-8 weeks | TA | | 50 Marks | |
| Credits | 15 | ESE/PE | | 150 Marks | |
| VAI281 | Master Trainer for soft Dev (SSC/Q0509) | | | | |
| VAI282 | RPA Implementation Specialist (SSC/Q8606) | | | | |
| *Any one On-Job-Training as per guidelines of AICTE & SSC for the given skill sets for 150 Marks External Assessment by NSDC/SSC | | | | | |


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