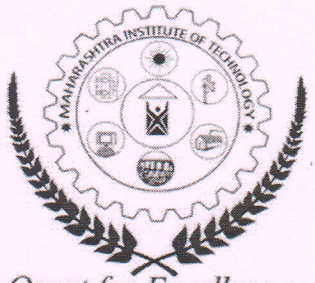

Quest for Excellence

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)

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)								

*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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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										

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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)								
*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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B.Voc. (Artificial Intelligence and Robotics)

NSQF Level-5	**VAI101 : Communicative English**	**Semester-I**

Teaching Scheme	
Lectures	03 hrs/Week
Practical	-
Credits	03

Examination Scheme	
MSE	10 Marks
TA	15 Marks
ESE	25 Marks
Duration of ESE	1.5 hours

Course Outcomes (CO)

Students will be able to

1.	To build up the learners confidence in oral and interpersonal communication by reinforcing the basics of pronunciation
2.	To introduce learners to Language Skills to find employment in the corporate.

Unit	Course Content	Hours
Unit 1	Communication: Meaning, Importance, and Process, Objectives of Communication, Effective Communication.	06
Unit 2	Preparation of Extempore speech: Group Discussion, Debates, Declamation; Stage Confidence, Business Correspondence: Definition, Importance Business letters.	06
Unit 3	Personality Development: Types of personality, Dynamics of Personality, Personality Traits, Influences on Personality, Personality Analysis through body language and Individual habits.	06
Unit 4	Memory Training: Mind and mental development, Mental Blocks, Manners and Art of Living.	06

Text/Reference Books

Sr. No.	Book	Author	Publisher
1	The Written Word,	Vandan R.Singh	Oxford University Press, 2006.
2.	Succeeding through Communication,	Subhash Jagota	Excel books, 2009.

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NSQF Level-5	**VAI102- Basics of Electronics**	**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.	To know fundamental skills to understand the basics of Electronics
2.	To know fundamental skills to understand semiconductor and components like diode, transistor, FET, MOSFET

Unit	Course Content	Hours
Unit 1	**Voltage and Current :** Resistance, Ohm's law, V-I Characteristics, Resistors, Capacitors, Inductors. Voltage and Current sources, Symbols and Graphical representation Overview of AC, DC, Cells and Batteries, Energy and Power.	06
Unit 2	**Basics of Semiconductor :** Semiconductor materials, Metals and Semiconductors and Photo-electric emission.N-type and P-type semiconductor. PN junction diode, depletion layer, Forward & Reverse bias, V-I Characteristic, Effects of temperature, Zener diode, Photo diode, LED, Types and applications of diode. Diode as a rectifier, half wave and full wave rectification.	06
Unit 3	**Bipolar Junction Transistor :** Operation of NPN and PNP transistors, Biasing of BJT. CB, CE and CC configuration Introduction to FET, JFET, MOSFET.	06
Unit 4	**Transistor Amplifier and Applications** :Introduction, Single and Multi-stage amplifiers Introduction to Oscillators Introduction to Thyristors, PNPN diode, SCR, LASCR, DIAC, TRIAC	06

Text/Reference Books

Sr. No.	Book	Author	Publisher
1	Basic Electronics	B.L.Theraja	S.Chand
2.	Applied Electronics	R.S.Sedha	S.Chand

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NSQF Level-5	**VAI103 : Fundamentals of Artificial Intelligence**	**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.	To provide an introduction to the basic principles of AI
2.	To provide functional elements of AI .

Unit	Course Content	Hours
Unit 1	**Introduction to Artificial Intelligence:** What is Artificial Intelligence, Foundation of AI, History of AI, agents, Applications of AI, A.I Representation, Future of AI.	06
Unit 2	**Introduction to Artificial Intelligence:** Issues in Design of Search Programs - Blind Search or Depth First search, Breadth First Search, Logic Programming.	06
Unit 3	**Introduction to Prolog :** Introduction to Logic Programming by Prolog, Writing a Prolog Program, Structure of PrologProgram	06
Unit 4	**Heuristic Search Techniques** –I : Heuristic Search, Heuristic Search Methods - Generate and Test, Hill Climbing.	06

Reference Book

Sr. No.	Book	Author	Publisher
1	"Artificial Intelligence"	Neeta Deshpande	Technical Publications
2.	"Artificial Intelligence"	Elaine Rcih and Kevin Knight (2003)	Second Edition-Tata McGraw Hill

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NSQF Level-5	**VAI104 : Control System**	**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.	To construct a system that has a desirable response to standard inputs.
2.	Understand the LTI system

Unit	Course Content	Hours
Unit 1	**Introduction**: Motivation, examples of control systems, feedback control systems.	03
Unit 2	**Mathematical modeling-I**: Mathematical modeling of: electrical systems, mechanical systems, Laplace transforms, transfer functions.	06
Unit 3	**Mathematical modeling-II** : Block diagrams, block diagram reductions. Signal flow graph, Mason's gain formula. Linearity, time-invariance versus nonlinearity and time-variance.	07
Unit 4	**Properties of feedback** : Basic idea of feedback control systems. Error analysis. P, PI, PD, PID controllers.	06

Reference Book

Sr. No.	Book	Author	Publisher
1	Modern Control Engineering	Ogata K	Prentice-Hall of India Pvt Ltd., New Delhi, 3rd edition, 2000
2.	Automatic Control Systems,	Kuo B.C.	Prentice-Hall of India Pvt Ltd., New Delhi, 6th edition, 1991.
3.	Control System Engineering	I J Nagrath Gopal	New age International publicion.at

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B.Voc. (Artificial Intelligence and Robotics)

NSQF Level -5	**VAI121 : Laboratory of Basic Electronics-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 Laboratory Instruments (Oscilloscope, Function Generator, Digital Multimeter, DC Power Supply)
2	Study NPN and PNP transistors.
3	Study of Diode characteristic
4	Study of half wave and full wave rectifier.
5	Study of SCR.
6	Study of DIAC.
7	Study of BJT
8	Study of FET

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NSQF Level -5	**VAI122: Laboratory of Control System**	**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 open loop system
2	Study of close loop system
3	Study of Feedback in Control Systems
4	Transfer Function &System Response
5	Mathematical Modeling of Physical Systems
6	Study of PI Controller
7	Study of PID Controller

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B.Voc. (Artificial Intelligence and Robotics)

NSQF Level -5	**On Job Training/Qualification Packs***	**Semester-I**

Teaching Scheme		Examination Scheme	
Practical	7-8 weeks	TA	50 Marks
Credits	15	ESE/PE	150 Marks

VAI131	Technical Writer (SSC/Q0505)
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

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B.Voc. (Artificial Intelligence and Robotics)

NSQF Level-5	**VAI151 : Programming In Python**	**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.	Build basic programs using fundamental programming constructs like variables
2.	Build basic programs skills
3.	

Unit	Course Content	Hours
Unit 1	**Introduction to Python** :Python overview; Getting started with python, Comments, Identifiers, Reserved keywords, Variables, Standard Data Types, Operators, Statements and Expressions.	06
Unit 2	**Functions** : Built-in Functions, Composition of Functions, User Defined Functions, Parameters and Arguments.	06
Unit 3	**Strings and Lists** :Strings - Compound Data type, len Function, String Slices.	06
Unit 4	**Tuples and Dictionaries** Tuples -Creating Tuples, Accessing Values m Tuples, Tuple Assignment, Tuples as Return Values, Basic Tuples Operations,	07

Reference Book

Sr. No	Book	Author	Publisher
1.	Introduction to Computing and Problem Solving Using Python,	E.Balagurusamy	McGraw Hill Education, First edition
2.	Core Python Programming	R. NageswaraRao	Dreamtech Press

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B.Voc. (Artificial Intelligence and Robotics)

NSQF Level-5	**VAI152: Data Structure & Algorithms**	**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.	To provide the knowledge of basic data structures.
2.	To develop skills to apply appropriate data structures in problem solving.

Unit	Course Content	Hours
Unit 1	**Introduction to C and Algorithm :** Constants, variables and keywords in C, operators and control structure in c(decision, loop and case), functions, macros, arrays and string manipulation, structure, union, enumeration, bitwise operations Functions: Parameter passing call by value and call by reference, scope rules, functions and pointers, function returning pointer, pointer to function, String manipulations using Arrays, pointer to pointer, Dynamic memory management. Analysis of algorithm: frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm, Big 'O' notation	06
Unit 2	**Searching & Sorting and Stacks :** Need of searching and sorting, why various methods of searching and sorting, Sorting methods: Linear, binary search and Fibonacci Search. Sorting methods: Bubble, insertion, selection, merge, Time complexity of each searching and sorting Algorithms and Hashing Techniques. Concept, Basic Stack operations, Array representation of stacks, Stack as ADT, Stack Applications: Reversing data, Arithmetic expressions conversion and evaluation.	06
Unit 3	**Queues & Linked Lists** :Concept, Queue operations, Array representation of queues, Queue as ADT, Circular queues, Application of queues: Categorizing data, Simulation of queues Concept of linked organization, singly linked list, stack using linked list, queue using linked list, doubly linked list, circular linked list, Linked list as ADT. Representation and manipulations of polynomials using linked lists, ,comparison of sequential linked organization with linked organization	06
Unit 4	**Trees & Graphs** :Introduction to trees: Basic Tree Concepts, Binary Trees: Concept & Terminologies, Representation of Binary Tree in memory, Traversing a binary tree, Binary Search Trees (BST): Basic Concepts, BST operations. Basic Concepts & terminology, Sequential representation of graphs; Adjacency matrix, Path matrix, Linked representation of a graph, Operations on graph, Traversing a graph, Spanning trees; Minimum Spanning tree, Kruskal's Algorithm.	06

Reference Book

Sr. No.	Book	Author	Publisher
1	Programming in ANSI C,	Balgurusamy -9	Tata McGraw-Hill, Third Edition.
2.	Data Structure with C, Schaum's Outlines,	Seymour Lipschutz,	Tata McGraw Hill.

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B.Voc. (Artificial Intelligence and Robotics)

NSQF Level-5	**VAI153 : Basics of 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.	To know the importance and basic theory of robotics.
2.	To Gain Knowledge about the Technology

Unit	Course Content	Hours
Unit 1	Introduction : Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics.	06
Unit 2	Specifications of Robot : 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 3	End Effectors and Robot Control –I : Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper.	06
Unit 4	End Effectors and Robot Control –II : 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.	06

Reference Book

Sr. No.	Book	Author	Publisher
1	Robotics Technology and flexible automation,	S.R. Deb	Tata McGraw-Hill Education., 2009
2.	Industrial Robotics, Technology programming and Applications	Richard D. Klafter, Thomas .A,	McGraw Hill,
3.	Robotics Engineering	Michael Negin,	Phi

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B.Voc. (Artificial Intelligence and Robotics)

NSQF Level-5	**VAI154: Digital Electronics**	**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.	To familiarize with the different number systems
2.	To familiarize with the different Gates

Unit	Course Content	Hours
Unit 1	**Introduction to Digital system** : Introduction to Digital electronics ,Digital and Analog Signals and Systems, Binary Digits, Logic Levels, and Digital Waveforms, Logic Systems-Positive and negative, Logic Operations, Combinational and Sequential Logic Functions, Programmable Logic, Fixed-Function Logic Devices.	06
Unit 2	**Number Systems and Codes** :Introduction to Number Systems-Types-Decimal, Binary, Octal, Hexadecimal; Conversion from one number system to other; Binary arithmetic operations; Representation of Negative Numbers;1's complement and 2's complement, Complement arithmetic, BCD code, Digital Codes -Excess-3 code, Gray code, Binary to Excess -3 code conversion and vice versa, ASCII code, EBCIDIC code , Error Detection Codes.	06
Unit 3	**Logic Gates**: Logical Operators, Logic Gates-Basic Gates, Other gates, Active high and Active low concepts, Universal Gates and realization of other gates using universal gates, Gate Performance Characteristics and Parameters.	06
Unit 4	**Boolean Algebra** :Rules and laws of Boolean algebra, Demorgan's Theorems, Boolean Expressions and Truth Tables, Standard SOP and POS forms; Minterm and Maxterms, Canaonical representation of Boolean expressions, Duality Theorem, Simplification of Boolean Expressions, Minimization Techniques for Boolean Expressions using Karnaugh Map and Quine McCluskey Tabular method.	06

Text/Reference Books

Sr. No.	Book	Author	Publisher
1	Modern Digital Electronics'	R.P.Jain	Microhill
2.	Digital Electronics	Vasudevan	Medteck

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B.Voc. (Artificial Intelligence and Robotics)

NSQF Level-5	**VAI171: Laboratory of Programming in Python-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	Create a list and perform the following methods 1) insert() 2) remove() 3) append() 4) len() 5) pop() 6) clear()
2	Create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4)change values 5) use len()
3	Write a python program to add two numbers.
4	Write a Program for checking whether the given number is an even number or not. Using a for loop.
5	Write a program to demonstrate basic data type in python.
6	Write a python program to print a number is positive/negative using if-else.

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B.Voc. (Artificial Intelligence and Robotics)

NSQF Level -5	**VAI172: Digital Electronics 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	To study and verify the truth table of logic .
2	Realization of a Boolean function.
3	Design and implementation using NAND gate
4	Design and implementation using OR gate
5	Design and implementation using AND gate
6	Design and implementation using NOR gate
7	Design and implementation using EXOR gate
8	Binary to grey generator

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B.Voc. (Artificial Intelligence and Robotics)

NSQF Level -5	**On Job Training/Qualification Packs***		**Semester-II**
Teaching Scheme		Examination Scheme	
Practical	7-8 weeks	TA	50 Marks
Credits	15	ESE/PE	150 Marks

VAI181	Industrial Automation Specialist (IAS/Q8005)
VAI182	Test Engineer(SSC/ Q7001)

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