MIT
Quest for Excellence

Maharashtra Institute of Technology

Chhatrapati Sambhajinagar

An Autonomous Institute Affiliated to

Dr. Babasaheb Ambedkar Marathwada University,

Chhatrapati Sambhajinagar, Maharashtra (India)

Third Year B. Voc. Syllabus

(Artificial Intelligence and Robotics)

Under Choice Based Credit System (CBCS)

Under Faculty of Science and Technology

(Effective from 2022-23 and onwards)

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Curriculum for B. Voc Artificial Intelligence and Robotics

NSQF Level -5						Semester -I				
Sr. No.	Course Code	Course Title	Credit	Contact Hr per Week		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)								
		Total	**30**	**12**	**4+**	**40**	**160**	**300**	**500**	

*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 -5						Semester -II				
Sr. No.	Course Code	Course Title	Credit	Contact Hr per Week		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)								
		Total	**30**	**12**	**4+**	**40**	**160**	**300**	**500**	

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(An Autonomous Institute)
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Curriculum for B. Voc Artificial Intelligence and Robotics

NSQF Level -6 — **Semester -I**

Sr. No.	Course Code	Course Title	Credit	Contact Hr per Week		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)								
		Total	**30**	**12**	**4+**	**40**	**160**	**300**	**500**	

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NSQF Level -6 — **Semester -II**

Sr. No.	Course Code	Course Title	Credit	Contact Hr per Week		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)								
		Total	**30**	**12**	**4+**	**40**	**160**	**300**	**500**	

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Curriculum for B. Voc Artificial Intelligence and Robotics

NSQF Level -7						Semester -I				
Sr. No.	Course Code	Course Title	Credit	Contact Hr per Week		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)								
		Total	**30**	**12**	**4+**	**40**	**160**	**300**	**500**	

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NSQF Level -7						Semester -II				
Sr. No.	Course Code	Course Title	Credit	Contact Hr per Week		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)								
		Total	**30**	**6**	**4+**	**20**	**180**	**300**	**500**	

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Semester-V
(NSQF Level 7, Semester-I)
Detail Course Curriculum

Third Year B. Voc. Syllabus
(Artificial Intelligence and Robotics)

(Effective from 2022-23 and onwards)

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Syllabus for Third Year B. Voc. (Artificial Intelligence and Robotics)

NSQF Level-7	VAI301:Embedded OS		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 become aware of the core characteristics and quality attributes of embedded systems
2.	To learn application specific and domain specific embedded systems.

Unit	Course Content	Hours
Unit 1	**Introduction to Embedded Systems** The concept of embedded systems design, Characteristics of Embedding Computing Applications, Concept of Real time Systems	09
Unit 2	**Introduction to Embedded Computing** The concept of embedded systems design, Characteristics of Embedding Computing Applications, Concept of Real time Systems	09
Unit 3	**Introduction to Embedded Systems OS** Embedded OS (Linux) Internals Linux internals: Process Management, File Management, Memory Management, I/O Management. , Threads Inter Process Communication – Semaphore, Pipes, FIFO,	09
Unit 4	**Design Process** Threads Inter Process Communication – Basics of Semaphore, Pipes, FIFO, Basics of Shared Memory Kernel	09

Text/Reference Books

Sr. No.	Book	Author	Publisher
1.	Embedded Microcomputer System: Real Time Interfacing to Artificial Neural Systems	J.W. Valvano	Brooks/Cole, 2000
2.	The Art of Designing Embedded Systems	Jack Ganssle	Newness, 1999

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Syllabus for Third Year B. Voc. (Artificial Intelligence and Robotics)

NSQF Level-7	VAI302-Wireless Sensor Network for Robotics		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 concepts and terminologies used in WSN
2.	To understand the working aspects of physical and MAC layer.

Unit	Course Content	Hours
Unit 1	**Introduction** Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor, Networks, Applications of Sensor Networks, Types of wireless sensor networks, Issues and challenges in wireless sensor networks	09
Unit 2	**Architectures:** Node Architecture, the sensing subsystem, processor subsystem, communication, interface, L Mote, XYZ, Hog throb node architectures	09
Unit 3	**Physical Layer and Medium Access Control:** Basic Components, Source Encoding, Channel Encoding, Modulation, Signal Propagation Types, protocols, standards and characteristics, challenges, Network Layer-Routing Metrics, different routing techniques.	09
Unit 4	**Operating Systems:** Functional and non functional Aspects, short overview of prototypes – TinyOS, SOS, Contiki, Lite OS, sensor grid.	09

Text/Reference Books

Sr. No.	Book	Author	Publisher
1.	Fundamentals of wireless sensor networks: theory and practice	Dargie, W. and Poellabauer	John Wiley and Sons, 2010
2.	Wireless sensor networks: technology, protocols, and applications	Sohraby, K., Minoli, D., Znati,	John Wiley and Sons, 2007

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Syllabus for Third Year B. Voc. (Artificial Intelligence and Robotics)

NSQF Level-7	VAI303:Business Analytics	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.	Demonstrate the technologies and tools used for analyzing large volumes of structured and unstructured data.
2.	Understand the ethical and legal implications of handling and analyzing data.

Unit	Course Content	Hours
Unit 1	**Big Data Platforms:** Big Data Platforms for the Internet of Things: network protocol- data dissemination –current state of art- Improving Data and Service Interoperability with Structure, Compliance.	09
Unit 2	**Conformance and Context Awareness** Interoperability problem in the IoT context- Big Data Management Systems for the Exploitation of Pervasive Environments - Big Data challenges and requirements.	09
Unit 3	**YATRAP** Overview of YATRAP protocol and its role in data collection in WSN. Basics of WSN and its relevance to business analytics. Techniques for collecting sensor data using YATRAP-enabled devices.	09
Unit 4	**Sustainability Data and Analytics:** Sustainability Data and Analytics in Cloud-Based M2M Systems - potential stakeholders and their complex relationships to data and analytics applications - Social Networking Analysis - Building a useful understanding of a social network - Leveraging Social Media and IoT to Bootstrap Smart Environments: lightweight Cyber Physical Social Systems - citizen actuation.	09

Reference Book

Sr. No.	Book	Author	Publisher
1	Big Data and the Internet of Things Enterprise Information Architecture for A New Age	Stackowiak, R., Licht, A., Mantha, V., Nagode, L.	Apress, 2015
2.	Thingalytics - Smart Big Data Analytics for the Internet of Things	Dr. John Bates	2015

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Syllabus for Third Year B. Voc. (Artificial Intelligence and Robotics)

NSQF Level-7	VAI304: Entrepreneurship Development		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 gain a comprehensive understanding of entrepreneurship as a concept, its significance in economic development
2.	To develop a business plan, including defining business objectives, formulating strategies, conducting market research, and creating financial projections.

Unit	Course Content	Hours
Unit 1	**Introduction to Entrepreneurship** Meaning and Definition of Entrepreneur ; Types and Functions of Entrepreneur; Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs; Corporate entrepreneurship; Women Entrepreneurship, Role of Entrepreneurship in Economic Development.	09
Unit 2	**Creating and Starting the Venture** Idea Generation: Sources and Methods of generating ideas ; Identification and Classification of Ideas; Individual creativity: Idea to Business Opportunity; Challenges of New Venture Start-Up, Product planning & development Entrepreneurship and Intellectual Property Rights: Patents, Trademarks and Copyrights.(Brief information)	09
Unit 3	**Developing a Business Plan** Environmental Scanning and SWOT analysis; Business Plan as an entrepreneurial tool; Business Planning Process; Elements of business planning; Preparation of project plan; Components of an ideal business plan – Market plan, financial plan and Operational plan, Launching formalities.	09
Unit 4	**New Venture** Launching a New Venture; Evaluation of joint venture, acquisitions, merges. franchising, Public issues, Steps involved in Launching a Business; Registration of Business Units	09

Reference Book

Sr. No.	Book	Author	Publisher
1	Entrepreneurial Development	Khanka, S.S	S. Chand and Co.
2.	Entrepreneurship: Creating & Leading an Entrepreneurial Organization	Kumar, Arya	Pearson 2012
3.	Entrepreneurship	Robert Hisrich Michael Peters Dean Shepherd	McGraw Hill 10th Ed (Indian Edition) 2016

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NSQF Level-7	VAI321 :Wireless Sensor Network 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	Introduction to WSN
2	Nes C Programming
3	Send and receive
4	Range and Connectivity Vs. Antenna Power
5	Sensor Data Acquisition
6	Duty Cycle Vs. Power Consumption
7	Data Collection Frequency and Transmitter Vs. Power Consumption

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NSQF Level-7	VAI322: Business Analytics 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 Big Data.
2	Study IoT.
3	Study of Data types.
4	Study of Analytics.
5	Study of Business analysis
6	Study of Applications.

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NSQF Level -7	On Job Training/Qualification Packs*		Semester-I
Teaching Scheme		Examination Scheme	
Practical	7-8 weeks	TA	50 Marks
Credits	15	ESE/PE	150 Marks
VAI331	Associate Analytics (SSC/Q2101)		
VAI332	Robotics Automation Lead (ELE/Q7106)		
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Semester-VI
(NSQF Level 7, Semester-II)
Detail Course Curriculum

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NSQF Level-7	VAI351:Deep Learning		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.	Understand deep learning fundamentals.
2.	Explain various neural network architectures

Unit	Course Content	Hours
Unit 1	**Neural Networks** History of neural networks & deep learning, working of biological neurons, Perceptron and MLP, Notations.	09
Unit 2	**Deep Learning Basics** Chain Rule, Memorization, Back propagation, activation function, vanishing gradient problem, a simple code using keras.	09
Unit 3	**Deep MLP** Deep multilayer perceptron, drop out layer and regularization, ReLU, batch normalization, SGD, optimizers, SoftMax and cross entropy for multiclass classification	09
Unit 4	**Convolution Neural Networks & Recurrent Neural Networks** **CNN:** Edge detection, padding and strides, Convolution over RGB image, convolution layer, max pooling **RNN:** RNN, types of RNN, Need for LSTM, LSTM	09

Reference Book

Sr. No.	Book	Author	Publisher
1	Deep Learning	Ian Goodfellow, Yoshua Bengio & Aaron Courville	MIT Press, 18-Nov-2016
2.	Deep Learning with Python (1st Edition)	François Chollet	Manning Publications; 1st Edition (Dec 2017)
3.	Fundamentals of Deep Learning: Designing next-generation machine intelligence algorithms	Nikhil Buduma, Nicholas Locascio	O'Reilly Media; 1st Edition (July 4, 2017)

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NSQF Level-7	VAI352:Mobile Robotics		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 Learn about different locomotion mechanisms for mobile robots.
2.	To Explore sensing modalities commonly used in mobile robotics.

Unit	Course Content	Hours
Unit 1	**Introduction** Introduction to mobile, Overview of an autonomous robotic system Evolution of robot systems, Roles of robots, Mobile robot hardware	09
Unit 2	**Robot Locomotion** Types of locomotion, hopping robots, legged robots, wheeled robots, stability and controllability.	09
Unit 3	**Input-Output Devices** Input devices including sensors (e.g. thermistors, light-dependent resistors), mechanical switches, opto-switches Output devices including Light-Emitting Diodes (LED), buzzers, DC Motors, and effectors (e.g. grippers, suckers, sweepers)	09
Unit 4	**Simple Mechanism** Common mechanism e.g. leg levers, linkages, gears and spring-loaded mechanism Common fasteners e.g. screws, rivets and pins	09

Reference Book

Sr. No.	Book	Author	Publisher
1	Introduction to Autonomous Mobile Robots	R. Siegwart, I. R. Nourbakhsh	The MIT Press, 2011
2.	Planning Algorithms	S. M. LaValle	Cambridge University Press, 2006

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NSQF Level-7		VAI371: Project		Semester-II
Teaching Scheme			Examination Scheme	
Practical	4 Hours/wk		TA	100 Marks
Credits	9		ESE/PE	100 Marks

On the basis of learning in the B. Voc. Programme, i.e. Level 5 to Level 7, a project to be taken up by the student strengthening his/ her vocational skills and prepare a report in following format:

Formatting:

- The font for chapter number should be in Calibri 16 and chapter title should be in upper case with Bold Calibri 20. Use after paragraph spacing should be 6 pts.
- The font for sub-title like (1.1) should be in Bold Calibri 14 and chapter title should be in upper case with Calibri 20. Use text font as Calibri 12 for a text with 1.5 line spacing. The text should be aligned with justify setting.

Report:

- Student has to submit a detailed report in two copies which shall be used for evaluation.

Evaluation:

Teachers Assessment will be based on the presentation of project in periodic reviews (like Review 1 and Review 2) during the semester.

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

VAI381	AI Data Engineer(SSC/Q8106)
VAI382	Software Engineer(SSC/ Q4601)

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