

# 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) Master Copy

# **Maharashtra Institute of Technology** Chhatrapati Sambhajinagar (An Autonomous Institute)

# Curriculum for B. Voc Artificial Intelligence and Robotics

NSQ	F Level -5								Sem	ester -l
Sr.	Course	Course Title	Credit	Cont Credit per		E	<b>Evaluation Scheme</b>			ESE
No.	Code			L	Р	MSE	TA	ESE	Total	Hour
	*		Th	eory						
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/P	racti	cal					
5.	VAI121	Basics of Electronics Lab	1.5	-	2	12-	25	25	50	-
6.	VAI122	Control System Lab	1.5	-	2		25	25	50	-0
		On Job Trai	ning (OJ	D/Q	alificatio	n Packs				
7.	VAI131	Technical support Engineer (SSC /Q5101)	15		7-8		50	150	200	-
	VAI132	Mechatronics Maintenance Specialist(ELE/Q7105)			weeks					
		Total	30	12	4+	40	160	300	500	-

Assessment by NSDC/SSC

NSQ	F Level -5					Concerna			Seme	ster -II
Sr.	Course	Course Title	Credit	Cor	r Week	Evaluation Scheme				ESE
No.	Code			L	Р	MSE	TA	ESE	Total	Hour
			Th	eory	_			_		
1.	VAI151	Programming in Python	3	3	-	10	15	25	50	1.5
2.	VA1152	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/P	ractio	cal					
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 Train	ning (OJ]	T)/Qu	alificatio	n Packs'				
7.	VAI181	Industrial Auto Specialist IAS/Q8005	15		7-8 weeks		50	150	200	-
	VAI182	Test Engineer (SC/Q7001)			WCCRS					
li	A second second	Total	30	12	4+	40	160	300	500	
*Any	one On-Jo	b-Training as per guidelines of	of AICTE	& SS	C for the	given sk	till sets	for 150	Marks Ex	ternal
Asse	ssment by ]	SDC/SSC		6	λ					
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Sr.	Course	Course Title	Credit	Con	ntact Hr r Week	3	ivaluati	on Schen	ne	ESE Hour
NO.	Code			L	P	MSE	TA	ESE	Total	
			Th	cory			1			
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/P	racti	cal					
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 Trai	ning (OJ	D/Qu	alificatio	n Packs				and the second
7.	VAI231	Master Trainer for junior Software Developer (SSC/Q0509)	15		7-8	-	50	150	200	-
	VAI232	AI Data Quality Analyst (SSC/ Q8101)			weeks					
		Total	30	12	4+	40	160	300	500	

#### Curriculum for B. Voc Artificial Intelligence and Robotics

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Sr.	Course	Course Title	Credit	Con	ntact Hr r Week	F	valuatio	on Schen	ne	ESE Hour
No.	Code			L	Р	MSE	TA	ESE	Total	
			Th	cory						
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	- 1	10	15	25	50	1.5
4.	VAI254	R Language	3	3	-	10	15	25	50	1.5
		State of the second second	Lab/P	ractio	cal					
5.	VAI271	Machine Learning Lab	1.5	-	2	-	25	25	50	-
6.	VAI272	R Language Lab	1.5	-	2	-	25	25	50	27
		On Job Trai	ning (OJ	D/Q	alificatio	n Packs				1.4.7
_	VAI281	Master Trainer for soft Dev (SSC/Q0509)			7-8					
7.	VAI282	RPA Implementation Specialist (SSC/Q8606)	15		weeks	-	50	150	200	- 1
		Total	30	12	4+	40	160	300	500	
•Any Asse	y one On-Jo ssment by ?	b-Training as per guidelines of	of AICTE	& 55	SC for the	given si	cill-sets	for 150	Marks Er	ternal

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NSQ	F Level -7								Sem	ester -l
Sr. No.	Course Code	Course Title	Credit	Credit Contact Hr		<b>Evaluation Scheme</b>				ESE
				L	Р	MSE	TA	ESE	Total	
			Th	eory				10.	4	1
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	- 2	10	15	25	50	1.5
4.	VAI304	Entrepreneurship Development	3	3	-	10	15	25	50	1.5
		1 m	Lab/P	racti	cal					
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	<u>_</u>
		On Job Trai	ning (OJ	T)/Qu	alificatio	n Packs				-
-	VAI331	Associate Analytics (SSC/Q2101)			7-8					
7.	VAI332	Robotics Automation Lead (ELE/Q7106)	15	-	weeks		50	150	200	-
		Total	30	12	4+	40	160	300	500	1

#### Curriculum for B. Voc Artificial Intelligence and Robotics

Assessment by NSDC/SSC

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NSQ	F Level -7					A TRANSPORT			Seme	ster -II
Sr. No.	Course Code	Course Title	Credit	Cor	ntact Hr r Week	E	valuati	on Sche	me	ESE Hour
				L	P	MSE	TA	ESE	Total	
			Th	eory						
1.	VAI351	Deep Learning	3	3	•	10	15	25	50	1.5
2.	VAI352	Mobile Robotics	3	3	-	10	15	25	50	1.5
		51	Lab/P	racti	cal			-		
3.	VAI371	Project	9	-	14	-	100	100	200	-
	1	On Job Trai	ning (OJ)	[]/Q1	alificatio	n Packs'				
	VAI381	AI Data Engineer (SSC/Q8106)	1.6		7-8		50	1.60	200	
4.	VAI382	Software Engineer (SSC/Q4601)	15	-	weeks		50	150	200	-
		Total	30	6	4+	20	180	300	500	

Assessment by NSDC/SSC

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

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



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NSQF Level-7 VAI301:Embedded OS Sem					ester-I				
Т	eaching ?	Scheme		Exam	ination Schen	ie			
Lectures		03 hrs/Week		MSE	10 Ma	rks			
Practical		-		ТА	15 Ma	rks			
Credits		03		ESE	25 Ma	rks			
				Duration of E	SE 1.5 ho	urs			
Course	Outcome will be a	es (CO)							
1.	To beco	me aware of the c	ore characteri	stics and quality attributes	of embedded	systems			
2.	To lear	application speci	fic and domai	in specific embedded system	ms.				
Unit			Course	Content		Hours			
Unit 1	Introd	action to Embedd	led Systems			09			
	The co	ncept of embedd	ed systems d	lesion Characteristics of	Embedding				
	Computing Applications, Concert of Pool time Systems								
	Computing Applications, Concept of Real time Systems								
Unit 2	Introduction to Embedded Computing								
	The concept of embedded systems design, Characteristics of Embedding								
	Computing Applications, Concept of Real time Systems								
Unit 3	Introdu	iction to Embedd	ed Systems (	DS		09			
	Embed	ded OS (Linux)	Internals Lin	nux internals: Process M	anagement,				
	File M	anagement, Men	nory Manage	ement, I/O Management.	, Threads				
	Inter Pr	ocess Communic	ation – Sema	phore, Pipes, FIFO,					
Unit 4	Design	Process				09			
	Thread	s Inter Process	Communicati	ion – Basics of Semaph	ore, Pipes,				
	FIFO, I	Basics of Shared 1	Memory Keri	nel					
Taut/Da	Cananaa	Doole							
Sr. No.	terence	Book		Author	Publis	her			
or. (x0.		DUUK			T HITTS				
1.	Embe Real	dded Microcompu Fime Interfacing to Neural System	iter System: o Artificial ns	J.W. Valvano	Brooks/Co	le, 2000			
2.	The	Art of Designing l Systems	Embedded	Jack Ganssle	Newness	, 1999			

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NSQF Level-7	VAI302	-Wireless Sensor Network for	or Robotics	Semester-I				
Teaching	Scheme		Examination	Scheme				
Lectures	03 hrs/Week		MSE	10 Marks				
Practical	-		ТА	15 Marks				
Credits	03	]	ESE	25 Marks				
			Duration of ESE	1.5 hours				
Course Outcon	tes (CO)							
Students will be	able to							
1. To know fundamental concepts and terminologies used in WSN								
2. To u	To understand the working aspects of physical and MAC layer.							
Unit		Course Content		Hours				
Unit 1 Intr	ntroduction							
Intro	duction to Sen	sor Networks, unique cons	traints and challer	nges,				
Adv	antage of Sensor, less sensor netwo	Networks, Applications of Ser	nsor Networks, Typ	es of				
Unit 2 Arc	hitectures:	res, issues and enanenges in w	neless sensor netwo	09				
Noc	e Architecture,	the sensing subsystem.	processor subsy	stem.				
com	munication, inter	face, L Mote, XYZ, Hog throb	node architectures					
Unit 3 Phy	sical Layer and l	Medium Access Control:		09				
Basi	c Components,	Source Encoding, Channel	Encoding, Modula	tion.				
Sign	al Propagation	Types, protocols, standar	ds and characteri	stics,				
chal	enges, Network I	ayer-Routing Metrics, different	nt routing technique	S.				
Unit 4 Ope	rating Systems:			09				
Fun	ctional and non	functional Aspects, short ov	erview of prototyr	bes -				
Tin	OS, SOS, Contik	i, Lite OS, sensor grid.						

Text/Refe	erence 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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NSQF	Level-7	VA1303;Bu	isiness Analytics	Semester-I	
1.	saching Scheme		Examination Scher	ne	
Lectures	03 hrs/Week		MSE	10 N	larks
Practical			TA	15 N	larks
Credits	03		ESE	25 N	larks
			Duration of ESE	1.5 h	ours
Course (	Jutcomes (CO)				
Students	will be able to				
1.	Demonstrate the technological	ologies and too	ls used for analyzing large volume	es of st	ructured
	and unstructured data.				
2.	Understand the ethical	and legal impli	cations of handling and analyzing	data.	
Unit		Course	Content		Hours
Unit 1	Big Data Platforms:				09
	Big Data Platforms for	the Internet of	Things: network protocol- data		
	dissemination -current	t state of art- Im	proving Data and Service		
	Interoperability with S	tructure, Comp	liance.		
Unit 2	Conformance and Co	ontext Awarend	255		09
	Interoperability proble	m in the loT co	ontext- Big Data Management Sys	stems	
	for the Exploitation o	f Pervasive En	vironments - Big Data challenge	s and	
	requirements				
Ilmit 3	VATDAD				00
Unit 5	Overview of YATRAI	protocol and it	ts role in data collection in WSN.		07
	Basics of WSN and	its relevance	to business analytics. Technique	s for	
	collecting sensor data	using YATRAP	P-enabled devices.	0 101	
Unit 4	Sustainability Data a	nd Analytics:			09
	Sustainability Data an	d Analytics in (	Cloud-Based M2M Systems - pot	ential	
	stakeholders and the	eir complex	relationships to data and ana	lution	
	stakenoiders and the	latworking Ang	luric Duilding a usaful understa	iyues	
	applications - Social P	Lawaraning Ana	aysis - Duntuing a userul understan	naing	
	of a social network -	Leveraging Soc	Physical Second C	smart	
	Environments: lightw	veight Cyber	Physical Social Systems - c	itizen	
	actuation.				
Reference	ce Book				
Sr. No.	Book		Author	Publ	isher
	Big Data and the Inter	met of Things	Stackowiak, R., Licht, A.		
1	Enterprise Information	n Architecture	Mantha, V., Nagode, L.	Apre	ss, 2015
	for A New A	Age			
2.	Thingalytics - Smar	rt Big Data	Dr. John Bates	1	2015
	Analytics for the inter	met of Things			
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	ver-/	VALS	04: Entre	reneursmp Develop			cster-1	
Tea	ching S	cheme			Exa	mination Schen	ne	
ectures		03 hrs/Week		1	MSE	10 M	arks	
Practical					ГА	15 M	arks	
Credits		03		I	ESE	25 M	arks	
				1	Duration of	of ESE   1.5 h	ours	
Course O	utcome	es (CO) - Studen	ts will be a	ble to				
1.	To gai	in a comprehe	nsive unde	erstanding of entrep	preneursh	ip as a conc	ept, i	
	signific	ance in economi	ic developn	nent				
2.	To dev	velop a busines	s plan, ir	cluding defining bu	isiness o	bjectives, form	nulatin	
	strategi	es, conducting n	narket resea	irch, and creating fina	ncial proj	ections.		
Unit	0	0	Co	urse Content			Hour	
Unit 1	Introd	uction to Entre	preneurshi	ip			09	
	Meani	ng and Defini	tion of F	ntrepreneur ; Type	s and	Functions of		
	Entren	reneur: Role of I	Entreprenet	urship in Economic D	evelopme	nt. Ethics and		
	Social	responsibility of	f Entrenre	neurs: Cornorate ent	renreneur	ship: Women		
	Entron	responsionity of	of Entrone	anaurchin in Economi	c Develo	oment		
11-14.2	Chuep	reneursmp, Kore	of Entreph	encursmp in Econom	e Develo	mient.	09	
Unit 2	Creati	ng and Starting	the ventu	re La da a Canadana i d	and i Idam	Gention and	07	
	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							
	Соруті	ghts.(Brief infor	mation)					
Unit 3	Develo	ping a Business	Plan				09	
	Enviro	nmental Scann	ing and	SWOT analysis; E	lusiness	Plan as an		
	entrepr	eneurial tool;	Business	Planning Process; 1	Elements	of business		
	plannin	ng; Preparation o	f project p	lan; Components of a	n ideal bu	usiness plan -		
	Market	plan, financial	plan and Or	erational plan, Launc	hing form	alities.		
Unit 4	New V	enture					09	
Chine V	Launch	ing a New Ven	ture: Evalu	ation of joint venture	e. acquisit	ions, merges.	1.12.14	
	franchi	sing Public i	ssues Ste	ps involved in La	unching	a Business:		
	Degiete	ation of Busines	e Units		6			
Defining	Regist	ation of Dusines	5 Onno					
Sr. No	C DOOK	Book		Author		Publishe	r	
51. 140.	Entre	preneurial Dava	lonment	Khanka SS		S. Chand and	Co	
1	Entre	preneurship: Cre	ating &	Khanka, 5.5		or chang and		
2	Lan	ding an Entrepre	neurial	Kumar, Arva		Pearson 20	12	
2.	Lea	Organization		runni, ru ju			0.00	
		- Bantanton		Robert Hisrich Mic	hael	McGraw Hill	0 <sup>th</sup> Ed	
3.	-	Entrepreneursh	ıp	Peters Dean Sheph	nerd	(Indian Edition	) 2016	
	-					Pa	ge 9 of	
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NSQF 1	evel-7	VAI321 :W	ireless Sensor Netwo	rk for Robotics	Lab	Semester-1
Ī	caching	Scheme			E summers	ation Scheme
Practical		2 Hours/week			TA	25 Marks
Credits		1.5			ESE/PE	25 Marks
Sr. No.			List of Exper	iments		
1	Introdu	ction to WSN				
2	Nes C	Programming				
3	Send a	nd receive				
4	Range	and Connectivity	Vs. Antenna Power			
5	Senso	r Data Acquisitio	n			
6	Duty	Cycle Vs. Power	Consumption			
7	Data (	Collection Freque	ency and Transmitter V	Vs. Power Cons	umption	

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NSQF Level-7		v	AI322: Business Analytics Lab		Semester-I	
	Feaching	Scheme		Examin	ation Scheme	
Practical 2 Hours Credits 1.5		2 Hours/week		TA	25 Marks	
		1.5		ESE/PE		
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 Train	ning/Qualification Packs*	Semester-1		
Tea	ching Sci	beme	Examinatio	on Scheme		
Practical		7-8 weeks	TA	50 Marks		
Credits 15			ESE/PE	150 Marks		
VAI332	Robotics Automation Lead (ELE/O7106)					
*Any one Marks Ext	On-Job-	Training as per guidelin sessment by NSDC/SSC	es of AICTE & SSC for the give	n skill sets for 150		

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# Semester-VI (NSQF Level 7, Semester-II) Detail Course Curriculum

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NSQF Level-7		VAI351:Deep Learning Seme			ster-II			
Te	aching	Scheme			Exam	nation S	scheme	
Lectures		03 hrs/Week			MSE	10 Ma	irks	
Practical		-			TA	A 15 Mark		
Credits		03			ESE	25 Ma	rks	
					Durati on of ESE	1.5 ho	urs	
Course ( Students	Jutcom will be	es (CO) –						
1.	Unders	tand deep learning fur	adamentals					
2	Explai	n various neural netwo	ork architect	ires				
Unit	2.1	i fullous neural neuro	Course C	ontent			Hours	
Unit 1	Neural Networks 09   History of neural networks & deep learning, working of biological neurons, 09							
Unit 2	Deep Learning Basics 09   Chain Rule, Memorization, Back propagation, activation function, vanishing gradient problem, a simple code using keras. 09							
Unit 3	Deep MLP 09 Deep multilayer perceptron, drop out layer and regularization, ReLU, batch normalization, SGD, optimizers, SoftMax and cross entropy for multiclass classification							
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			
Referen	ce Book							
Sr. No.		Book		Author	P	ublishe	r	
1		Deep Learning		Ian Goodfellow, Joshua Bengio & Aaron Courville	MIT P	MIT Press, 18-Nov- 2016		
2.	Deep	Learning with Pythor Edition)	n (1st	François Chollet	N Publ Editio	Manning Publications; 1st Edition (Dec 2017)		
3.	Fund Design	amentals of Deep Lea ning next-generation n intelligence algorithm	ming: nachine s	hil Buduma, Niche Locascio	olas O'Rei Edition	O'Reilly Media; 1st Edition (July 4, 2017)		
	-i		(IV)	anton Com				



NSQF Le	evel-7	VAI352:Mobile Robotics Seme			ster-II		
Te	aching Scheme	-	1	Examination Schem	e		
Lectures 03 hrs/Week			MSE	10 Ma	ks		
Practical		_	TA	15 Mar	ks		
Credits	03	-	ESE	25 Mar	ks		
			Duratio	n of ESE 1.5 hou	irs		
Course ()	Jutcomes (CO)						
Students	will be able to						
1.	To Learn about differ	rent locomotion	n mechanisms for mobile	e robots.			
Z.	To Explore sensing n	nodalities com	monly used in mobile ro	botics.			
Unit	In the deside	Cour	rse Content		Hours		
Unit	Introduction				09		
	Introduction to me	obile, Overvi	ew of an autonomou	s robotic system			
	Evolution of robot s	vstems Roles	of robots Mobile robo	thardware			
	Evolution of robot's	ystems, Roles	of Tobots, Mobile Tobo	t hatuwate			
Unit 2	Robot Locomotion				09		
	Types of locomotion	, hopping robo	ts, legged robots, wheel	ed robots, stability			
	Types of locomotion, hopping rooms, legged rooms, wheeled rooms, stability						
	and controllability.				_		
Unit 3	Input-Output Devices (						
	Input devices includ	ing sensors (e	.g. thermistors, light-de	pendent resistors).			
	and a first sector	ing consols (c	Grand Later State	pendent resistors),			
	mechanical switches	, opto-switches	s Output devices includ	ing Light-Emitting			
	Diodes (LED), buzz	ers, DC Moto	ors, and effectors (e.g.	grippers, suckers,			
	sweepers)						
	C' 1 1 1 1						
Unit 4	Simple Mechanism				09		
	Common mechanism e.g. leg levers, linkages, gears and spring-loaded						
	mechanism Common fosteness e.g. coreus, situate and size						
	meenamism common	lasteners e.g.	screws, rivers and phis				
Reference	e Book						
Sr. No.	Book		Author	Publisher			
1	Introduction to A	utonomous	R. Siegwart, I. R.	The MIT D	2011		
	Mobile Ro	bots	Nourbakhsh	The MIT Press	, 2011		
	D1		C M L M H	Cambridge Uni	versity		
	Planning Algorithms S. M. LaValle Press 2006						

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Synthous f Samphein Bg 10431050 cial Intelligence and Robotics) (2022-23 Autonomous Pattern) (An Autonomous Institute)



NSQF Level-7		VAI371: Project		Semester-II
Teach	ing Scheme		Examin	ation Scheme
Practical	4 Hours/wk	1	ſA	100 Marks
Credits	9	H	SE/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 Trai	n Job Training/Qualification Packs* Sem			
Teac	ching S	cheme	Examinati	on Scheme		
Practical 7-8 weeks		7-8 weeks	TA	50 Marks		
Credits		15	ESE/PE	150 Marks		
VAI381	AI Data Engineer(SSC/Q8106)					
VAIS62	Son	Training on and midelin	Q4001)	en skill sats for 150		
Marks Ext	ernal A	ssessment by NSDC/SS	C	en skill sets for 150		

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