Curriculum for AI & Robotics (D.Voc.)

NSQF Level	Code	Educational Component	Credit	Marks
3 (1st Year) Semester I	**Theory**			
	3.GE.01	Language – I	3	50
	3.GE.02	Applied Chemistry	3	50
	3.GE.03	Applied Physics	3	50
	3.GE.04	Applied Mathematics – I	3	50
	Lab / Practical			
	3.GP.01	Applied Chemistry Lab	1.5	50
	3.GP.02	Applied Physics Lab	1.5	50
	On-Job-Training (OJT) / Qualification Packs			
	Operator – Conventional Training	(Any one)	15	200
	Factory automation trainee			
	IT Attendant			
3 (1st Year) Semester II	**Theory**			
	3.GV.01	General Foundation Course	3	50
	3.GV.02	Basic Electricity and Electronics	3	50
	3.GE.05	Language – II	3	50
	3.GE.06	Applied Mathematics – II	3	50
	Lab / Practical			
	3.VP.01	Basic Electricity and Electronics Lab	1.5	50
	3.VP.02	Workshop Practice	1.5	50
	On-Job-Training (OJT) / Qualification Packs			
	Any one of the QP's can be opted as offered in Semester I	(Any one)	15	200
4 (2nd Year) Semester I	**Theory**			
	4.GV.01	Engineering Science	3	50
	4.GV.02	IT Foundations & Programming Concept (using C / Python)	3	50
	4.GV.03	Digital Electronics	3	50
	4.GV.04	Fundamentals of AI & Robotics	3	50
	Lab / Practical			
	4.VP.01	IT-Tools & Programming Lab (using C / Python)	1.5	50
	4.VP.02	Fundamentals of AI & Robotics Lab	1.5	50
	On-Job-Training (OJT) / Qualification Packs			
	Factory automation trainee	(Any one)	15	200
	Junior Software Developer			
	Draftsman – Mechanical			
4 (2nd Year) Semester II	**Theory**			
	4.GV.05	Data Structures and Design Analysis of Algorithms	3	50
	4.GV.06	Tools, Equipment & Safety Measures	3	50
	4.GV.07	Robotic Engineering	3	50
	4.GV.08	Human-Computer Interaction	3	50
	Lab / Practical			
	4.VP.03	Data Structure Lab	1.5	50
	4.VP.04	Computer Aided Design & Drafting	1.5	50
	On-Job-Training (OJT) / Qualification Packs			
	One more QP to be opted from the QPs	(Any one)	15	200

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		mentioned in the Level 4 first semester		
	Theory			
5 (3rd Year) Semester I	5.GV.01	AI & Expert Systems	3	50
	5.GV.02	Embedded Systems & Microcontrollers	3	50
	5.GV.03	Elements of Mechatronics	3	50
	5.GV.04	Machine Learning & Data Analytics	3	50
	Lab / Practical			
	5.VP.01	Embedded Systems & Microcontrollers Lab	1.5	50
	5.VP.02	AI based Programming Lab	1.5	50
	On-Job-Training (OJT) / Qualification Packs			
	Systems Analysist			
	Automobile sector trainee	(Any one)	15	200
	Automation lab instructor			
5 (3rd Year) Semester II	**Theory**			
	5.GV.05	Robotics Engineering-Based Industrial Automation	3	50
	5.GV.06	AI in Industrial Internet of Things	3	50
	5.GV.07	Robot Vision & Image Processing	3	50
	5.GV.08	Startup, Entrepreneurship and Business Planning	3	50
	Lab / Practical			
	5.VP.03	Project Work & Seminar-Presentation	3	100
	On-Job-Training (OJT) / Qualification Packs			
	One more QP to be opted from the QPs mentioned in the Level 5 first semester	(Any one)	15	200

Detailed Curriculum

(Level 3: 1st Year, Semester – I)

(3.GE.01): Language – I
Reading comprehension (prescribed texts) and functional grammar: A variety of genres – short stories, expository pieces, biographies, poems, plays, newspaper and magazine excerpts have been included. Teaching of grammar has been integrated with the reading texts. The emphasis is on functional grammar.
Non prescribed: In this section learners will be exposed to newspaper, articles, tables, diagrams, advertisements etc. which they have to read carefully and interpret. In the examination similar pieces will be used.
Grammar and usage. Functional writing and study skills: Paragraph writing, Letter writing, Note making, Ending (punctuation, spelling, appropriate vocabulary, structures).
Reference Books:
  1. Effective Communication Skills, Kulbhushan Kumar, Khanna Publishing House
  2. Business Communications, Varinder Bhatia, Khanna Publishing House

(3.GE.02): Applied Chemistry
Structure of Atom, Periodic Properties of Elements, Chemical Bonds, Fuel and their Classification, Water, Corrosion, Plastic and Polymers.
Reference Books:
  1. Chemistry, Satyaprakash, Khanna Publishing House
  2. Engineering Chemistry, Saiful Islam, Khanna Publishing House

(3.GE.03): Applied Physics
Units & Dimensions, Surface Tension and Viscosity, Vibrations, Heat, Ultrasonics, Optics.
Reference Books:
  1. Engineering Physics, Malik and Singh, Tata Mc Graw Hill
  2. Engineering Physics, Naidu, Pearson
  3. Modern Physics for Engineers, S.P. Taneja, R. Chand

(3.GE.04): Applied Mathematics – I

Sets, Relations and Functions, Sequences and Series, Algebra-I, Co-ordinate Geometry, Statistics and Probability.
Reference Books:
 1. Applied Mathematics-I, J.K. Tyagi, Khanna Publishing House
 2. Engineering Mathematics, Reena Garg, Khanna Publishing House

(3.GP.01): Applied Chemistry Lab

1. Proximate analysis of solid fuel.
2. Experiments based on Bomb Calorimeter.
3. Determination of turbidity in a given sample.
4. To determine the flash and fire point of a given lubricating oil.
5. To determine the viscosity of a given lubricating oil by Redwood viscometer.
6. To determine cloud and pour point of a given oil.

(3.GP.02): Applied Physics Lab

1. To determine the surface tension of a liquid by rise in capillary.
2. To determine the viscosity of a given liquid.
3. To determine the frequency of tuning fork using a sonometer.
4. To determine the frequency of AC main using sonometer.
5. Time period of a cantilever.

(Level 3: 1st Year, Semester – II)

(3.GV.01): General Foundation Course

Business Management and Entrepreneurship, Computational Skills, Environmental Education, Rural Development.
Reference Books:
1. Environmental Studies, M.P. Poonia & S.C. Sharma, Khanna Publishing House
2. A Textbook of Environmental Sciences, Rimpi Mehani Ne' Chopra, Khanna Publishing House

(3.GV.02): Basic Electricity and Electronics

Current Electricity, D.C. Circuits, Electric Cells, Lighting Effects of Current, Capacitors, Electromagnetic Effects, A.C Circuits.
Overview of Atom, Sub-Atomic Particles and CRO, Voltage and Current, Basics of Semiconductor, Bipolar Junction Transistor, Transistor Amplifier and Applications.
Reference Books:
1. Basic Electrical Engineering, Ritu Sahdev, Khanna Publishing House
2. Basic Electrical Engineering, Pradeep Kumar, Khanna Publishing
3. Basic Electronics, S. Biswas, Khanna Publishing House
4. All in One Electronics Simplifies, A.K. Maini, Khanna Publishing House

(3.GE.05): Language – II

Listening and speaking skills, English for specific purposes (opt any one):
English for Science: 1. Health and hygiene, 2. Conservation of (nearly extinct) animals, 3. Plant life, 4. Bio gas / solar energy.
English for Receptionist: 1. Receiving messages, making request etc., 2. Supplying information, 3. Giving advice and making suggestions, 4. Dealing with complaints, 5. Making entries in an appointment book, register etc.
English for Office Use: 1. Using the telephone taking and passing messages, 2. Receiving messages, 3. Marking noting on files and circular, 4. Writing office notes, memos, notices, agendas for meetings, 5. Telegrams and fax messages, 6. Writing business letters, application enquires, complaints, 7. Filling in forms, cheques, pay in slips etc.
Reference Books:
1. Effective Communication Skills, Kulbhushan Kumar, Khanna Publishing House
2. Business Communications, Varinder Bhatia, Khanna Publishing House

(3.GE.06): Applied Mathematics – II

Algebra-II, Relations and Functions, Calculus, Vectors and Three Dimensional Geometry, Linear Programming and Mathematical Reasoning.
Reference Books:
1. Applied Mathematics-II, J.K. Tyagi, Khanna Publishing House
2. Elements of Mathematical Analysis, R. Agor, Khanna Publishing House

(3.VP.01): Basic Electricity and Electronics Lab

1. Verify that resistance of conductor is directly proportional to resistivity and length and inversely proportional to cross- sectional area of the conductor.
2. Verification of Ohm's Law.
3. Verification of temperature co-efficient of resistance:
   (i) Positive for Tungsten and Nichrome and
   (ii) Negative for carbon.
4. Study of series resistive circuits.
5. Study of parallel resistive circuits.
6. Study of series and parallel connection of cells in circuits.
7. Preparation of Electrolyte for lead acid battery and its charging and measurement of Specific gravity with the help of hydrometer.
8. To find heat efficiency of an electric kettle.
9. Charging and Discharging of a capacitor.
10. Verification of magnetic field of a Solenoid with:
    (i) Iron core and
    (ii) Air core.
11. Verification of Faraday's Laws of electromagnetic induction.
12. Verification of Torque development in a current carrying coil in magnetic field.
13. Study of R.L. series circuit and measurement of power and power factor.
14. Study of R.C. series circuit and measurement of power and power factor.
15. Study of R.L.C. series circuit and measurement of power and power factor.
16. Study of R.L.C. series circuit for calculation of inductive reactance, capacitive reactance, impedance and Q- Factor.

1. Study of current and voltage measurement using Ammeter and Voltmeter.
2. Study of current and voltage measurement using Galvanometer.
3. Study of current, voltage and resistance measurement using of Multi-meter
4. Study of Power and Energy measurement using Wattmeter and Energy meter.
5. Study of working principle of Signal Generator and measurement of amplitude, time period and frequency of signal using Oscilloscope.
6. Study of V-I Characteristic of Diode.
7. Study of V-I Characteristic of Zener Diode. And use of Zener Diode as voltage regulator.
8. Study of Half wave rectifier with and without filter circuit.
9. Study of Full wave rectifier with and without filter circuit.
10. Study CE configuration for NPN and PNP transistors and measurement of voltage and current gain.
11. Study CB configuration for NPN and PNP transistors and measurement of voltage and current gain.
12. Study CC configuration for NPN and PNP transistors and measurement of voltage and current gain.
13. Study of working of single layer PCB manufacturing
14. Study of working of double layer PCB manufacturing.
15. Design of 7 segment display using LED and bread board

(3.VP.02): Workshop Practice

Carpentry shop work, Painting and polishing, Sheet metal working and soldering, Fitting shop work, Plumbing shop work, Smithy shop work, Welding shop work.

Reference Books:
1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Workshop Practices, HS Bawa, Tata Mc Graw Hill

(Level 4: 2nd Year, Semester – I)

(4.GV.01): Engineering Science

Soldering and Brazing, Measuring Instruments, Electrical Engineering Drawing, Electrical wiring, Earthing.

Reference Books:
1. Environmental Studies, M.P. Poonia & S.C. Sharma, Khanna Publishing House
2. A Textbook of Environmental Sciences, Rimpi Mehani Ne' Chopra, Khanna Publishing House

(4.GV.02): IT Foundations & Programming Concept (using C / Python)

Computer Organization & OS: User perspective, Networking and Internet, Office automation tools, Multi Media Design: (Open Source Design Tools), Troubleshooting: Hardware, Software and Networking, Work Integrated Learning IT.

Introduction, Conditional Statements, Control Statements, String Manipulation, Lists, Tuple, Dictionaries, Functions, Modules, Exception Handling.

Reference Books:
1. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
3. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
4. Python Crash Course, 2Nd Edition: A Hands-On, Project-Based Introduction to Programming, Eric Matthes
5. Python Programming: Using Problem Solving Approach, Reema Thareja
6. Core Python Programming, R. Nageswara Rao
7. Introduction to Computing and Problem Solving with Python, J. Jose, Khanna Publications
8. Mastering PC Hardware & Networking, Ajit Mittal, Khanna Publishing House
9. Information Security & Cyber Laws, Sarika Gupta, Khanna Publishing House
10. IT Tools, R.K. Jain, Khanna Publishing House

(4.GV.03): Digital Electronics
Number Systems and Boolean Algebra, Logical Circuits, Latches and Flip-Flops, Introduction to Display Devices, Integrated Circuits and Memories.

Reference Books:
1. Fundamentals of Digital Electronics, Aditya Chaturvedi, Khanna Publishing House
2. Digital Electronics by S.Salivahan, Digital Fundamentals by Floyd, Digital Design by Morris Mano
3. Digital Electronics, A. Anand Kumar, PHI
4. Modern Digital Electronics, R.P. Jain, TMH

(4.GV.04): Fundamentals of AI & Robotics
Introduction, Intelligent Agents, Problem Solving, Search techniques, Heuristic search strategies, Adversarial search, Knowledge & reasoning, Using predicate logic, Learning, AI problems, Need for Ambiguity and its relevance.

Introduction, End effectors and robot controls, Robot transformations and sensors, Robot cell design and applications, Micro/Nano robotics system.

Reference Books:
1. Artificial Intelligence – A Modern Approach, Stuart Russell and Peter Norvig
2. A First Course in Artificial Intelligence by Deepak Khemani
3. A classical approach to Artificial Intelligence, Munesh Chandra Trivedi, Khanna Publications
4. Robotics Technology, Satyarajan Deb, TMH
5. S.K. Saha, Introduction to Robotics, TMH
6. S. Mukherjee, Robotics, Khanna Book Publishing Co., New Delhi

(4.VP.01): IT-Tools & Programming Lab (using C / Python)
Spreadsheets, Word, Presentation, Multimedia Design, Troubleshooting, Study of computer components, Booting of Computer and its shutdown, Practicing some fundamental DOS Commands, Simple Programs in BASIC to compute Mean, Variance, Correlation and Regression, Creating database in MS-Access, structuring with different types of fields and use of query facility for accessing the information, Project / Practical File, Viva Voce.

Interactive interpreter and Python Script, Indentation Error, decision making and looping, one dimensional and two dimensional arrays, explore string functions, mean, median, mode, find all duplicates in the list, find all unique elements of a list, compute gcd, lcm of two numbers, use of Lists, Dictionaries, implement Turtle, Linear and Binary Search, Exceptions in Python.

(4.VP.02): Fundamentals of AI & Robotics Lab
Introduction, Search methods, Robotics, Programming and logics in artificial intelligence, Expert system.

(Level 4: 2nd Year, Semester – II)

(4.GV.05): Data Structures and Design Analysis of Algorithms
Program structures, Variables, Data Types, Declarations, Operators (Arithmetic, Relational, Logical), increment and decrement operators, Assignment operators and expressions, Arithmetic expressions, Functions, external variables, scope rules, header files, Pointers and addresses, pointers and function arguments, pointer and arrays, Data Structures: Arrays, Linked list, Stacks and queues, Trees, Graphs, Hashing, Searching & Sorting.

Reference Books:
1. Fundamentals of Data Structures, Sartaj Sahni, University Press
2. Data Structures through C, Yashwant Kanetkar, BPB Publications
3. Data Structures Through C In Depth, S.K.Srivastava/Deepali Srivastava
4. Data Structures using C & C++, Rajesh K. Shukla
5. Introduction to Algorithms, Thomas H. Cormen

(4.GV.06): Tools, Equipment & Safety Measures

Industrial safety, Fundamentals of maintenance engineering, Wear and Corrosion and their prevention, Fault tracing, Periodic and preventive maintenance.

Reference Books:
1. Industrial Safety and Maintenance Management, M. P. Poonia, S. C. Sharma
2. Industrial Safety Management, L M Deshmukh

(4.GV.07): Robotic Engineering

Introduction, Drive systems and Sensors, Kinematics and Dynamics of Robots, Robot Control, Programming and Applications.

Reference Books:
1. Robotics and Control, Mittal & Nagrath, Tata McGraw Hill
2. Robotics Technology, Deb, Wiley India

(4.GV.08): Human-Computer Interaction

Introduction to Human Computer Interface, Interaction Devices, Color and Content, User Interface Design Process, Graphical User Interface, Device and Screen-Based Control, Screen Design, Windows, Understanding Business Functions, Software Tools, Information Search and Visualization, Time, Usability and Prototypes.

Reference Books:
1. Interaction Design: Beyond Human Computer Interaction, Preece Rogers, Sharp
2. Human-Computer Interaction, Alan Dix
3. Human-Computer Interaction, MacKenzie

(4.VP.03): Data Structure Lab

Implement stack, Write functions like push, pop, Initialize, Empty or Full, Implement concept of queues, Implement queues in a circular array, Implement queues as a circular linked list, Implementing doubly linked list, Binary search tree to sort an array.

(4.VP.04): Computer Aided Design & Drafting

Introduction, Wire frame modelling, Surface Modeling, Solid Modeling Techniques, Advanced Modeling Concepts.

(Level 5: 3rd Year, Semester – I)

(5.GV.01): AI & Expert Systems

AI, Search Techniques, Knowledge Representation, Handling uncertainty, Planning, Expert System: Need and Justification for expert systems- cognitive problems, Neural networks, Expert System Architectures, Natural language processing, Computational models of neurons, Structure of neural networks. Functional units of ANN for pattern recognition tasks, Pattern classification using perceptron, Multilayer feed forward neural networks (MLFFNNs), Back propagation learning, Empirical risk minimization, Regularization, Newer optimization methods for neural networks (AdaGrad, RMSProp, Adam)

Reference Books:
1. Rich, Knight, Shivshankar, Artificial Intelligence, TMH
2. P.Joshi, P.Kulkarni, Artificial Intelligence: Building Intelligent Systems, PHI
3. R.B. Mishra, Articificial Intelligence, PHI Learning Pvt. Ltd

(5.GV.02): Embedded Systems & Microcontrollers

Introduction to Embedded System Design, Categories of ES, Overview of Embedded System Architecture, Robotics: Classification of Robots, Degree of freedom, Kinematics; Multidisciplinary approach: Motors-DC motors, Stepper Motors, Servo Motors, Jump, Loop and Call instruction, Time delay for various 9051 chip, I/O programming and I/O bit manipulation, Case studies of Closed-loop control and a learning robot- Hardware requirement, Locomotion and obstruction sensing, Addressing Modes of 8051,Power Management of 8051, Timer Interrupts.

Reference Books:
1. Introduction to Embedded Systems, K.V. Shibu, McGraw Hill
2. Introduction to Embedded Systems, Raj Kamal, Tata McGraw Hil
3. Microprocessor Architecture: Programming and Applications with the 8085/8080A, Gaonkar, Penram Int. Pub.
4. Microprossers and Microcontrollers, Krishna Kant, PHI
5. 8051 Microcontrollers, Rajakamal, TMH

(5.GV.03): Elements of Mechatronics

Introduction, Sensors and Transducers, Mechanical Actuation System, Hydraulic and Pneumatic Actuation System, Electrical Actuation System, Microprocessors, Programmable Logic Controllers, System Models, Design of Mechatronics systems.

Reference Books:
1. A Textbook of Mechatronics, RK Raput, S.Chand Publishing
2. Mechatronics: Principles, Concepts and applications, Mahalik N.P, Tata McGraw Hill
3. Introduction to Mechnotronics, Kuttan, Oxford University

(5.GV.04): Machine Learning & Data Analytics

Introduction, Concept, Learning and General to specific ordering, Decision Tree learning (DTL), Bayesian Learning, Instance Based Learning, Learning set of rule, Analytical learning, Inductive analytical approaches to learning, supervised, unsupervised and reinforcement learning, Knowledge representation, Identify and implement appropriate learning strategies like Linear Regression, Support Vector Machine, Decision Trees, Random Forest.

Reference Books:
1. Machine Learning, Rajiv Chopra, Khanna Publishing House
2. Artificial Intelligence and Machine Learning, Chandra S.S. & H.S. Anand, PHI Publications

(5.VP.01): Embedded Systems & Microcontrollers Lab

Small Assembly language programs to understand the significance of Op-Codes (Arithmetic, Barrel Shifter etc.), 8051 Microcontroller trainer kit, addition of 8-bit numbers stored in an array, Multiplication by successive addition of two 8-bit numbers, finding largest no. from a given array of 8-bit numbers, arrange 8-bit numbers stored in an array in ascending order, Stepper motor control by 8051 Microcontroller, Interfacing of 8-bit ADC 0809 with 8051 Microcontroller, Serial Communication by using 8051 serial ports, Timer/Counter for various applications, Traffic light controller/Real-time clock display, ARM 9 mini 2440 kit.

(5.VP.02): AI based Programming Lab

Installation of gnu-prolog, Study of Prolog (gnu-prolog), its facts, and rules, simple facts for the statements and querying it, program for Family-tree, Program for Monkey-banana Problem, program which behaves a small expert for medical Diagnosis, programs for computation of recursive functions like factorial Fibonacci numbers, etc., program to solve 5-queens problem, Program for water jug problem, program for travelling salesman program, case study of standard AI programs like Mycin and AI Shell, python and advanced viz tool like tableau/qliksense.

(Level 5: 3rd Year, Semester – II)

(5.GV.05): Robotics Engineering-Based Industrial Automation

Introduction, Fixed Automation, Analysis of Automated Flow Lines, Assembly Systems and Line Balancing, Automated Assembly Systems, Automated Materials Handling, Automated Storage Systems, Automated Inspection and Testing, Modelling Automated Manufacturing Systems.

Reference Books:
1. Control in Robotics and Automation, Ghosh, Allied Publishers
2. K.Goyal and D.Bhandari, Industrial Automation and Robotics, S.K.Kataria and Sons

(5.GV.06): AI in Industrial Internet of Things

Introduction about IIoT, Sensors & actuators, Communication technologies, Networking technologies, Industry 4.0, Industrial Processes, Industrial Sensing & Actuation, Industrial Internet Systems. IIoT Sensing, IIoT Actuating, IIoT Communication Models, IIoT Networking Technologies, IIoT Business Models, IIoT Reference Architecture, Smart and Connected Business Perspective, Data Analytics in IIoT, Introduction, Big Data Analytics, Machine Learning, Artificial Intelligence and Data Science-R and Python Programming, IIoT Application Domains, Factories and Assembly Line, Food Industry, Healthcare, Power Plants, Inventory Management & Quality Control.

Reference Books:
1. Internet of Things, Jeeva Jose, Khanna Publishing House
2. Internet of Things, Arsheep Bahga and Vijay Madisetti

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3. Hands-On Artificial Intelligence for IoT: Expert machine learning and deep learning techniques for developing smarter IoT systems, Amrita Kapoor
4. Internet of Things : Architecture and Design Principles, Raj Kamal

(5.GV.07): Robot Vision & Image Processing

Introduction, Recognition Methodology, Morphological Image Processing, Image Representation and Description, Binary Image Analysis and Segmentation, Area Extraction, Facet Model Recognition, Perspective Projective geometry, Object Models And Matching, Knowledge Based Vision, Object Recognition, Applications.

Reference Books:
1. Computer Vision: A Modern Approach, Forsyth / Ponce
2. Robot Vision (MIT Electrical Engineering and Computer Science)
3. Algorithms for Image Processing and Computer Vision, J. R. Parker

(5.GV.08): Startup, Entrepreneurship and Business Planning

Introduction to innovation, Entrepreneur and the process, Problem identification, Idea vs opportunity, Building financial statements, Idea selection, Analysis of the competitive environment, Effective teamwork in complex and evolving contexts, Business planning process, Entrepreneurial marketing, Entrepreneurship, Business case and financing opportunities, Business model & secondary market research, Business canvas, Intellectual property and legal aspects, Pitching, Business plan.

Reference Books:
1. Entrepreneurship, Robert D. Hisrich, Michael P. Peter, Dean A. Shepherd
2. Taxmann's Entrepreneurship, CA (Dr.) Abha Mathur
3. Let's Build A Company: A Start-up Story Minus the Bullshit, Harpreet Grover, Vibhore Goyal
4. Before You Start Up: How to Prepare to Make Your Startup Dream a Reality, Pankaj Goyal

(5.VP.03): Project Work & Seminar-Presentation

On the basis of learning in the Diploma of Vocational, a project to be taken up by the student strengthening his / her vocational skills.

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