Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune

Curriculum Structure and Syllabus

of

B. Voc. Internet of Things

(Regulations 2021)

Effective from Academic Year 2024-25

Institute Vision

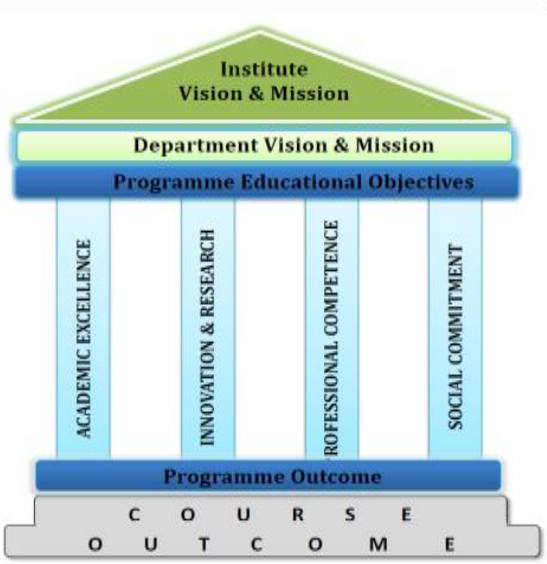
To Serve the Society, Industry and all the Stakeholders through the **Value-Added Quality Education.**

Institute Mission

To serve the needs of society at large by establishing State-of-the-Art Engineering, Management and Research Institute and impart attitude, knowledge and skills with quality education to develop individuals and teams with ability to think and analyze right values and self-reliance.

Quality Policy

We at PCCOE are committed to impart Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders. We shall strive for academic excellence, professional competence and social commitment in fine blend with innovation and research. We shall achieve this by establishing and strengthening state-of- the-art Engineering and Management Institute through continual improvement in effective implementation of Quality Management System.



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INDEX

ABBREVIATIONS

Abbreviations	Course Full Name
PCC	Professional Core Course
BSC	Basic Science Course
ECC	Engineering core/Science course
HSMC	Humanities, Social Sciences, and Management Course
INTR	Internship
PROJ	Project
FA	Formative Assessment
SA	Summative Assessment

CURRICULUM STRUCTURE
STRUCTURE FOR IST YEAR B. VOC. (INTERNET OF THINGS)
SEMESTER I

B. Voc. Structure		Sem-I	Teaching Scheme				Examination Scheme						
Course Code	**Course Type**	**Course Name**	**L**	**P**	**H**	**CR**	**FA1**	**FA2**	**SA**	**TW**	**OR**	**PR**	**Total**
C4.GE.01	BSC	Applied Science	3	-	3	3	20	30	50	-	-	-	100
C4.GV.01	ECC	Engineering Drawing	3	-	3	3	20	30	50	-	-	-	100
C4.GV.02	ECC	Basics of Electrical & Electronics	3	-	3	3	20	30	50	-	-	-	100
I4.GV.03	PCC	Professional Core Course I ((Sensor and Signal Conditioning)	3	-	3	3	20	30	50	-	-	-	100
C4.GP.01	BSC	Applied Science Lab	-	3	3	1.5	-	-	-	-	-	50	50
C4.VP.01	ECC	Basics of Electrical & Electronics Lab	-	3	3	1.5	-	-	-	-	-	50	50
I4.QP.01	INTR	On Job Training (ELE/Q1405)	-	30	30	15	-	-	-	-	-	200	200
		Total	**12**	**36**	**48**	**30**	**80**	**120**	**200**	**-**	**-**	**300**	**700**

SEMESTER II

B. Voc. Structure		Sem-II	Teaching Scheme				Examination Scheme						
Course Code	**Course Type**	**Course Name**	**L**	**P**	**H**	**CR**	**FA1**	**FA2**	**SA**	**TW**	**OR**	**PR**	**Total**
C5.GE.01	BSC	Applied Mathematics	3	-	3	3	20	30	50	-	-	-	100
C5.GV.01	ECC	IT Tools	3	-	3	3	20	30	50	-	-	-	100
C5.GE.02	HSMC	Language I (Soft Skill)	3	-	3	3	20	30	50	-	-	-	100
I5.GV.02	PCC	Professional Core Course II (Introduction to Controllers and Operations)	3	-	3	3	20	30	50	-	-	-	100
I5.VP.01	PROJ	Mini Project	-	6	6	3	-	-	-	-	100	-	100
I5.QP.01	INTR	On Job Training (ELE/Q1405)	-	30	30	15	-	-	-	-	-	200	200
		Total	**12**	**36**	**48**	**30**	**80**	**120**	**200**	**-**	**100**	**200**	**700**

Abbreviation: L- Lecture; **P**- Practical; **H**- Hours; **CR**- Credits; **FA**–Formative Assessment**, SA-**Summative Assessment; **TW** – Term Work; **OR** – Oral Exam; **PR** – Practical Exam.

STRUCTURE FOR IIND YEAR B. VOC. (INTERNET OF THINGS)

SEMESTER III

B. Voc. Structure		Sem-III	Teaching Scheme				Examination Scheme						
Course Code	**Course Type**	**Course Name**	**L**	**P**	**H**	**CR**	**FA1**	**FA2**	**SA**	**TW**	**OR**	**PR**	**Total**
C6.GE.01	HSMC	Language II (Soft Skills for Professionals)	3	-	3	3	20	30	50	-	-	-	100
C6.GE.02	HSMC	Introduction to Entrepreneurship	3	-	3	3	20	30	50	-	-	-	100
I6.GV.01	PCC	Fundamentals of C & C++ programming	3	-	3	3	20	30	50	-	-	-	100
I6.GV.02	PCC	Basics of Computer Networking	3	-	3	3	20	30	50	-	-	-	100
I6.VP.01	PCC	Programming Lab I	-	3	3	1.5	-	-	-	-	-	50	50
I6.VP.02	PCC	Basics of Computer Networking Lab	-	3	3	1.5	-	-	-	-	-	50	50
I6.QP.01	INTR	On Job Training (ELE/Q1403)	-	30	30	15	-	-	-	-	-	200	200
		Total	**12**	**36**	**48**	**30**	**80**	**120**	**200**	**-**	**-**	**300**	**700**

SEMESTER-IV

B. Voc. Structure		Sem-IV	Teaching Scheme				Examination Scheme						
Course Code	**Course Type**	**Course Name**	**L**	**P**	**H**	**CR**	**FA1**	**FA2**	**SA**	**TW**	**OR**	**PR**	**Total**
C6.GE.03	HSMC	Management and Entrepreneurship	3	-	3	3	20	30	50	-	-	-	100
I6.GV.03	PCC	Advanced Microcontrollers	3	-	3	3	20	30	50	-	-	-	100
I6.GV.04	PCC	Database Management System	3	-	3	3	20	30	50	-	-	-	100
I6.GV.05	PCC	Python Programming	3	-	3	3	20	30	50	-	-	-	100
I6.VP.03	PCC	Advanced Microcontrollers Lab	-	3	3	1.5	-	-	-	-	-	50	50
I6.VP.04	PCC	Programming Lab II (DBMS + Python)	-	3	3	1.5	-	-	-	-	-	50	50
I6.QP.02	INTR	On Job Training (ELE/Q1403)	-	30	30	15	-	-	-	-	-	200	200
		Total	**12**	**36**	**48**	**30**	**80**	**120**	**200**	**-**	**-**	**300**	**700**

Abbreviation: L- Lecture; **P**- Practical; **H**- Hours; **CR**- Credits; **FA–**Formative Assessment**, SA**-Summative Assessment; **TW** – Term Work; **OR** – Oral Exam, **PR** – Practical Exam

STRUCTURE FOR IIIRD YEAR B. VOC. (INTERNET OF THINGS)

SEMESTER V

B. Voc. Structure		Sem-V	Teaching Scheme				Examination Scheme						
Course Code	**Course Type**	**Course Name**	**L**	**P**	**H**	**CR**	**FA1**	**FA2**	**SA**	**TW**	**OR**	**PR**	**Total**
I7.GV.01	PCC	Principles of Internet of Things	3	-	3	3	20	30	50	-	-	-	100
I7.GV.02	PCC	IoT enabling Technologies	3	-	3	3	20	30	50	-	-	-	100
I7.GV.03	PCC	IoT System Architecture & Communication Protocols	3	-	3	3	20	30	50	-	-	-	100
I7.GV.04	PCC	Data Analytics for IoT	3	-	3	3	20	30	50	-	-	-	100
I7.VP.01	PCC	IoT Lab I	-	3	3	1.5	-	-	-	-	-	50	50
I7.VP.02	PCC	IoT Lab II	-	3	3	1.5	-	-	-	-	-	50	50
I7.QP.01	INTR	On Job Training (ELE/Q9801)	-	30	30	15	-	-	-	-	-	200	200
		Total	**12**	**36**	**48**	**30**	**80**	**120**	**200**	**-**	**-**	**300**	**700**

SEMESTER-VI

B. Voc. Structure		Sem-VI	Teaching Scheme				Examination Scheme						
Course Code	**Course Type**	**Course Name**	**L**	**P**	**H**	**CR**	**FA1**	**FA2**	**SA**	**TW**	**OR**	**PR**	**Total**
I7.GV.05	PCC	Cloud Computing & Virtualization	3	-	3	3	20	30	50	-	-	-	100
I7.GV.06	PCC	Programming Languages for IoT	3	-	3	3	20	30	50	-	-	-	100
I7.VP.03	PROJ	Project	-	18	18	9	-	-	-	50	150	-	200
I7.QP.02	INTR	On Job Training (ELE/Q9801)	-	30	30	15	-	-	-	-	-	200	200
		Total	**6**	**48**	**54**	**30**	**40**	**60**	**100**	**50**	**150**	**200**	**600**

Abbreviation: L- Lecture; **P**- Practical; **H**- Hours; **CR**- Credits; **FA–**Formative Assessment**, SA**-Summative Assessment; **TW** – Term Work; **OR** – Oral Exam, **PR** – Practical Exam.

LIST OF QUALIFICATION PACKS (QP)

Course code	QP code	Name of QP
I4.QP.01	**ELE/QP1405**	IOT hardware analyst
I5.QP.01	**ELE/QP1405**	IOT hardware analyst
I6.QP.01	**ELE/QP1403**	Embedded product design Engineer
I6.QP.02	**ELE/QP1403**	Embedded product design Engineer
I7.QP.01	**ELE/QP9801**	Project Management
I7.QP.02	**ELE/QP9801**	Project Management

Course Syllabus
Semester-I

Program:	**B. Voc. (Internet of Things)**				**Semester: I**	
Course:	**Applied Science**				**Code: C4.GE.01**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA 1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Detailed Syllabus:

Unit	Description	Duration (36 Hrs)
1	**Water** Impurities in water, methods of their removal, hardness of water, its types and units. Chemical analysis of water by determination of hardness by EDTA method and its numericals. Alkalinity - its determination and numerical. Disadvantages of hard water in boilers,. Water softening techniques: Permutit and Ion exchange method. Water purification by reverse osmosis and electro-dialysis methods.	6
2	**Fuel and their Classification** Definition, characteristics, classification into solid, liquid and gaseous fuel. Calorific value of fuels – GCV, NCV and their relation. Coal, its types and their properties, proximate analysis and ultimate analysis. Petroleum and brief idea of refining into various factions and their characteristics and uses. Octane number and cetane number, knocking and anti-knocking agents. Synthesis reaction, properties, advantages and disadvantages of Biodiesel. Gaseous fuels- Gaseous fuels: Hydrogen gas as a future fuel, production by steam reforming of methane and coke, storage and transportation. .	6
3	**Corrosion** Theory of corrosion. Different types of corrosion: Pitting corrosion, concentration cell corrosion, stress corrosion and soil corrosion. Factors affecting corrosion: nature of metal and nature of environment. Prevention of corrosion by various methods using metallic and non-metallic coatings like – hot dipping, cladding, electroplating and cementation and powder coating.	6
4	**Units and dimensions** M.K.S. fundamentals & derived units, S.I. base units, supplementary units and derived units, Dimensions of various physical quantities, uses of dimensional analysis.	6
5	**Optics:** wave nature of light, reflection and refraction of a wave from a plane surface, total internal reflection, plane polarized light, Law of Malus	6
6	**Ultrasonics:** Productions of ultrasonic waves by magnetostriction and piezo-electric effect, application of ultrasonics in industry	6

Text Books:

1. Jain and Jain, *Engineering Chemistry*, Dhanpat Rai Publishing Co., 2016.
2. Avadhanulu M. N., Kshirsagar P.G., *A text book of Engineering Physics*, S. Chand publication, 2015.

Reference books:

1. Wiley Editorial, *Engineering Chemistry*, Wiley India, 2012.
2. Palanna O.G., *Engineering Chemistry*, Tata McGraw-Hill Education, 2009.
3. Gaur *R.* K., Gupta *S.* L., *Engineering Physics*, Dhanpat Rai Publications, 2001.

Program:	B. Voc. (Internet of Things)				Semester: I	
Course:	Engineering drawing				Code: C4.GV.01	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	FA 1	FA 2	SA	Total
3	3	3	20	30	50	100

Detailed Syllabus:

Unit	Description	Duration (36 Hrs)
1	**Introduction** Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice, Dimensioning – linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension. Tolerances – methods of representing tolerances, unilateral and bilateral tolerances, tolerance on linear and angular dimensions, geometrical tolerances.	6
2	**Projection of Line and Planes** Introduction, Projection of points – points on the different quadrants and on the reference planes. Projection of straight lines – Line on the reference planes - perpendicular to one plane and parallel to other plane – inclined to one plane and parallel to the other plane – parallel to both the planes –inclined to both the planes. Projection of planes- Types of planes, Projection of planes perpendicular to both the reference planes, Perpendicular to one plane and parallel to other plane, Perpendicular to one plane and inclined to the other plane, Inclined to both planes.	6
3	**Orthographic Projections** Reference planes, types of orthographic projections – First angle projections, Third angle projections, methods of obtaining orthographic views by First angle method.	6
4	**Isometric View** Introduction, Isometric scale, construction of Isometric view of simple objects from given orthographic.	6
5	**Development of Lateral Surfaces of Solids** Introduction, Development of lateral surfaces of Cone, Cylinder, Pyramid and Prism.	6
6	**Freehand Sketching and introduction of AutoCAD software** Free hand sketching -- FV and TV of standard machine parts – Hexagonal headed nut and bolt, foundation bolts, shafts, keys, couplings, springs, screw thread forms, welded joints, riveted joints.	6

Text Books

1. Bhatt N.D., and Panchal V.M., *Engineering Drawing*, Charotar Publishing House, 2010.
2. Agrawal B., and Agrawal C M "*Engineering drawing*", Tata McGraw Hill Education Private Limited., 2014.

Reference books:

1. Gill P.S., *Engineering drawing*, S.K. Kataria & Sons., 2016.
2. Gopalakrishnan.K.R., *Engineering Drawing*, (Vol.I and Vol.II), Dhanalakshmi publishers, 1970.
3. Venugopal. K, and Sreekanjana G., *Engineering Graphics*, New Age International Publishers. 2019.
4. Natarajan K. V., *A text book of Engineering Drawing Graphics*. Dhanalakshmi Publishers, 2008.

Program:	B. Voc. (Internet of Things)			Semester: I		
Course:	Basics of Electrical & Electronics			Code: C4.GV.02		
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	FA 1	FA 2	SA	Total
3	3	3	20	30	50	100

Detailed Syllabus:

Unit	Description	Duration (36 Hrs)
1	**Electromagnetism:** Flux, flux density, reluctance, MMF, permeability and field strength, their units and relationships; comparison of electric and magnetic circuit, Series magnetic circuit with air-gap, comparison of electric and magnetic circuit, force on current carrying conductor placed in magnetic field, Fleming's left-hand rule. Faradays laws of electromagnetic induction, Fleming's right-hand rule, statically and dynamically induced e.m.f, self and mutual inductance, coefficient of couplings. Energy stored in magnetic field.	**6**
2	**Single Phase AC Circuits:** Generation of single phase sinusoidal A.C. voltages, AC quantities, phasor representation, R-L-C series &, parallel circuit (No Numerical), impedance, admittance, concept of active, reactive, apparent power and power factor. **Polyphase A.C. Circuits:** Introduction to 3 phase supply and its necessity, balance three phase system, relation between line and phase quantities (with phasor diagram), power in three phase circuits for star and delta connection.	6
3	**DC and AC machines** **DC Machines:** Construction, working principle of D.C. generator, emf equation of DC generator (derivation not expected), working principle of D.C. motor, types of D.C. motor, Back emf (Numerical), Industrial applications. **AC Machines:** Single phase transformers: Construction, operating principle, emf equation, voltage and current ratios. Losses, Efficiency and regulation, Auto-transformer.	6
4	**Fundamentals of Electronics** Resistance, Ohm's law, power calculations, V-I Characteristics, Resistors, Capacitors, Inductors. Voltage and Current sources, Symbols and Graphical representation Overview of AC, DC.	6
5	**Basics of Semiconductor** Semiconductor materials, N-type and P-type semiconductor, PN junction diode, depletion layer, Forward & Reverse bias, V-I Characteristic, Zener diode, Photo diode, LED, Diode as a rectifier, Half wave and full wave rectification, Introduction to Filters, Clippers, Clampers	6
6	**Fundamentals of Digital Electronics** Number System & Logic Gates: Introduction to number system, Conversion of number systems, Signed & unsigned numbers, Binary arithmetic, Binary subtraction using 2's complement, Introduction to logic gates, Boolean Laws.	6

Books:

Text Books:

1. Nagrath I. J. and Kothari, *Theory and Problems of Basic Electrical Engineering*, PHI Learning Private Limited, 2016.
2. Husain A., *Fundamentals of Electrical Engineering*, Dhanpat Rai & Co., 2010.
3. Mittal V. N. and Mittal Arvind, *Basic Electrical Engineering*, McGraw Hill., 2006.
4. Mehta V.K., *Basic Electrical Engineering*, S. Chand & Co. Pvt. Ltd. New Delhi, 2012.
5. Bell, D. A., *Electronic Devices and Circuits*, Oxford University Press, 2008.
6. Tomasy W., *Advanced Electronic Communication system*, PHI Publishers, 2003.
7. Morris M., *Digital Logic and Computer Design*, Prentice Hall of India, 2004.

Reference Books:

8. Kulshreshta D.C., *Basic Electrical Engineering*, Tata McGraw Hill, 2009.
9. Theraja B.L. and Theraja A.K., *A textbook of Electrical Technology*, S. Chand & Co. Pvt. Ltd. New Delhi, 2007.
10. Hughes E., John H., McKenzie-Smith I., and Brown K., *Electrical and Electronic Technology*, Pearson, 2016.
11. Donald N., *Electronic Circuit Analysis and Design*, Tata McGraw Hill, 2006.
12. Hayt W. H., Kimmerly J. E., and Durbin Steven M., *Engineering Circuit Analysis*, TataMcGraw Hill, 2012.

Program:	**B. Voc. (Internet of Things)**				**Semester: I**	
Course:	**Profession Core Course I (Sensor and Signal Conditioning)**				**Code: I4.GV.03**	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	FA 1	FA 2	SA	Total
3	**3**	**3**	**20**	**30**	**50**	**100**

Detailed Syllabus:

Unit	Description	Duration (36 Hrs)
1	**Introduction** Introduction to sensors and transducers, need of sensors, sensor performance characteristics- static characteristics: Accuracy, Precision, sensitivity, resolution, Hysteresis, drift, repeatability, reproducibility, dynamic characteristics, Dynamic errors, fidelity.	6
2	**Sensor - I** Types of sensors. Basic principle of resistive, capacitive and inductive sensors, displacement measurement using resistive, inductive transducers, LVDT	**6**
3	**Sensor - II** Introduction to the principle of photo-emissive sensors: photodiode/phototransistor, photovoltaic, hall effect - flow measurement and optical based sensors.	**6**
4	**Sensor - III** Self-generating sensors-Thermoelectric, Thermocouple temperature sensor, piezoelectric, strain gauge load cell , photovoltaic, electrochemical sensors	**6**
5	**Signal Conditioning -I** Concept of signal conditioning, introduction to AC bridge inductance/capacitance bridge, DC bridge: Wheatstone bridge, Operational amplifier used in instrumentation	**6**
6	**Signal Conditioning - II** Instrumentation amplifier, Introduction to Analog to Digital (ADC): successive approximation and Digital to Analog conversion (DAC): R2R Ladder.	**6**

Books:

Text Books:

1. Areny R. P., and Webster J. G., *Sensors and Signal Conditioning*, John Wiley and Sons, 2000.
2. Doebelin E.O., and Manic D.N., *Measurement Systems: Applications and Design*, McGraw–Hill, 2004.
3. Sawhney A.K., and Sawhney P., A *Course in Electrical and Electronic Measurements and Instrumentation*, Dhanpat Rai and sons, 2008.
4. Sawhney A.K., *Electrical and Electronics Measurements and Instrumentation*, Dhanpat Rai and Sons, 2000.
5. Kalsi H.S., *Electronic Instrumentation*, Tata McGraw Hill, 2001.
6. Patranabis D., *Sensors and Transducers*, PHI, 2003.
7. Doebelin E. O., "Measurement Systems: Application and Design", Tata McGraw Hill Ltd., New Delhi (2004).

Reference Books:

1. Murty D.V.S., *Transducers & Instrumentation*, PHI, 2000.
2. Nakra, B.C., and Chaudhry K.K., *Instrumentation, Measurement and Analysis*, Tata McGraw Hill, 2003.

Program: B. Voc. (Internet of Things)				**Semester:** I		
Course: Applied Science Lab				**Code: C4.GP.01**		
Teaching Scheme			**Evaluation Scheme**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
3	**3**	**1.5**	**-**	**50**	**-**	**50**

Guidelines:

1. Total experiments to be conducted are four from Part A and four from Part B
2. Total : 8 experiments/assignments to be conducted

Detailed Syllabus:

Part A: Applied Chemistry (Any four)

Expt.	**Description**
1.	Determination of total hardness of water sample by EDTA method (two water samples).
2.	Determination of total alkalinity of the water sample..
3.	Determination of pH and conductance of different water sample solutions.
4.	Proximate analysis of solid fuel.
5.	Electrode position of Zinc (Zn) over Cu plates or Fe plates.

Part B: Applied Physics (Any four)

Expt.	Description
1.	To determine least counts and take readings with given measuring instruments
2.	To verify Snell's law of refraction
3.	To verify law of Malus
4.	To determine critical angle for given transparent medium
5.	To determine velocity of ultrasonic waves in a given liquid

Text Books:

1. Jain and Jain, *Engineering Chemistry*, Dhanpat Rai Publishing Co.,2016.
2. Avadhanulu M.N., Kshirsagar P.G., *A text book of Engineering Physics*, S. Chand publication, 2015.
3. Virmani O.P., and Narula A.K., *Applied Chemistry Theory and Practice*, New age International (P) Ltd., 1995.

Reference books:

1. Wiley Editorial, *Engineering Chemistry*, Wiley India, 2012.
2. Palanna O.G., *Engineering Chemistry*, Tata McGraw-Hill Education, 2009.
3. Gaur R.K., and S.L. Gupta, *Engineering Physics*, Dhanpat Rai Publications,2001.
4. Mendham J., Denny R.C., Barnes J.D., and Vogels Thomas M.J.K., *Text book of Qualitative Chemical Analysis*, Pearson Education ltd., 1989.

Program:	**B. Voc. (Internet of Things)**			**Semester:** I		
Course:	**Basics of Electrical & Electronics Lab**			**Code:** C4.VP.01		
Teaching Scheme			**Evaluation Scheme**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
3	**3**	**1.5**	**-**	**50**	**-**	**50**

Guidelines:

1. Total experiments to be conducted are four from Part A and four from Part B
2. Total : 8 experiments/assignments to be conducted

Detailed Syllabus:

Part A: Basic Electricity (Any four)	
Expt.	**Description**
1.	To study of various wiring accessories, earthing system and safety precautions while working with electrical systems
2	To measure steady state response of series RL and RC circuits on AC supply and observations of voltage and current waveforms.
3	To verify the relation between phase and line quantities in three phase balanced star and delta connections of load.
4	Perform speed control of DC Shunt Motor to plot characteristics.
5	To determine efficiency and regulation of single-phase transformer by direct loading test.
Part B: Basic Electronics (Any four)	
Expt.	Description
1	Testing & Measurements of various electronic components using multimeter.
2	Study of current and voltage measurement using Ammeter and Voltmeter.
3	Study of working principle of Signal Generator and measurement of amplitude, time period and frequency of signal using CRO/DSO.
4	Study of V-I Characteristic of Diode.
5	Study of Digital Logic Gates.

Text Books:

1. Nagrath I. J., and Kothari, *Theory and problems of Basic Electrical Engineering*, PHI learning Pvt.Ltd., 2013.
2. Husain A., *Fundamentals of Electrical Engineering*, Dhanpat Rai & Co., 2002.
3. Mittal V. N., and Mittal Arvind, *Basic Electrical Engineering*, McGrawHill. 2006.
4. Mehta V.K., *Basic Electrical Engineering*, S. Chand & Co. Pvt. Ltd., 2012.
5. Bell, D. A., *Electronic Devices and Circuits*, Oxford University Press, 2008.
6. Tomasy, W., *Advanced Electronic Communication system*, PHI Publishers, 2003.
7. Morris M., *Digital Logic and Computer Design*, Fourth edition, Prentice Hall of India, 2004.

Reference Books:

8. Kulshreshta D.C., *Basic Electrical Engineering*,Tata McGraw hill, 2009.
9. Theraja B.L., and Theraja A. K., *A textbook of Electrical Technology Vol I* S. Chand & Co. Pvt. Ltd., 2005.
10. Theraja B.L., and Theraja A. K., *A textbook of Electrical Technology Vol II*, S. Chand & Co. Pvt. Ltd., 2005.
11. Hughes E., Electrical Technology, and Neaman Donald, *Electronic Circuit Analysis and Design*, Tata McGraw Hill, 2006.
12. Hayt W. H., Kimmerly J. E., and Durbin S. M., *Engineering Circuit Analysis*, TataMcGraw Hill, 2012.

Program:	**B. Voc. (Internet of Things)**			**Semester:** I		
Course:	**On Job Training (ELE/Q1405)**			**Code: I4.VP.01**		
Teaching Scheme			**Evaluation Scheme**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
30	**30**	**15**	**-**	**-**	**200**	**200**

Guidelines:

Students will take on job training in the industry in the domain of Internet of Things as per the following job description and personal attributes.

	Job Description
1	IoT Hardware Analyst prepares complete blueprint of the hardware including schematics and layout. The individual also prepares quality and verification requirements and perform PCB testing in compliance with regulatory standards and records them in a design document. The individual will also be responsible for working and efficient functioning of the system.
	Personal Attributes
1	The individual must have attention to details, logical thinking, and ability to execute the project as per client's requirement. This job requires the individual to work collaboratively with diverse teams. The individual should be able to hold interest in technology changes; demonstrate strong technical expertise and possess good oral and written communications skills. The individual should also be comfortable working with deadlines and budgets.

Course Syllabus
Semester-II

Program: B. Voc. (Internet of Things)					**Semester: II**	
Course: Applied Mathematics					**Code: C5.GE.01**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA 1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Detailed Syllabus:

Unit	Description	Duration (36 Hrs)
1	**Linear Algebra:** Determinants: Definition and expansion of determinants of order 2 and 3, Cramer's rule to solve simultaneous equations in 2 and 3 unknowns Matrices: Definition of a matrix of order m X n and types of matrices, Algebra of matrices, Transpose of a matrix, Minor, cofactor of an element of a matrix, adjoint of matrix and inverse of matrix by adjoint method, Solution of simultaneous equations containing 2 and 3 unknowns by matrix inversion method.	**6**
2	**Calculus I:** Limits: Definition of Limit, Limits of algebraic, trigonometric, exponential and logarithmic functions with simple examples Differentiation: Definition of derivatives, notations, Derivatives of standard functions, Rules of differentiation, Differentiation of Trigonometric, Exponential and Logarithmic function, Application of Derivatives: Geometrical meaning of derivative, tangent and normal, Maxima and minima.	6
3	**Calculus II:** Integration: Definition of integration as anti-derivative. Integration of standard function, Rules of integration. Definite Integrals: Definition of definite integral, Properties of definite integral with simple problems	6
4	**Differential Equations:** Definition of differential equation, order and degree of differential equation. Formation of differential equation, Solution of differential equations of first order and first degree such as variable separable type, Homogeneous Differential equations	6
5	**Vectors and Three-Dimensional Geometry:** Introduction to Three-Dimensional Geometry, Vectors: Definition of vector, position vector, Algebra of vectors (Equality, addition, subtraction and scalar multiplication) Dot (Scalar) product with properties, Vector (Cross) product with properties.	6
6	**Statistics and Probability:** Measures of central tendency (mean, medium & mode) for ungrouped and grouped frequency distribution, Measures of Dispersion: range, mean deviation, standard deviation, Variance and coefficient of variation. Probability: Random Experiments and Events, Definition of probability, Addition and multiplication theorems of probability.	6

Text Books:

1. Tyagi J.K., and Tyagi S. K., *Applied Mathematics-I*, Khanna Publishing House, 2012.
2. Garg R., *Engineering Mathematics*, Khanna Publishing House, 2021.

Reference Books:

1. Dass H. K., *Applied Mathematics for Polytechnics*, CBS Publishers, 2019.
2. Shrivastava P. K., *Applied Mathematics – I*, Vayu Education of India, 2016.
3. Dass H. K., Verma R., and Verma Rajesh, *Introduction to Engineering Mathematics, Vol. I*, S. Chand Publication, 2018.
4. Dass H. K., and Verma R., *Introduction to Engineering Mathematics, Vol. II*, S. Chand Publication, 2019.

Program:	**B. Voc. (Internet of Things)**				**Semester: II**	
Course:	**Language I**				**Code: C5.GE.02**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA 1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Detailed Syllabus:

Unit	**Description**	**Duration (36 Hrs)**
1	**Listening Skills** – Importance of Listening, Hearing v/s Listening, Types of Listening, Techniques to improve listening skills, Receiving messages / Instructions	4
2	**Reading Skills** – Importance and Types of Reading, Techniques of effective Reading, Types of Reading Comprehensions.	4
3	**Grammar & Vocabulary** Grammar - Articles, Prepositions, Tenses, Subject-Verb Agreement, Types of Sentences, Common errors of grammar. Vocabulary – Synonyms, Antonyms, Words often confused, Collocations, Prepositional Phrases, General and Professional English words	10
4	**Speaking Skills**– Accuracy v/s Fluency, Proper Pronunciation, Pace and Tone, Self introductions, Narrating incidents, Making Enquiries, Agreeing/Disagreeing, Group Discussions.	6
5	**Writing Skills** Coherence and Cohesion in writing, Stages of writing, Writing instructions, Describing Objects, Letter writings, Reports writing	6
6	**Communication Skills** Importance of Effective Communication, 7C Principles of Communication, Types of Communication, Barriers to Communication, How to remove the barriers	6

Text Books:

1. Wren & martin, and Rao Prasada N. D. V., *English Grammar and Composition*, S. Chand and Co. Pvt. Ltd, 2017.

Reference Books:

1. Salaria R.S., and Kumar K.B., *Effective Communication Skills*, Khanna book publishing co. (P)Ltd, 2020.
2. Patil Z.N., Walke B., Thorat A., and Merchant Z., *English For Practical Purposes*, Macmillan Publication, 2016.
3. Mishra S., and Muralikrishna C., *Communication Skills for Engineers*, Pearson India Publication, 2011.
4. Bhatia V., *Business Communication*, Khanna book publishing co. (P)Ltd, 2013.

Program: B. Voc. (Internet of Things)					**Semester: II**	
Course: IT Tools					**Code: C5.GV.01**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA 1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Detailed Syllabus:

Unit	Description	Duration (36 Hrs)
1	**Introduction to Computer:** Evolution of Computers & its applications, Basics of Hardware and Software, Central Processing Unit, Input devices, Output devices, Computer Memory & storage, Application Software, Systems Software, Utility Software, Open source and Proprietary Software, Mobile Apps	**6**
2	**Introduction to Internet and WWW :** Basic of Computer Networks, Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Network (WAN), Network Topology, Concept of Internet & WWW, Applications of Internet, Website Address and URL, Introduction to IP Addresses, Internet Protocol, Modes of Connecting Internet (Hotspot, Wi-Fi, LAN Cable, Broadband, USB Tethering), Identifying and uses of IP/MAC/IMEI of various devices, Web Browsers (Internet Explorer/Edge, Chrome, Mozilla Firefox, Opera etc.), Surfing the web, Search Engines,	6
3	**Word Processing :**Word Processing Basics, Creating a New Document, Opening and Closing Documents, Save and Save As, Using The Help, Page Setup, Page Layout, Borders, Watermark, Print Preview, Printing of Documents, Saving a Document as PDF file, Text Selection, Cut, Copy and Paste, Font, Color, Style and Size selection, Alignment of Text, Undo & Redo, AutoCorrect, Spelling & Grammar, Find and Replace, Formatting the Text, Creating and using user-defined Styles, Paragraph Indentation, Bullets and Numbering, Change case, Header & Footer, Insert & Draw Table, Changing cell width and height, Alignment of Text in cell, Delete / Insertion of Row, Column and Merging & Splitting of Cells, Border and Shading.	6
4	**Spreadsheet :**Elements of Spread Sheet, Creating of Spread Sheet, Concept of Cell Address [Row and Column] and selecting a Cell, Entering Data [text, number, date] in Cells, Page Setup, Printing of Sheet, Saving Spreadsheet, Opening and Closing, Modifying / Editing Cell Content, Formatting Cell (Font, Alignment, Style), Cut, Copy, Paste & Paste Special, Changing Cell Height and Width, Inserting and Deleting Rows, Column, AutoFill, Sorting & Filtering, Freezing panes, Formulas, Functions and Charts, Using Formulas for Numbers (Addition, Subtraction, Multiplication & Division), AutoSum, Functions (Sum, Count, MAX, MIN, AVERAGE), sort, Filter, Pivot table Charts (Bar, Column, Pie, Line).	6
5	**Presentation :**Creation of Presentation, Creating a Presentation Using a Template, Creating a Blank Presentation, Inserting & Editing Text on Slides, Inserting and Deleting Slides in a Presentation, Saving a Presentation, Inserting Table, Adding ClipArt Pictures, Inserting Other Objects, Resizing and Scaling an Object, Creating & using Master Slide, Presentation of Slides, Choosing a Set Up for Presentation, Running a Slide Show, Transition and Slide Timings, Automating a Slide Show,	6

	Working with Color and Line Style, Adding Video and Sound, Adding Headers, Footers and Notes, Printing Slides and Handouts.	
6	**E-mail and Social Networking:** Structure of E-mail, Using E-mails, Opening Email account, Mailbox: Inbox and Outbox, Creating and Sending a new E-mail, replying to an E-mail message, Forwarding an E-mail message, Searching emails, Attaching files with email, Email Signature, Social Networking & e-Commerce, Facebook, Twitter, LinkedIn, Instagram, Instant Messaging (WhatsApp, Facebook Messenger, Telegram), Introduction to Blogs.	6

Text Books:

1. Kumar B., *Mastering MS Office: Concise Handbook with screenshots*, V&S Publishers, 2017.
2. Orchids, *Microsoft Office 2007*, MS Office Series, 2018
3. Jain S., Kartika Geeta, *Microsoft Office 2010 Training Guide*, BPB Publications 2015.
4. Kurose James F., and Ross Keith W., *A Computer Networking: A top-down approach featuring the internet*, Pearson Publication, 2017.
5. Thareja Reema, *Fundamentals of Computers*, Oxford University Press, 2019.

Reference Books:

1. Ed Tittel, and Muthukumaran B., *Computer Networking*, Schaum's Outlines, TATA Mcgraw Hill Publications, 2006.
2. Peter Norton, *Introduction to Computers*, Tata Mcgraw Hill Publication, 2005.

Program:	**B. Voc. (Internet of Things)**				**Semester: II**	
Course:	**Professional core course II (Introduction to Controllers and Operations)**				**Code: I5.GV.03**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA 1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Detailed Syllabus:

Unit	**Description**	**Duration (Hrs)**
1	**Introduction to Microprocessors and Microcontrollers** Microprocessor Vs Microcontroller, Applications of Microcontrollers, Features of 8051, Architecture of 8051, Pin diagram of 8051, Memory organization.	6
2	**8051 Peripherals and Development tools** Port structure, Interrupt structure, timers and its modes, serial communication and its modes, Programming environment for microcontrollers, Study of software and hardware development tools.	6
3	**Embedded C Programming** Introduction to Embedded C, Difference between C & Embedded C, Programming style Basic structure of C program, Constants, Variables & Data Types, Arrays and strings, Types of Operators, Bitwise Operators explained, Control structures and loops, functions, Embedded programming issues.	6
4	**Interfacing with 8051 - Part 1** GPIO programming of 8051, Interfacing of: LEDs, Keypad, 16x2 LCD, Interfacing of: Stepper motor (All programs in embedded C)	6
5	**Case study of:** i. Data Acquisition system ii. Robot Control system Both side serial communication between 8051 and PC	6
6	**Advanced Microcontroller Development Boards** Understanding Development board Architectures, Arduino open platform, ATMega328p based Uno board, structure of Arduino programs, introduction to Arduino library, Study of IoT development boards like NodeMCU.	6

Books:

Text Books:

1. *Hand Book on Embedded Microcontrollers*, Intel, 2013.
2. Mazidi Muhammad Ali, Mazidi Janice Gillispie, and McKinlay Rolin D., *The 8051 Microcontroller and Embedded Systems using Assembly and C*, Pearson, 2007.
3. Manoharan P.S, and Kannan P.S., *Microcontroller based System Design*, Scitech Publications 2015
4. Deshmukh Ajay, *Microcontroller - Theory & Applications*, Tata McGraw Hill, 2017

Reference Books:

1. Calcutt David, Cowan Fred, Parchizadeh Hassan, *8051 Microcontrollers – An Application based Introduction*, Elsevier 2003.
2. Pal Ajit, *Microcontrollers: Principles and Applications*, EEE, PHI, 2011.
3. Predko Michael, *Programming and customizing the 8051 microcontroller*, McGraw-Hill, 2015.

Program: B. Voc. (Internet of Things)				**Semester:** II		
Course: Mini Project				**Code:** I5.VP.01		
Teaching Scheme			**Evaluation Scheme**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
6	**6**	**3**	**-**	**-**	**100**	**100**

Guidelines to the Students:

1. Group Size: The student will carry the project work individually or by a group of students. Optimum group size is in 3 students. However, if project complexity demands a maximum group size of 4 students, the committee should be convinced about such complexity and scope of the work.

2. Selection and approval of Topic: Topic should be related to real life application/Thrust areas in the above application fields but not limited to.

OR

The investigation of practical problem in manufacture and / or testing of electronics or communication equipment in Industry.

Note: The group should maintain a logbook of activities. It should have entries related to the work done, problems faced, solution evolved etc., duly signed by internal/external guides. Project report must be submitted in the prescribed format only. No variation in the format will be accepted.

Detailed Syllabus:

Task	**Description**
1	A Project based learning approach will be followed for this course and hence the experiments will be a small project built by the students with the help of any any 8 bit microcontroller for the following application fields (Thrust areas). The application fields (Thrust areas) are as follows: Agricultural, Health and Hygiene, Industry automation, Smart Cities, Logistics, Energy, Transportation, Communication and Networking, Cyber security, Robotics, Quality Education, Digital India etc. Development boards: 8051, or any 8 bit microcontroller

Program:	**B. Voc. (Internet of Things)**			**Semester:** II		
Course:	On Job Training (ELE/Q1405)			**Code:** I5.QP.01		
Teaching Scheme			**Evaluation Scheme**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
30	**30**	**15**	**-**	**-**	**200**	**200**

Guidelines:

Students will take on job training in the industry in the domain of Internet of Things as per the following job description and personal attributes.

	Job Description
1	IoT Hardware Analyst prepares complete blueprint of the hardware including schematics and layout. The individual also prepares quality and verification requirements and perform PCB testing in compliance with regulatory standards and records them in a design document. The individual will also be responsible for working and efficient functioning of the system.
	Personal Attributes:
1	The individual must have attention to details, logical thinking, and ability to execute the project as per client's requirement. This job requires the individual to work collaboratively with diverse teams. The individual should be able to hold interest in technology changes; demonstrate strong technical expertise and possess good oral and written communications skills. The individual should also be comfortable working with deadlines and budgets.

Course Syllabus
Semester-III

Program:	**B. Voc. (Internet of Things)**				**Semester: III**	
Course:	**Soft Skills for Professionals**				**Code: C6.GE.01**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA 1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Detailed Syllabus:

Unit	Description	Duration (45 Hrs)
1	**Introduction to Soft Skills:** What are Soft Skills, Importance of Soft Skills, Soft Skills v/s Hard Skills, Ways to Develop Soft Skills, Traits of a Pleasant Personality	**8**
2	**Language Skills:** Interactive Nature of Communication, Importance of Context, Formal and Informal, Language Functions, Introducing - Making Requests - Asking for / Giving Permission, Giving Instructions and Directions, Agreeing / Disagreeing, Seeking and Giving Advice, Conversational Manners	**8**
3	**Communication Skills:** Oral and Written Communication, Body Language, Basics of Email Writing, Attending and Coordinating Meetings, Telephonic Conversational Skills, Business Expressions, Public Speaking Skills	**8**
4	**Self-Management:** Importance of Self Grooming, Dress Sense, Self Awareness, Developing Right Attitude, Developing Assertiveness, Being Fit, Work Scheduling, Punctuality, Time Management, Stress Management	**7**
5	**People Skills:** Creating Positive Impression, People-Networking Skills, Building Trust And Rapport With People, Interpersonal Skills, Presentation Skills	**7**
6	**Work Skills:** Listening as a Team, Contributing as a Team, Process of Problem-Solving, Work Ethics, Professionalism, Taking Initiatives	**7**

Text Book

1. Prashant Sharma, *Soft Skills - Personality Development for Life Success*, BPB Publications, 2018.

Reference books:

1. Jay, *Effective Presentation*, Pearson, 2009.
2. Mishra, and C. Muralikrishna, *Communication Skills for Engineers*, Pearson, 2011.
3. Gopalaswamy Ramesh, *The Ace of Soft Skills: Attitude, Communication and Etiquette For Success*, Pearson Education, 2010.
4. Mitra Barun K., *Personality Development & Soft Skills*, Oxford University Press, 2012.
5. Mishra Rajiv K., and Rupa & Co., *Personality Development the Complete Manager –Life Skills for Success*, ICFAI University, 2004.

Program:	**B. Voc. (Internet of Things)**				**Semester: III**	
Course:	**General foundation course – I (Introduction to Entrepreneurship)**				**Code: C6.GE.02**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA 1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Detailed Syllabus:

Unit	**Description**	**Duration (45 Hrs)**
1	**The Entrepreneur:** Why to become entrepreneur ,Types of Entrepreneur , Concept of Social Enterprise and Social Entrepreneurship**,** Social Entrepreneurs, Rural Entrepreneurship, Family Business Entrepreneurship**,** The entrepreneurial decision process, **Case Study of Entrepreneurship in different Sectors**	8
2	**Skills for Successful Entrepreneurs:** Communication Skills, Creativity and Problem solving, Innovation, Negotiation Skills, Risk management **Case Study of Successful Entrepreneurs- Cases of Tata, Birlas, Kirloskar and new generation entrepreneurs in India**	8
3	**Inter Personal Relationship and Understanding Individual Behavior** Importance of maintaining good inter personal relationship with related people in business, Need for leadership in the enterprise development, Characteristics of a good leader, Various styles of Leadership, Definition Personality, importance of personality in Performance, Ego State, Johari window- Transactional Analysis	8
4	**Business Opportunity Identification** Concept of Business Opportunity, What is a business idea, How to generate Business Ideas? Business Opportunities Identification Process, Business Value Chain, different sections of the business value chain for potential opportunities	7
5	**Business Organizations and Business Laws:** Types of Business Organizations -Sole Proprietorship, Joint Hindu Family Business, Partnership, Limited Liability Partnership (LLP), Corporate Governance, Franchising, Business Laws in India to start Business	7
6	**Government Initiatives:** Role of Government in promoting Entrepreneurship in India, Start up India, Atmanirbhar Bharat, Make in India, Assistance to an Entrepreneur Industrial Park , Special Economic Zone , MSME Act , MSME policy in India Financial assistance to MSME ,Various Government schemes - PMEGP, CGTMSE, PMKVY, Mudra loan, Case studies of Start ups, Role of Institutional Support	7

Reference Books:

1. S.S. Khanna, *Entrepreneurial Development,* S. Chand Publication, 2011
2. Poornima M., *Entrepreneurship Development, and small business management*, Charantimath, Pearson Publication, 2018.
3. Arya Kumar, *Entrepreneurship*, Pearson Publication, 2012.
4. Kavita Singh, *Organizational Behavior*, Vikas Publishing House, 2015.

Program:	**B. Voc. (Internet of Things)**				**Semester: III**	
Course:	**PCC – III : Fundamentals of C, C++ Programming**				**Code: I6.GV.01**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA 1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Detailed Syllabus:

Unit	**Description**	**Duration (45 Hrs)**
1	**Programming language 'C'** Types of programming languages-machine-level, assembly, high level languages. Features of C, basic concepts, structure of a C program, declarations, constants, variables, data types, Operators and expressions, conditional expressions. Operators-assignment, arithmetic, relational, logical, increment and decrement, precedence and associativity of operators, type conversions, Input and Output functions- scanf and printf.	8
2	**Decision Control Structures in 'C'** if, if-else, nested if-else, cascaded if-else and switch statement, loop control structures: for, while, do-while loops, break and continue. Pointers in 'C': Concept, address operators, pointer variable declaration, pointer assignment, pointer initialization.	7
3	**Arrays in 'C'** Concept, declaration, initialization, assessing elements, operations, multidimensional array. Functions in 'C': definition, function call, call by value and call by reference, return statement, standard library functions and user-defined functions, passing array as function parameter. Strings in 'C': Concept, declaration, initialization and string manipulation functions, library functions.	7
4	Principles of Object Oriented Programming, Beginning with C++, Basic concepts of procedure-oriented and object oriented programming, Benefits and Applications of OOP, Structure of C++ program with simple C++ program, C++ data types, Symbolic constants and Reference by variables. Operators in C++ and Operator precedence	8
5	Control structures, Function in C++ , the main function, Function prototyping, Call by reference & Return by reference, Inline function & Default arguments, Function overloading.	7
6	**Classes and Objects :** Specifying a class- Defining member functions, Private member functions & Nesting of member functions, Arrays within a class, Memory allocation for objects, Static data members & Static member functions, Arrays of objects, Objects as function arguments, Returning Objects.	8

Text Books:

1. Donald E. Knuth, *The Art of Computer Programming* , Vols. 1, Addison-Wesley, ISBN- 13: 978-0201485417, ISBN-10: 0201485419, 2017.
2. E. Balagurusamy, *Object Oriented Programming with C++*, Fifth edition, Tata McGraw Education Hill, 2011.

Reference books:

3. Lafore Robert, *Object Oriented Programming in Turbo C++*, Galgotia Publications, 2016.
4. Ravichandran D., *Programming with C++*, Tata McGraw- Hill, 2018.

Program:	**B. Voc. (Internet of Things)**				**Semester: III**	
Course:	**PCC – IV : Basics of Computer Networks**				**Code: I6.GV.02**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA 1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Detailed Syllabus:

Unit	**Description**	**Duration (45 Hrs)**
1	**Introduction to Computer Networking** Introduction to Computer Networking, Peer to Peer, Client-Server model, Types of Networks: LAN, MAN, WAN, PAN, Network Topologies: Star, Mesh, Bus, Ring, Hybrid, Transmission Media: Guided & Unguided.	8
2	**Networking Models & Devices** ISO-OSI Reference Model, TCP/IP Protocol suite and Protocols, Networking devices: Modem, Repeaters, Hubs, Multiplexers, Bridges, Switches, Routers, Gateways.	7
3	**Networking Layer Part I** Introduction to Datalink Layer, MAC Address, Media Access: Contention, Token-passing, Polling, IEEE standards of protocol, Flow Control and Error Control. Network switching: Circuit switching, packet switching, message switching.	8
4	**Networking Layer Part II** Introduction to Network layer, Internet Protocol (IPv4), Subnet Mask, Classful and Classless IP addressing, Private address space, IPv4 header format, Subnetting, NAT.	8
5	**Networking Layer Part III** IPv6, IPv6 Header Format, Introduction to the transport layer, Transport layer protocols: TCP, UDP, SCTP, Port address.	7
6	**Application Layer, Security and Cloud** Introduction to the Application layer, Application layer protocols: WWW, HTTP, DNS, DHCP, FTP, E-mail, Network Security: Firewall, Introduction to Cloud	7

Text Books:

1. Forouzan Behrouz A., *Data Communications and Networking*, MacGraw Hill, 2017.

2. Kurouse James F., and Rouse W., *Computer Networking: A Top-down Approach*, Pearson Education, 2016.

Reference Books:

1. Tannenbaum Andrew S., *Computer Networks*, Pearson Education, 2003.
2. Tomasi Wayne, *Introduction to Data Communication and Networking*, Pearson Education, 2017.
3. Olifer Natalia, and Olifer Victor, *Computer Networks*, Wiley Student Edition, 2012.

Program: B. Voc (Internet of Things)				**Semester:** III		
Course: PCC III LAB : Programming Lab 1				**Code: I6.VP.01**		
Teaching Scheme			**Evaluation Scheme**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
3	**3**	**1.5**	**-**	**50**	**-**	**50**

Guidelines:

3. Total experiments to be conducted are four from Part A and four from Part B
4. Total : 8 experiments/assignments to be conducted

Detailed Syllabus:

Part A: C Programming (Any four)	
Expt.	**Description**
1	Write a C program to compute the roots of given quadratic equation for non-zero coefficients.
	Write a C program to calculate the sum of all positive even numbers and the sum of all negative odd numbers from the set of input numbers
3	Write a C program to check the number is perfect number or not. Hint: If sum of the factors (including 1 and excluding the number itself) is same as that of original number then the number is said to be perfect number.
4	Write a C program to separate digits of input 4 digit integer, separate & display its digits.
5	Write a C program to generate first 20 Fibonacci numbers.
6	Write a C program to store the N data samples in an array and calculate mean, mode and median
Part B: C++ (Any four)	
Expt.	Description
1	Write a program in C++ to exchange the content of two variables using call by reference
2	Write a program in C++ to demonstrate the Constructor Overloading, assume desired parameters
3	Write a program in C++ to create the class shape, and overload the function to return the perimeters of the different shapes.
4	Write a program in C++ demonstrating the public, protected and private parameters.
5	Write a program in C++ to sort the integer array.
6	Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.

Program:	**B. Voc. (Internet of Things)**				**Semester:** III	
Course:	**PCC IV LAB : Basics of Computer Networking Lab**				**Code: I6.VP.02**	
Teaching Scheme			**Evaluation Scheme**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
3	**3**	**1.5**	**-**	**50**	**-**	**50**

Guidelines:

1. Total: 8 experiments/assignments to be conducted.

Detailed Syllabus:

Expt.	**Description**
1.	Create Straight through and Crossover LAN cable using appropriate networking tool kit.
2.	Practical use of networking commands: Ipconfig, Ping, pathping, Hostname, getmac, tracert, systeminfo, net, netstat, nslookup, telnet, ssh, ftp.
3.	Connect two computers on LAN using cross cable and Implement a Star topology & troubleshoot the connectivity.
4.	Share the folder/printer in LAN and access it.
5.	Implementation and configuration of subnetting using IP addressing in LAN.
6.	Practical demonstration and configuration of networking devices.
7.	Configure any network topology using packet tracer tool.
8.	Configuration of Wi-Fi Network using packet tracer tool.
9.	Configuration of Wi-Fi Network using Wi-Fi Router.

Text Books:

1. Forouzan Behrouz A., *Data Communications and Networking*, MacGraw Hill, 2018.

2. Kurouse James and F. Rouse, *Computer Networking: A Top-down Approach*, Pearson Education, 2019.

Reference Books:

1. Tannenbaum Andrew S., *Computer Networks*, Pearson Education, 2003.
2. Wayne Tomasi, *Introduction to Data Communication and Networking*, Pearson Education, 2009.
3. Olifer Natalia, and Olifer Victor, *Computer Networks*, Wiley Student Edition, 2012.

Program:	**B. Voc. (Internet of Things)**			**Semester:** III		
Course:	On Job Training (ELE/Q1403)			**Code:** I6.QP.01		
Teaching Scheme			**Evaluation Scheme**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
30	**30**	**15**	**-**	**-**	**200**	**200**

Guidelines:

Students will take on job training in the industry in the domain of Internet of Things as per the following job description and personal attributes.

	Job Description
1	An Embedded Product designer - Technical lead designs, develops and debugs embedded systems based products as per the given requirement specifications, system architecture and feasibility analysis. The candidate leads and performs the assigned responsibilities independently and exemplifies good logical reasoning, thorough technical analysis, proper negotiation/ communication and clear/ concise documentation skills. He/ she also ensures that relevant occupational health and safety parameters, intellectual property confidentiality, and trade compliance rules are followed while carrying out the work

	Personal Attributes
1	Must exhibit good customer service attributes—courteous, solution-oriented, polite, reliable, good decision-making skills, etc. Must be focused on quality outcomes and possess an analytical bent of mind. Should be responsible for own outcomes and be able to interface and interact with multiple teams (H/w, Customer Unit, Systems, third-party vendors, etc.)

Course Syllabus
Semester-IV

Program:	**B. Voc. (Internet of Things)**				**Semester: IV**	
Course:	**General foundation course – II** **Management and Entrepreneurship**				**Code: C6.GE.03**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA 1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Detailed Syllabus:

Unit	**Description**	**Duration (45 Hrs)**
1	**Management:** Meaning, Definition, Need and Process of Management, Managerial levels/Hierarchy: Top Level, Middle Level, Lower Level, Five Functions of Management: Planning, Organizing, Staffing, Directing, Controlling, Managerial Skills: Technical Skill, Human Skill, Conceptual Skill	8
2	**Marketing Management:** Definition & Functions of Marketing- Scope of Marketing, Core concepts of marketing:- Need, Want, Demand, Customer Value, Exchange, Customer Satisfaction, Customer Delight, Customer loyalty, Company orientation towards market place, Segmentation, Target Marketing & Positioning,	8
3	**Marketing Mix:** Marketing Mix, 7P's - Product, Price, Place, Promotion, People, Process, Physical evidence. Product Life Cycle	7
4	**Startup opportunities** Meaning of Startup,The Rise of The startup Economy, Startup Policy, Startup opportunities, Registration and Legal Process of Startups, The Startup Ecosystem -Entrepreneurship in India.	7
5	**Market Survey and Research:** What is a market survey?, Process of conducting a market survey, Primary and secondary sources of information, Market survey tools, Preparation of schedule, Techniques of data collection, Questionnaire	7
6	**Business Plan** The Business plan as an entrepreneurial tool, Elements of Business Plan, Market Analysis, Technical Analysis, Financial Analysis, Economic Analysis, SWOT analysis, Internal and External Environment Analysis	8

Reference Books:

1. Khanka S.S., *Entrepreneurial Development*, S.Chand Publication, 2013.
2. Charantimath Poornima M., *Entrepreneurship Development and small business management*, Pearson Publication, 2018.
3. Kumar Arya, *Entrepreneurship*, Pearson Publication, 2012.
4. Singh Kavita, *Organizational Behaviour*, Vikas Publishing House, 2015.
5. Kotler Philip, Keller K., Koshy Abraham, and Mithileshwar Jha, *Marketing Management: A South Asian Perspective*, Pearson Education, 2013.

Program: B. Voc (Internet of Things)							**Semester:** IV
Course: PCC V : Advanced Microcontroller							**Code:** 16.GV.03
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**FA1**	**FA2**	**SA**	**Total**
3	-	-	3	20	30	50	100

Prior knowledge of

a. Basic Programming
b. Microcontroller is essential.

Objectives:

After Completing this course, student will have adequate background to understand and solve the problem involving:

1. Industry requirements form Embedded Systems professionals.
2. Applications written using Embedded C.
3. Design and development of a hardware platform encompassing a microcontroller and peripherals.

Outcomes:

On the completion of the course, students will be able to-

1. Understand Architecture of PIC Microcontroller.
2. Use MPLAB IDE for embedded project development.
3. Develop applications using PIC Microcontroller
4. Understand the fundamental concepts of real-time operating systems.

Detailed Syllabus:

Unit	**Description**	**Duration (Hrs.)**
1	**PIC Basics** PIC Microcontroller Hardware, Architecture, Memory Organization	**7**
2	**PIC Programming Environment** Development toolchain, Study of CCS-PICC 'C' Compiler, creating a Source File, Programming the Target Device, Study of IDE (MPLAB)	**8**
3	**Standard I/O and Preprocessor Directives** Character Input/Output Functions, Standard Output Functions, Standard Input Functions, Standard Preprocessor Directives	**8**
4	**PIC Programming** GPIO Programming, Interrupt Programming, Timer Programming, Serial Port Programming	**7**
5	**Advanced Interfacing with PIC** ADC, DAC Interfacing, Using Flash and EEPROM Memories for Data Storage, Watchdog Timer, Motor Control with PWM	**7**
6	**Introduction to RTOS** Difference between OS and RTOS, Process management of OS/RTOS, Process Synchronization, Memory and I/O management, Applications of RTOS	**8**
	Total Hrs.	**45**

Text Books:

1. Mazidi Muhammad Ali, McKinlay Rolin, and Causey Danny, *PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18*, Pearson Publication, 2021.
2. Barnett Cox , and O'Cull, *Embedded C Programming and the Microchip PIC*, Thomson Delmar Learning, 2003.
3. Ajay Deshmukh, *Microcontroller Theory & Application*, Tata M/c Graw Hill, 2007.

Reference Books:

1. Peatman John B, *Design with PIC Microcontroller*, Pearson Education, 2002.
2. Predko Myke, *Programming and Customizing PIC Microcontroller*, Tata McGraw-Hill, 1998.
3. Gaonkar Ramesh, *Fundamentals of Microcontrollers and Applications in Embedded Systems*, Penram International, 2010.
4. 18F xxx reference manual www.microchip.com

Program:	B. Voc. (Internet of Things)		Semester :			IV
Course:	PCC VI : DBMS		Code :			I6.GV.04
Teaching Scheme:			Evaluation Scheme:			
Lecture	Hours	Credit	FA1	FA2	SA	Total
03	03	03	20	30	50	100

Detailed Syllabus

Unit	Description	Duration (45 Hrs)
1	**Introduction To DBMS:** Database Concepts, Database System Architecture, Data Modeling: Data Models, Basic Concepts, entity, attributes, relationships, constraints, keys.	7
2	**Data Models:** The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction.	8
3	**Database Design, ER-Diagram and Unified Modeling Language:** Database design and ER Model: overview, ER-Model, Constraints, ER-Diagrams, ERD Issues, weak entity sets, Codd's rules, Relational Schemas, Introduction to UML Relational database model: Logical view of data, keys, integrity rules. Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF).	8
4	**Constraints, Views and SQL:** What is constraints, types of constrains, Integrity constraints, Views: Introduction to views, data independence, security, updates on views, comparison between tables and views. SQL: data definition, aggregate function, Null Values, nested sub queries, Joined relations. Triggers.	8
5	**Transaction management and Concurrency control:** Transaction management: ACID properties, serializability and concurrency control, Lock-based concurrency control (2PL, Deadlocks),Time stamping methods, optimistic methods, database recovery management.	7
6	**Modern Concepts of DBMS:** Different types of the modern database in the DBMS, File organization:– File organization – various kinds of indexes. Query Processing – Measures of query cost - Selection operation – Projection operation, - Join operation – set operation and aggregate operation – Relational Query Optimization	7

Reference Books:

1. Silberschatz A., Korth H., and Sudarshan S., *Database System and Concepts*, McGraw-Hill, 2021.
2. Coronel, and Rob, *Coronel, Database Systems*, Cengage Learning, 2006.
3. Singh S.K., *Database Systems: Concepts, Design and Application*, Pearson Publication, 2011.
4. Cormen Thomas H. and Leiserson Charles E.L., *Introduction to Algorithm*, PHI Publication, 2009.

Program:	B. VoC (Internet of Things)			Semester :		IV
Course:	PCC VII : Python Programming			Code :		I6.GV.05
Teaching Scheme:			Evaluation Scheme:			
Lecture	Hours	Credit	FA1	FA2	SA	Total
03	03	03	20	30	50	100

Detailed Syllabus

Unit	Description	Duration (45 Hrs)
1	**Fundamentals of Python:** Introduction, Setting up Python environment-Installing Python, Python Command Line, Running simple python program Data Types and Variables, Built-in data types, Getting the data type,setting the data type, Python casting	**7**
2	**Python Strings**: String operation-slicing, modify, concatenate operation **Python Operators**-Arithmetic, Assignment, comparison, Logical, bitwise operator **Python Control statements**- if/else/elif, Nested if; Python Loops-while/for loops, break and continue statements	**8**
3	**Python List**-Access, change, add, remove list items, list indexing and splitting, Iterating a list, loop through a list **Python Tuples**-Access, update, loop, join tuples, Tuple Indexing and slicing List Vs. Tuples	**8**
4	**Python Set**- Access, add, remove operations in Set, Loop Sets, Join Sets **Python Dictionary**: Access, add, remove operations in Dictionaries, Loop, copy dictionary	**7**
5	**Python Functions**- creating a function, calling a function, Arguments and return value Python Lambda Function, Map and Filter function	**7**
6	**Python OOPs Concepts** : Python Classes/Objects-Create a class/object, The __init__() Function, Inheritance in Python-super() function, , Python Constructors	**8**

Text Books:

1. Kanetkar Yashwant, and Kanetkar Aditya, *Let Us Python*,, BPB Publication, ISBN: 9789388511568, 2021.
2. Krishna Marlapalli Krishna & Prakash S. Jaya, Krishna Marlapalli K., and Varada Rajkumar, *Basic Python Programming for Beginners,* Blue Rose, 2021.
3. Marvin Ryan, Mark Ng'Ang'A and Amos Omondi, *Python Fundamentals*, Packt Publishing, 2016.

Reference Books:

1. Montojo Jason, Campbell Jennifer, and Gries Paul, *An Introduction to Computer Science using Python*, The pragmatic bookshelf, 2013.
2. Payne James, *Beginning Python: Using Python and Python 3.1*, Wrox Publication, 2016.
3. Dierbach Charles, *Introduction to Computer Science Using Python,* Wiley Publication Learning with Python, Green Tea Press, 2002.
4. Goldwasser Michael H., and Letscher David, *Object-oriented Programming in Python,* Pearson Prentice Hall, 2008.

Program: B. Voc (Internet of Things)							**Semester: IV**
Course: PCC V LAB : Advanced Microcontroller Lab							**Code: 16.VP.03**
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**OR**	**PR**	**Total**
3	-	-	1.5	-	-	50	50

Prior knowledge of

A. Basic Programming
B. Microcontroller is essential.

Objectives:

After Completing this course, student will have adequate background to understand and solve the problem involving:

1. Industry requirements form Embedded Systems professionals.
2. Applications written using Embedded C.
3. Design of real applications tasks using microcontroller and its peripherals.

Outcomes:

On the completion of the course, students will be able to-

1. Use MPLAB IDE for embedded project development.
2. Build embedded C programs for PIC microcontroller.
3. Develop applications using PIC Microcontroller.

List of Experiments: (any 8)

Sr. No.	**Description**
1	Write an embedded C code for Interfacing of LED.
2	Write an embedded C code for Interfacing of relay.
3	Write an embedded C code generating a Square Wave using timer.
4	Write an embedded C code for sending and receiving data serially to/from PC.
5	Write an embedded C code for interfacing 16x2 LCD.
6	Write an embedded C code for generating DAC output.
7	Write an embedded C code using a Watchdog Timer.
8	Write an embedded C code for Stepper Motor Control.
9	Write an embedded C code for DC Motor Control using PWM module.
10	Write an embedded C code for interfacing of analog sensor.

Text Books:

1. Mazidi Muhammad Ali, McKinlay Rolin, and Causey Danny, *PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18*, Pearson Publication, 2021.
2. Barnett Cox, and O'Cull, *Embedded C Programming and the Microchip PIC*, Thomson Delmar Learning, 2003.

Reference Books:

1. Myke Predko, *Programming and Customizing PIC Microcontroller*, Tata McGraw-Hill, 1998.
2. 18F xxx reference manual www.microchip.com
3. MPLAB X IDE User's Guide - *Microchip Technology, 2008.*

Program:	**B. VoC (Internet of Things)**		**Semester :**			**IV**
Course:	**PCC VI&VII LAB : Programming Lab - DBMS + Python**		**Code :**			I6.VP.04
Teaching Scheme:			**Evaluation Scheme:**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
03	03	1.5	--	50	--	50

Guidelines:

1. Total experiments to be conducted are four from Part A and four from Part B
2. Total : 8 experiments/assignments to be conducted

Part A: DBMS Programming (Any Four)	
Expt.	**Description**
1	Design a Database and create required tables. For e.g. Bank, College Database
2	Apply the constraints like Primary Key , Foreign key, NOT NULL to the tables
3	Write a sql statement for implementing ALTER,UPDATE and DELETE
4	Write the queries to implement the joins
5	Write the query for implementing the following functions: MAX(),MIN(),AVG(),COUNT()
Part B: Python Programming (Any Four)	
1	Write a python program to perform addition of ‘n’ numbers and display the result. ‘n is the user input.
2	Write a function ‘reverse’ to reverse a list without using reverse function
3	Write a Python program to print the number of prime numbers which are less than or equal to a given integer.
4	Write a program to add ‘n’ strings in a list and reverse each string element in the list
5	Write a python program to find maximum and minimum number from the list of given ‘n’ numbers

Text Books:

1. Silberschatz A., Korth H., Sudarshan S., *Database System and Concepts*, McGraw-Hill, 2021.
2. Coronel, and Rob, *Coronel, Database Systems*, Cengage Learning, 2006.
3. Kanetkar Yashwant, Kanetkar Aditya, *Let Us Python*, ,BPB Publication, ISBN: 9789388511568, 2021.
4. Krishna Marlapalli, Prakash S. Jaya, Krishna Marlapalli, Rajkumar K. Varada, *Basic Python Programming for Beginners*, ISBN, 2021.
5. Marvin Ryan, Mark Ng’Ang’A, ans Omondi Amos, *Python Fundamentals*, Packt Publishing, 2018.

Reference Books:

1. Singh S. K., *Database Systems: Concepts, Design and Application*, Pearson Publication, 2011.
2. Cormen Thomas H., and Leiserson Charles E.L., *Introduction to Algorithm*, PHI Publication, 2009.
3. Montojo Jason, Campbell Jennifer, Gries Paul, *An Introduction to Computer Science using Python 3*, The pragmatic bookshelf 2013.
4. James Payne, *Beginning Python: Using Python and Python 3.1*, Wrox Publication, 2011.
5. Dierbach Charles, *Introduction to Computer Science Using Python*, Wiley Publication Learning with Python, Green Tea Press, 2002.
6. Goldwasser Michael H., and Letscher David, *Object-oriented Programming in Python*, Pearson Prentice Hall, 2008.

Program:	**B. Voc. (Internet of Things)**			**Semester:** IV		
Course:	On Job Training (ELE/Q1403)			**Code:** I6.QP.02		
Teaching Scheme			**Evaluation Scheme**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
30	**30**	**15**	**-**	**-**	**200**	**200**

Guidelines:

Students will take on job training in the industry in the domain of Internet of Things as per the following job description and personal attributes.

	Job Description
1	An Embedded Product designer - Technical lead designs, develops and debugs embedded systems based products as per the given requirement specifications, system architecture and feasibility analysis. The candidate leads and performs the assigned responsibilities independently and exemplifies good logical reasoning, thorough technical analysis, proper negotiation/ communication and clear/ concise documentation skills. He/ she also ensures that relevant occupational health and safety parameters, intellectual property confidentiality, and trade compliance rules are followed while carrying out the work

	Personal Attributes
1	Must exhibit good customer service attributes—courteous, solution-oriented, polite, reliable, good decision-making skills, etc. Must be focused on quality outcomes and possess an analytical bent of mind. Should be responsible for own outcomes and be able to interface and interact with multiple teams (H/w, Customer Unit, Systems, third-party vendors, etc.)

Course Syllabus
Semester-V

Program:	B. Voc. (Internet of Things)				Semester: V	
Course:	Principles of Internet of Things				I7.GV.01	
Teaching Scheme			Evaluation Scheme			
Lecture	Hours	Credit	FA1	FA 2	SA	Total
3	3	3	20	30	50	100

Course Objectives:

1. To make students to understand the basics of IoT
2. To explore the need/role of sensors and actuators in the field of IoT
3. To make students aware about the IoT architecture, framework, security for developing the IoT applications.

Course Outcomes: After completion of this course students will be able to

1. Understand building blocks of Internet of Things and characteristics.
2. Explain the Architecture of IoT
3. Utilize IoT programming frameworks to develop applications and solutions for IoT systems.
4. Define the concepts of reliability, security and privacy in the context of IoT system.
5. Understand the application areas of IoT

Detailed Syllabus:

Unit	Description	Duration (45 Hrs)
1	IOT Eco System and Concepts and Architecture: Introduction, Definition, Emergence, Industrial IOT, IOT Architecture, IOT Data management and Analysis, Communication protocols and Applications.	7
2	Architecture: Open IOT Architecture, IOT Services Lifecycle, Device/cloud collaboration framework, Fog Computing: Principles, Architecture and Applications.	8
3	Programming Frameworks for IOT Embedded device programming languages, Message passing in devices, IOT Programming frameworks, Cloud assisted Cyber-physical systems.	7
4	IOT Reliability, Security and Privacy: Concepts, IOT Security Overview, Security frameworks for IOT, Privacy in IOT Networks, Reliability Issues.	8
5	IOT Applications I: Applied Internet of Things, Sensor to Gateway communication, Data Transmission, Internet of Vehicles and Applications: Characteristics and Challenges of IOV.	7
6	IOT Applications II: Smart Homes: Characteristics and Challenges and other Applications, Industrial IoT, Smart Transportation System.	8

Text Books:

1. Adrian McEwen,Hakim Cassimally: Designing the Internet of things, Willy Publication 2014
2. Rajkumar Buyya and A.V.Dastjerdi: “Internet of things: Principles and Foundations” Morgan Kaufmann, Elsevier, 2016.

Program: B. Voc. (Internet of Things)					**Semester: V**	
Course: IoT Enabling Technologies					**I7.GV.02**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Course Objectives:

1. To make students to understand the various IoT enabling technologies.
2. To make students aware about the fundamentals of embedded system.
3. To make students to understand the various applications in the field of industrial IoT.

Course Outcomes: After completion of this course students will be able to

1. Understand role of embedded system in the field of IoT.
2. Explore the concepts of Wireless Sensor Networks (WSN) and various wireless protocols.
3. Explore various cloud platforms for IoT.
4. To understand big data, its characteristics, data handling technologies, and the flow of data.
5. Understand the role of IoT in the field of Industry.

Detailed Syllabus:

Unit		Duration (45 hrs)
1	**Embedded Systems** Introduction to IoT Boards, IoT deployment for Raspberry Pi /Arduino/Equivalent platform – Interfacing of Sensors and actuators, Communication: Connecting microcontroller with mobile devices – communication through Bluetooth and wifi	**07**
2	**Wireless Sensor Network** What is WSN? WSN node, Anatomy of the network node, Architecture of WSN, Types of WSN, WSN standards: IEEE 802.15.4, Low rate WPAN, Zigbee, Wireless HART, 6LOWPAN, Zwave, BLE, LoRA. Protocol stack of WSNs	**08**
3	**Cloud Computing** Introduction to Cloud Computing(concept, architecture, working) Introduction to Cloud service models- SaaS, PaaS, IaaS, NaaS, IdaaS, DbaaS Cloud Platforms: Google App Engine, Amazon Web Services, Microsoft Azure Cloud services, Windows Azure Platform Appliance. Distributed Computing: Need, Distributed computing vs. Cloud computing	**07**
4	**Big Data** Introduction to Big data, Types of data, Characteristics of Big data, Data handling technologies, Flow of data, Data acquisition, Data storage, Introduction to Hadoop, Introduction to Data Analytics, Types of data analytics-Local Analytics, Cloud analytics and applications	**08**

5	**Introduction to Industrial IoT:-** Business Model and Reference Architerture: IIoT-Business Models, IIoT Sensing,IIoT Communication ,IIoT Security and Fog Computing.	**07**
6	**Industrial IoT Applications** Home Automation, Industrial IoT, Logistics, Driver assistance, collision impact, Inventory Management & Quality Control, Smart Cities, Environmental Protection, Lavatory maintenance, Water quality, Power Plants Food, Warehouse, Retail, Energy management, Agriculture, Health and Lifestyle **,** Facility Management	**08**

Text Books:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press,2017
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, ―The Internet of Things: Key Applications and Protocols‖, WileyPublications, 2012
3. Giacomo Veneri Antonio Capasso, "Hands-On Industrial Internet of Things", Packtr Publications, January 2018

Reference Books:

1. Hakima Chaouchi, ― The Internet of Things Connecting Objects to the Web‖ ISBN : 978-1- 84821-140-7, Wiley Publications, 2013
2. Kazem Sohraby, Daniel Minoli and TaiebZnati, ― Wireless Sensor Networks Technology, Protocols, and Applications―, John Wiley & Sons, 2010.
3. Holger Karl and Andreas Willig, ―Protocols and Architectures for Wireless Sensor Networks‖, John Wiley & Sons, Ltd, 2007.
4. Daniel Minoli, ―Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications‖, ISBN: 978-1-118-47347-4, Wiley Publications, 2013

MOOC courses:

4. NPTEL course on "Components and Applications of IoT" by Dr. Sanjoy Parida, https://onlinecourses.swayam2.ac.in/arp19_ap52/preview
5. Coursera Course "Introduction to IoT and Embedded systems" by Ian Harris, https://www.coursera.org/learn/iot
6. NPTEL Course "Sensors and Actuators" by Prof. Hardik Pandya https://nptel.ac.in/courses/108108147

Program:	**B. Voc. (Internet of Things)**				**Semester: V**	
Course:	**IoT System Architecture and Communication Protocols**				**I7.GV.03**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Prior knowledge of

Basics of Computer Network, is essential

Course Objectives:

4. To make Understand the students Architectural Overview of IoT
5. To make Understand the students various IoT Protocols.

Course Outcomes: After completion of this course students will bw able to

1. Understand the concepts of IoT Architecture Reference model and IoT reference architecture.
2. Gain the knowledge of various IoT connectivity.
3. Apply IP based protocols and Authentication Protocols for IoT.
4. Analyze various Transport & Session Layer Protocols.
5. Analyze various Service Layer Protocols.
6. Design IoT-based systems for real-world problems

Detailed Syllabus:

Unit	**Description**	**Duration (45 Hrs.)**
1	**IoT Architecture:-** Introduction, State of the art, IoT reference Model - IoT Reference Architectures, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.	**7**
2	**IoT Connectivity Technologies:-** RFID , NFC, Wi-Fi, Bluetooth low energy, IEEE 802.15.4, Zigbee, Thread, Wireless HART, LoRa, NB-IoT	**8**
3	**IoT Communication Technologies:-** Constrained nodes, Constrained networks, Types of constrained devices, Low power and lossy networks, Infrastructure protocols, IPv4, IPv6, Content-centric networking (CCN), Discovery Protocols, Data Protocols, MQTT, CoAP, AMQP, XMPP.	**9**
4	**Transport & Session Layer Protocols:-** Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP	**7**
5	**Service Layer Protocols & Security:-** Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4	**7**
6	**Case study:** Cloud-Based Smart-Facilities Management, Healthcare, Environment Monitoring System, Industrial IoT Applications etc.	**7**

Text Books: 1.

1. Jan Holler, *From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence*", 1 st Edition, Academic Press, 2014.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Keyapplicationsand Protocols", Wiley, 2014

Reference Books:

1. Peter Waher *"Learning of Internet of Things",*Packt Publications,2016.
2. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1 st Edition, VPT, 2014

Program:	**B. Voc. (Internet of Things)**				**Semester: V**	
Course:	Computational Tools for Data Analytics				**I7.GV.04**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Prior Knowledge of:
1. Basic knowledge of MATLAB
2. Python Programming is essential

Objectives:
1. To introduce the data analytics concepts using MATLAB and Python.
2. To familiarize to applicability using statistical analysis of data analytics.
3. To introduce Graphical Analysis using Data Processing and Visualization.
4. To introduce to the basics concept of Machine Learning.

Outcomes:
1. Demonstrate the data analytics concepts using MATLAB and Python.
2. Apply and Analyze algorithms using statistical methods
3. Demonstrate the applicability of graphical analysis using Data processing and Visualization.
4. Understand and apply the concept of Regression, Classification and clustering algorithms
5. Understand the Basics of machine learning
6. Demonstrate the need of AI in IoT

Detailed Syllabus:

Unit	**Description**	**Duration (45 Hrs.)**
1	Introduction to MATLAB for Data analytics: Data Analytics Introduction, Understanding the data, accessing data set Introduction to MATLAB for Data analytics: MATLAB libraries for Data analytics, importing & exporting data in MATLAB	**8**
2	Introduction to Python for Data analytics: Python packages for Data Science, importing & exporting data in Python	**7**
3	Introduction to Statistical Methods: Overview of statistical analysis, Introduction to descriptive statistics and data distributions. Visualizing Data Sets, Measures of Centrality and Spread, and Distributions.	**7**
4	Data Processing and Visualization: Overview of the content-Importing Hurricane Data, Getting Started with the Data, Preprocessing data-Importing data from multiple files -Read extensive data stored in multiple files using datastores, Introduction to visualization tools (Tableau, Grafana).	**8**
5	Introduction to Machine Learning: Introduction to Machine Learning example and its applications, Supervised Learning: Regression and Classification, Unsupervised Learning: Clustering.	**8**
6	Fundamentals of AI: What is artificial Intelligence, Foundation of AI, History of AI, agents, Applications of AI, Future of AI, Issues in Design of search programs: Blind Search or depth first search, Breadth first search.	**7**

Text Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer 2009.
2. Wes McKinney and O'Reilly, "Python for Data Analysis", 2nd Edition. 2010.

Reference Books:

1. EthemAlpaydın ,"Introduction to Machine Learning", Second Edition, MIT Press 2010.
2. Jake Vander Plas and O'Reilly, "Python Data Science Handbook: Essential Tools for Working with Data"2010
3. Joel Grus and O'Reilly, "Data Science from Scratch: First Principles with Python".2012

Online Courses:

1. https://www.mathworks.com/academia/courseware/teaching-data-science-with-matlab.html
2. https://swayam.gov.in/nd1_noc20_cs46/
3. https://onlinecourses.nptel.ac.in/noc21_cs33/

Program:	**B. VoC (Internet of Things)**		**Semester :**			**V**
Course:	**IoT Lab I**		**Code :**			I7.VP.01
Teaching Scheme:			**Evaluation Scheme:**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
03	03	1.5	--	50	--	50

Guidelines:

1. Total experiments to be conducted are four from Part A and four from Part B
2. Total : 8 experiments/assignments to be conducted

Detailed Syllabus

Part A (Any Four)

Expt.	**Description**
1	Familiarization of Arduino/Raspberry Pi and perform necessary software installation.
2	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
3	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
4	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 secs.
5	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is pressed from smart phone using Bluetooth.

Part B: (Any Four)

Expt.	**Description**
1	LDR to Vary the Light Intensity of LED Using Arduino
2	Sense a Finger When it is Placed on Board Using Arduino
3	Measure the Distance Using Ultrasonic Sensor and Make Led Blink Using Arduino
4	Detect the Vibration of an Object Using Arduino
5	MySQL Database Installation in Raspberry Pi

Reference Books:

1. Arduino cookbook by Michel Margolis, O'Reilly Media, Inc, 1st edition.
2. Arduino for beginners: Essential Skills Every Maker Needs, John Baichtal, Person Eduction, Inc, 1st edition.
3. Raspberry Pi 3: An introduction to using with Python Scratch, Javascript and more, Gary Mitnick, Create space independent publishing platform 2017.
4. Raspberry Pi for python programmers cookbook, Tim Cox, Packt publishing Limited. 2nd revised edition, 2016
5. Raspberry Pi user guide, Eben upton and Gareth Halfcreee, John Wiley and sons, 2016

Program:	**B. VoC (Internet of Things)**		**Semester :**			**V**
Course:	**IoT Lab II**		**Code :**			I7.VP.02
Teaching Scheme:			**Evaluation Scheme:**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
03	**03**	**1.5**	**--**	**50**	**--**	**50**

Guidelines:

1. Total experiments to be conducted are four from Part A and four from Part B
2. Total : 8 experiments/assignments to be conducted

Detailed Syllabus

Part A: (Any Four)

Expt.	**Description**
1	To connect to WiFI and implement Soft API on IOT nodes.
2	To implement client-server communication between two IOT nodes.
3	To send emails with the IOT node using an SMTP Server
4	To use MQTT communication protocol to publish messages and subscribe to topics
5	To create a simple LoRa Sender and LoRa Receiver with the RFM95 transceiver module.

Part B: (Any Four)

Expt.	**Description**
1	Creating Array using NumPy
2	Arithmetic operations using NumPy
3	Python Pandas creating data framework
4	Python Pandas read CSV
5	Python Pandas Marge Dataframe

Reference Books:

1. Peter Waher *"Learning of Internet of Things",*Packt Publications,2016.
2. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1 st Edition, VPT, 2014
3. EthemAlpaydın ,"Introduction to Machine Learning", Second Edition, MIT Press 2010.
4. Jake Vander Plas and O'Reilly, "Python Data Science Handbook: Essential Tools for Working with Data"2010
5. Joel Grus and O'Reilly, "Data Science from Scratch: First Principles with Python".2012

Program:	**B. Voc. (Internet of Things)**			**Semester:** V		
Course:	On Job Training (ELE/Q9801)			**Code:** I7.QP.01		
Teaching Scheme			**Evaluation Scheme**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
30	**30**	**15**	**-**	**200**	**-**	**200**

Guidelines:
Students will take on job training in the industry in the domain of Internet of Things as per the following job description and personal attributes.

	Job Description
1.	Introduction and orientation to the role of a Project Manager, Process of carrying out project initiation and planning, Process of carrying out execution, monitoring, control and closure of the project, Soft Skills and Work Ethics, Basic Health and Safety Practice
	Personal Attributes
1.	Describe the size and scope of the Electronics industry and its subsectors. • Discuss the role and responsibilities of a Project Manager. • Describe various employment opportunities for a Project Manager

Course Syllabus
Semester-VI

Program:	**B. Voc. (Internet of Things)**				**Semester: VI**	
Course:	**Cloud Computing & Virtualization**				**I7.GV.05**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA 1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Prior knowledge of

1. **Computer networks**
2. IoT fundamentals is essential

Objectives:

1. To impart understanding of the fundamental ideas behind Cloud Computing, the evolution of the paradigm with benefits and challenges
2. To elaborate principles in data center design, cloud management techniques
3. To demonstrate virtualization and cloud storage

Outcomes:

Students will be able to

1. Explain the concepts of cloud computing, advantages and challenges
2. Apply the fundamental concepts in cloud infrastructure
3. Analyze cloud programming models to solve solving problems on the cloud

Detailed Syllabus:

Unit	**Description**	**Duration (45 Hrs.)**
1	Introduction: Definition and evolution of Cloud Computing Enabling Technologies, Service and Deployment Models, Popular Cloud Stacks, Benefits, Risks, and Challenges of Cloud Computing, Economic Models and SLAs Topics in Cloud Security	**7**
2	Cloud Infrastructure: Compute, network, and storage concept, Datacenter Components: IT Equipment and Facilities, Design Considerations: Requirements, Power, Efficiency, & Redundancy Power Calculations, PUE and Challenges in Cloud Data Centers Cloud Management and Cloud Software Deployment Considerations	**8**
3	Virtualization: Virtualization (CPU, Memory, I/O) Case Study: Amazon EC2 Software Defined Networks (SDN), Software Defined Storage (SDS)	**7**
4	Cloud storage: Introduction to Storage Systems, Cloud Storage Concepts, Distributed File Systems (HDFS, Ceph FS), Cloud Databases (HBase, MongoDB, Cassandra, DynamoDB), Cloud Object Storage (Amazon S3, OpenStack Swift, Ceph)	**8**
5	Programming Models: Distributed Programming for the Cloud Data-Parallel Analytics with Hadoop MapReduce (YARN) Iterative Data-	**8**

	Parallel Analytics with Apache Spark Graph-Parallel Analytics with GraphLab 2.0 (PowerGraph), Lambda (Serverless)	
6	Security management in Peer to peer networks, power trust and security overlays, cloud security and trust management, data and software protection techniques	**7**

Text Books:

1. Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, "Distributed and cloud computing: clusters, grids, clouds and future of Internet", First edition, Morgan Kaufman publisher, an imprint of Elsevier, 2012.

Reference Books:

1. Rajkumar buyya, James broberg, Andrzej M.Goscinski , cloud computing principles and paradigm, Wiley, 2010
2. Toby Velte, Anthony Velte, Robert Elsenpeter, cloud computing, A practical approach, McGrawHill, 2010
3. Thomas Erl, Ricardo puttini, Zaigham Mahmood,"Cloud computing:concepts, Technology and Architecture", First edition, prentice hall,2013

Program:	**B. Voc. (Internet of Things)**				**Semester: VI**	
Course:	**Programming Languages for IoT**				**I7.GV.06**	
Teaching Scheme			**Evaluation Scheme**			
Lecture	**Hours**	**Credit**	**FA 1**	**FA 2**	**SA**	**Total**
3	**3**	**3**	**20**	**30**	**50**	**100**

Prior knowledge of
Basic programming concepts, fundamentals of IoT
is essential.

Objectives:

1. To introduce students to the key programming languages and protocols used in the Internet of Things (IoT) sector, focusing on Python and C/C++.
2. To equip students with the skills to understand, analyze, and implement IoT applications using these languages.
3. To emphasize the importance of security in IoT and to teach secure coding practices.
4. To expose students to advanced topics in IoT programming, such as edge computing and machine learning.

Outcomes:

1. Understand and apply Python in the context of IoT.
2. Leverage C/C++ for creating IoT applications, specifically for resource-constrained devices.
3. Understand and implement standard IoT protocols in their IoT applications.
4. Utilize JavaScript and Node.js for building interactive IoT applications.
5. Implement secure coding practices and understand the security aspects of IoT programming.
6. Apply advanced topics such as edge computing and machine learning in IoT and implement a real-world IoT application.

Detailed Syllabus:

Unit	**Description**	**Duration (45 Hrs.)**
1	**Unit 1: Python for IoT** Python basics: data types, variables, operators, control flow, Advanced Python: functions, modules, exceptions, file handling, Python libraries for IoT: PyMata, MQTT Python, RPi.GPIO, IoT applications: sensor data collection, data analysis, data visualization, automation	**7**
2	**Unit 2: C/C++ for IoT** C/C++ basics: data types, variables, operators, control flow, Advanced C/C++: functions, pointers, structures, dynamic memory, IoT applications: working with Arduino, sensors, data handling, Introduction to C/C++ libraries for IoT Introduction to programming for point to point communication.	**8**
3	**Unit 3: Introduction to IoT Protocols** Basics of MQTT, CoAP, HTTP, WebSockets, Implementing MQTT and CoAP in IoT applications, Comparing different IoT protocols, Case studies on IoT protocol selection	**7**

4	**Unit 4: JavaScript and Node.js for IoT** JavaScript basics: syntax, variables, data types, functions Asynchronous programming in JavaScript Introduction to Node.js, event-driven programming Applications using Node-RED, creating IoT flows, integrating services	**8**
5	**Unit 5: IoT Security** Understanding IoT security: common threats and challenges Secure coding practices in Python and C/C++ Implementing authentication and encryption in IoT applications Case study: analyzing and mitigating security risks in IoT applications	**7**
6	**Unit 6: Advanced Topics in IoT Programming** Introduction to edge computing in IoT Basics of machine learning in IoT Case studies: analysis of advanced IoT applications	**8**

Text Books:

1. Severance, Charles R. "Python for Everybody: Exploring Data in Python 3." Amazon Digital Services LLC - Kdp Print Us, 2016.
2. Vine, Michael. "C Programming for the Absolute Beginner, Second Edition." Premier Press, 2007.
3. Flanagan, David. "JavaScript: The Definitive Guide: Master the World's Most-Used Programming Language." 7th ed. O'Reilly Media, 2020.
4. Powers, Shelley. "Learning Node: Moving to the Server-Side." 2nd ed. O'Reilly Media, 2016.

Reference Books:

1. Norris, Donald. "Python for Microcontrollers: Getting Started with MicroPython." McGraw-Hill Education TAB, 2016.
2. Kernighan, Brian W., and Ritchie, Dennis M. "C Programming Language." 2nd ed. Pearson, 1988.
3. Haverbeke, Marijn. "Eloquent JavaScript, 3rd Edition: A Modern Introduction to Programming." No Starch Press, 2018.
4. Wilson, Jim. "Programming Node.js: A Comprehensive Guide to Writing Clean, Maintainable Servers in JavaScript." O'Reilly Media, 2022.
5. Balani, Navveen. "Mastering IoT: Build modern IoT solutions using MQTT, CoAP, RESTful APIs, WebSockets, and Python." Packt Publishing, 2020.
6. Gierke, Oliver, Wolff, Eberhard, and Darimont, Thomas. "Machine Learning for the Internet of Things: Enhancing IoT Innovation with Data-Driven Techniques." O'Reilly Media, 2022.

Program: B. Voc. (Internet of Things)				**Semester:** VI		
Course: Project				**Code: I7.VP.03**		
Teaching Scheme			**Evaluation Scheme**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
18	**18**	**9**	**50**	**-**	**150**	**200**

Guidelines to the Students:

The project course allows students to apply their knowledge and skills learned throughout the B. Voc. IoT program. The project should be based on the principles and technologies of IoT and must exhibit a clear understanding and application of these principles.

- The project can be done individually or in small groups, per the department's guidelines.
- Regular meetings with assigned project supervisors must be maintained.
- The project will be assessed on the final product and the planning, management, and development process, including documentation.
- The project must include a written report and an oral presentation.

Detailed Syllabus:

Task	**Description**
1.	**Project Proposal** Select a topic related to IoT spaces by conducting an in-depth search within a specific thrust area like Smart city, Healthcare, Infrastructure, Transportation, Agriculture, etc. The proposal should clearly state the problem, the proposed solution, the technologies to be used, and a rough timeline for the project.
2	**Detailed Planning and Design** Create a detailed plan of the project, including software design (UML diagrams, data flow diagrams, etc.) and hardware design.
3	**Implementation** This is the development phase where the design from Task 2 is implemented. Regular updates should be provided to the project supervisor. Students are encouraged to work on FOSS (Free and Open Source Software) Tools and open-source hardware platforms.
4	**Testing and Debugging** Test the project thoroughly to find and fix any bugs. This includes unit testing, integration testing, and system testing.
5	**Documentation** Develop a detailed report of the project, including problem statement, design, implementation, testing, results, and conclusions.
6	**Presentation and Viva** Prepare a project presentation to be given in front of the evaluation panel. Be ready to answer questions and defend the decisions made during the project's development.

Program:	**B. Voc. (Internet of Things)**			**Semester:** VI		
Course:	On Job Training (ELE/Q9801)			**Code:** I7.QP.02		
Teaching Scheme			**Evaluation Scheme**			
Practical	**Hours**	**Credit**	**TW**	**PR**	**OR**	**Total**
30	**30**	**15**	**-**	**200**	**-**	**200**

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	Job Description
1.	Introduction and orientation to the role of a Project Manager, Process of carrying out project initiation and planning, Process of carrying out execution, monitoring, control and closure of the project, Soft Skills and Work Ethics, Basic Health and Safety Practice
	Personal Attributes
1.	Describe the size and scope of the Electronics industry and its subsectors. • Discuss the role and responsibilities of a Project Manager. • Describe various employment opportunities for a Project Manager