Savitribai Phule Pune University
Faculty of Science & Technology

Curriculum

For
Bachelor of Vocational (Engg)
First Year ELECTRONIC MANUFACTURING SERVICES
(Choice Based Credit System) (2019 Course)

(With Effect from Academic Year 2019-20)

1. Course Objectives

After successfully completing the vocational course, the student would have acquired relevant appropriate and adequate technical knowledge together with the professional skills and competencies in the field of Electronics Manufacturing Service so that he/she is properly equipped to take up gainful employment in this Vocation. Thus he/she should have acquired:-

A. Understanding of

(a) The relevant basic concepts and principles in basic science subjects (Physics, Chemistry and Mathematics) so that the students is able to understand the different vocational subjects.

(b) The basic concepts in engineering drawing.

(c) The concepts, principles of working of basic electronic devices and circuits.

(d) The knowledge of testing procedure of components and circuits by making use of different test instruments.

(e) The procedure of making P.C.B.

(f) The concepts and principles used in Radio/Audio/Video Systems and Communication devices and its maintenance.

B. Adequate Professional Skills and Competencies in

(a) Testing different electronic components.

(b) Testing the performance of electronic circuits.

(c) Locating the fault at component level and at the stage level.

C. A Healthy and Professional Attitude so that the student has

(a) An analytical approach while working on a job.

(b) An open mind while locating/rectifying faults.

(c) Respect for working with their own hands.

(d) Respect for honesty, punctuality and truthfulness

D. NSQF compliant skills in Qualification developed by sector skill council in Electronic sector

3. Course Structure:

The course will consist of combination of practice, theory and hands on skills in the electronics sector.

Curriculum:

The curriculum in each of the years of the programme would be a suitable mix of general education and skill components.

Skill Development Components:

- The focus of skill development components shall be to equip students with appropriate knowledge, practice and attitude, to become work ready. The skill development components will be relevant to the industry as per its requirements.
- The curriculum will necessarily embed within itself, National

Occupational Standards (NOSs) of specific job roles within the industry. This would enable the students to meet the learning outcomes specified in the NOSs.

- The overall design of the skill development component along with the job roles selected will be such that it leads to a comprehensive specialization in few domains.
- The curriculum will focus on work-readiness skills in each of the year of training.

- Adequate attention will be given in curriculum design to practical work, on the job training, development of student portfolios and project work.

General Education Component:

- The general education component adheres to the normal senior secondary and university standards. It will emphasize and offer courses which provide holistic development. However, it will not exceed 40% of the total curriculum.
- Adequate emphasis is given to language and communication skills.

B. Voc Electronics Manufacturing Services Syllabus for First Year

Structure for Semester-I

Course Code	Course Name	Teaching Scheme (Hours/Week)		Examination Scheme and Marks						Credits		
		Theory	Practical	ISE	ESE	TW	PR	OR	Total	TH	PR	Total
101	Electronic Measurement and Instrumentation –I	03		50	50				100	03		03
102	Identification of Components, Tools, SOP & Work Instructions-I	03		50	50				100	03		03
103	Tools, Equipment & Safety Measures –I	03		50	50				100	03		03
104	Soldering & De-Soldering of Components–I	03		50	50				100	03		03
105	Identification of Components, Tools, Equipment and its working –Lab		02				50	--	50		1.5	1.5
106	Electronic Measurement and Instrumentation -I –Lab		02				50	--	50	--	1.5	1.5
107	On Job Training		18			100			100		15	15
	Total	12	22	200	200	100	100	--	600	12	18	30

Structure for Semester-II

Course Code	Course Name	Teaching Scheme (Hours/Week)		Examination Scheme and Marks						Credits		
		Th	Prac	ISE	ESE	TW	PR	OR	Total	TH	PR	Total
201	Electronic Measurement and Instrumentation –II	03		50	50				100	03		03
202	Identification of Components, Tools, SOP & Work Instructions-II	03		50	50				100	03		03
203	Tools, Equipment & Safety Measures –II	03		50	50				100	03		03
204	Soldering & De-soldering of Components & Emergency –II	03		50	50				100	03		03
205	Soldering & De-Soldering of Components-Lab		02				50	--	50		1.5	1.5
206	Electronic Measurement and Instrumentation -II –Lab		02				50		50		1.5	1.5
207	On Job Training		18			100			100		15	15
	Total	12	22	200	200	100	100	--	600	12	18	30

*On Job Training should be carried out in any one subject per semester as per NSDC Guide lines for following Skill Sets:

1. Embedded Software Engineer (ELE/Q1501)
2. Security Pack-security surveillance and access control supervisor (ELE/Q4611)
3. Systems Analyst (ELE/Q8701)
4. Smartphone Repair Technician (ELE/Q8104)
5. Business Development Executive (ELE/Q1101)

Syllabus

Name of the Course: B. Vocational (Electronics Manufacturing Services)

Semester I

Subject Name: Electronic Measurements and Instrumentation-I		
Course Code :101	Semester: I	
Weekly Teaching Hours: TH: 03 Tut: 00	Scheme of Marking TH: 100	ISE: 50 ESE: 50
	Scheme of Marking PR: 50	
Credit: 3		

Content		Hours
Unit – I	1.0. Unit, dimensions and standards	12
	Scientific notations and metric prefixes. SI electrical units, SI temperature scales, Other unit systems, dimension and standards.	
Unit – II	2.0. Measurement Errors	12
	Gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, Measurement error combination, basics of statistical analysis.	
Unit – III	3.0. Analog meters	12
	PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter Transistor voltmeter circuits, AC electronic voltmeter.	
Unit – IV	4.0. Digital meters	9
	Current measurement with electronic instruments, probes Digital voltmeter systems, digital multimeters, digital frequency meter system.	

Books:

Name of Authors	Title of the Book	Publisher
Kalsi H S	Electronic Instrumentation	Mcgraw Higher Ed
Albert D. Helfrick, William David Cooper	Modern Electronic Instrumentation and Measurement	PHI
A Course in Electrical and Electronic Measurements and Instrumentation	A. K. Sawhney, Puneet Sawhney	Rai

Subject Name: Identification of Components, Tools, SOP & Work Instructions-I		
Course Code :102	Semester: I	
Weekly Teaching Hours: TH: 03 Tut: 00	Scheme of Marking TH: 100	ISE: 50, ESE: 50
	Scheme of Marking PR: 50	
Credit:3		

	Content	**Hours**
Unit – I	1.0. Main components & modules/ sub-assemblies of electronic	12
	Control Panel (System Controller), Keypads, Door and Window Contacts, Motion Detectors, Glass Break Detection, Smoke Detectors, Heat Sensors, Carbon Monoxide Detectors, Water Detectors (or Water Bug), Temperature Sensors, Capacitance switches / control push buttons & rotary switches.	
Unit – II	2.0. Digital Electronics	12
	Electronic controls in a common way, Counters, Flip- flops, Logic gates, Multiplexers, Decoders.	
Unit – III	3.0. Amplification factors	12
	Concept of Amplification factor, Gain & Signal distortion	
Unit – IV	4.0. TCP/IP	09
	Protocols like TCP/TP for communication purpose and for digital networks & circuits.	

Books:

Name of Authors	**Title of the Book**	**Publisher**
Andrew S. Tanenbaum	Computer Network	Pearson
Jon S. Wilson	Sensor Technology Handbook - Volume 1	Newnes Pub.
Kennedy	Electronic Communication Systems	Tata MC Graw Hill

Subject Name: Tools, Equipment and Safety Measures-I	
Course Code : 103	Semester: I
Weekly Teaching Hours: TH: 03 Tut: 00	Scheme of Marking TH: 100, ISE: 70, ESE: 30
	Scheme of Marking PR: __--
Credit:3	

	Content	**Hours**
Unit – I	1.0. Types of Cables	12
	Classification of cables: Non-metallic Sheathed Cable, Un-grounded / grounded Power supply cable, metallic Sheathed Cable, Multi-Conductor Cable, Coaxial Cable, Unshielded Twisted Pair Cable, Shielded twisted pair cable, Ribbon Cable, Armored & Unarmored Cable, Twin-Lead Cable, Twin Axial Cable, Optical fiber cable.	
Unit – II	2.0. Specification and material of Cables	12
	Study of material and electrical Specification of all cables in Unit-I	
Unit – III	3.0. Connectors and sockets	12
	Study of Connectors and sockets for all types of cables and electrical devices	
Unit – IV	4.0. ESD Clothing	09
	What to wear, how to wear	

Books:

Name of Authors	**Title of the Book**	**Publisher**
----	Cable Assemblies, Cables, Connectors and Passive Microwave Components: Screening Attenuation Measurement by the Reverberation Chamber Method	International Electro technical Commission
William G. Duff	Cables and Connector	IET Digital Library
----	Hardware Book, http://www.hardwarebook.info/	----
Andrew S. Tanenbaum,, David J. Wetherall	Computer Network	Pearson
Albert D. Helfrick, William David Cooper	Modern Electronic Instrumentation and Measurement	PHI

Subject Name: Soldering & De-Soldering of Components-I	
Course Code :104	Semester: I
Weekly Teaching Hours: TH: 03 Tut: 00	Scheme of Marking TH: 100 ISE: 50 ESE: 50
	Scheme of Marking PR: --
Credit:3	

Content		Hours
Unit – I	1.0. Soldering Tools	09
	Different types of Soldering Guns related to Temperature and wattages, types of tips, Solder materials and their grading.	
Unit – II	2.0. Soldering and De Soldering Stations	09
	Soldering and De Soldering Stations and their Specifications, Preparing Component for Soldering.	
Unit – III	PCB	09
	PCB Applications, Types of PCB, Soldering Basic Components on PCB.	
Unit – IV	De soldering tools	09
	De soldering Basic Components, Safety precautions while Soldering & De soldering, Check for cold continuity of PCB.	
Unit – V	Identification of Faults	09
	Identification of loose/dry solder, broken tracks on printed wire assemblies & discrete components mounted circuit boards , Join the broken PCB track and test, De soldering using Pump and wick, Introduction of SMD Components.	

Books:		
Name of Authors	**Title of the Book**	**Publisher**
----	http://spoken-tutorial.org/watch/KiCad/Designing+printed+circuit+board+in+KiCad/Hindi/	----
Bruce R. Archambeault and James Drewniak	PCB Design for Real-World EMI Control	Springer Science
Kraig Mitzner	Complete PCB Design Using OrCad Capture and Layout	Newnes Pub

Subject Name: Identification of Components, Tools, SOP & Work Instructions-I –Lab	
Course Code :105	Semester: I
Weekly Practical: PR: 01 Tut: 00	
	Scheme of Marking PR: 50
Credit:1.5	

Content
1. Identification & working of various electronic components (1.a., 1.b and 1.c. for any three group of components) 2. Working of testing equipment (2.a., 2.b and 2.c. for any two equipments) 3. a. Measurement using Multimeter 3. b. Measurement using Clamp meter 4. Battery health check-up 5. Measure and test the voltage of given cells.

Subject Name: Electronic Measurement and Instrumentation -I Lab	
Course Code : 106	Semester: I
Weekly Practicals: PR: 01 Tut: 00	
TH Exam Duration: --	Scheme of Marking PR: 50
Credit:1.5	

Content

1. a. Study of semiconductor diode voltmeter
1. b. Its use as DC average responding AC voltmeter.
2. a. Study of construction of L.C.R. bridge
2. b. Determination of the value of the given components using LCR Q meter.
3. Study of distortion factor meter and determination of the % distortion of the given oscillator.
4. Study of the diode testing and determination of the parameters of the given diode.
5. Study of the transistor tester and determination of the parameters of the given transistors.
6. Study of the IC tester and determination of the parameters of the given IC.
7. Use a galvanometer as voltmeter.
8. Use a galvanometer as ammeter.

Syllabus

Name of the Course: B. Voc (Electronics Manufacturing Services)

Semester II

Subject Name: Electronic Measurement and Instrumentation –II	
Course Code : 201	Semester: II
Weekly Teaching Hours: TH: 03 Tut: 00	Scheme of Marking TH: 100, ISE: 50, ESE: 50
	Scheme of Marking PR: --
Credit:3	

Content		**Hours**
Unit – I	Voltmeter and ammeter	09
	Study of Galvanometer, Voltmeter and ammeter and measuring methods	
Unit – II	Wheatstone bridge, low resistance measurements	09
	Low resistance measuring instruments AC bridge theory, capacitance bridges, Inductance bridges, and Q meter.	
Unit – III	CRO Construction	09
	CRT, wave form display, time base, dual trace oscilloscope	
Unit – IV	CRO based measurements	09
	Measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Oscilloscope specifications and performance. Delay time based Oscilloscopes, Sampling Oscilloscope, DSO, DSO applications.	
Unit – V	Instrument calibration	09
	Comparison method, digital multi-meters as standard instrument, calibration Instrument Recorders: X-Y recorders, plotters.	

Books:

Name of Authors	**Title of the Book**	**Publisher**
Albert D. Helfrick, William David Cooper	Modern Electronic Instrumentation and Measurement	PHI
U.A.Bakshi, A.V.Bakshi	Electrical Measurements And Measuring Instruments	Technical Publications
R.K. Rajput	Electrical Measurements and Measuring Instruments	S Chand

Subject Name: Identification of Components, Tools, SOP & Work Instructions-II	
Course Code : 202	Semester: II
Weekly Teaching Hours: TH: 03 Tut: 00	Scheme of Marking TH: 100, ISE: 50, ESE: 50
	Scheme of Marking PR: --
Credit:3	

	Content	Hours
Unit – I	Introduction to wireless communication	09
	Analog Communication: AM, FM etc Digital communication: ASK, PSK etc Wifi communication, Bluetooth communication etc	
Unit – II	Signal Converters	09
	AC to DC converts, DC to AC converters, DC to DC converters, Signal conditioning, Instrumentation Amplifier	
Unit – III	Tools & their Uses	09
	Use of tester to monitor AC Power, Skin the electrical wires/cables using the wire stripper and cutter, Main cable for control & electronic circuit wires, Crimping tools and buses.	
Unit – IV	Introduction to measuring equipment's	09
	Signal generator's, CRO, Function Generators, Frequency Counter, Logic analyzer, Spectrum analyzer, LCRQ Meter.	
Unit – V	Standard Operating Procedures and Work Instructions	09
	What is SOP and WI, How to read & follow SOP and WI, Overall Quality Assurance Plan.	

Books

Name of Authors	**Title of the Book**	**Publisher**
Behrouz A. Forouzan, Sophia Chung Fegan	Data Communications and Networking	McGraw Hill
Andrew S. Tanenbaum,, David J. Wetherall	Computer Network	Pearson
Albert D. Helfrick, William David Cooper	Modern Electronic Instrumentation and Measurement	PHI
P. S. Bimbhra	Power Electronics	Khanna
U.A.Bakshi, A.V.Bakshi	Electrical Measurements And Measuring Instruments	Technical Publications

Subject Name: Tools, Equipment & Safety Measures –II	
Course Code : 203	Semester: II
Weekly Teaching Hours: TH: 03 Tut: 00	Scheme of Marking TH: 100, ISE: 50, ESE: 50
	Scheme of Marking PR: --
Credit:3	

Content		**Hours**
Unit – I	Tools & Equipment	09
	Study of all types of tools used in manufacturing.	
Unit – II	Equipments	09
	Study of all equipment required and deployed in manufacturing.	
Unit – III	Installing & servicing processes	09
	Installing & servicing, Identification and termination process, General maintenance of tools/equipment and recalibration of Test equipment, General safety and common-Sense safety.	
Unit – IV	PPE	09
	Usage & benefits of PPE, Electronics Manufacturing Services and Types & usage of Various PPE, Maintenance of PPE.	
Unit – V	Clean Room Environment	09
	Do's and Don't and Shop Floor Discipline.	

Books

Name of Authors	**Title of the Book**	**Publisher**
R. S. Khandpur	Troubleshooting Electronic Equipment	McGraw Hill Professional
David Herres	Troubleshooting and Repairing Commercial Electrical Equipment	McGraw Hill Education
John Cadick, Mary Capelli-Schellpfeffer, Dennis Neitzel	Electrical Safety Handbook 3E	Delmar Publishers
W Fordham Cooper	Electrical Safety Engineering	Newnes-Butterworths

Subject Name: Soldering & De-Soldering of Components & Emergency actions II	
Course Code : 204	Semester: II
Weekly Teaching Hours: TH: 03 Tut: 00	Scheme of Marking TH: 100, ISE: 50, ESE: 50
	Scheme of Marking PR: --
Credit:3	

Content		**Hours**
Unit – I	Introduction to SMD Components	09
	Identification of 2, 3 and 4 terminal SMD components.	
Unit – II	Soldering the SMD components	09
	Soldering the SMD components on the PCB, Make the necessary settings on SMD soldering station to solder various ICs of different packages by choosing proper clamping tools, Identify various connections and the setup required for SMD Soldering station.	
Unit – III	De soldering	09
	De solder the SMD components from the given PCB, Make the necessary settings on SMD soldering station to de solder various ICs of different packages by Choosing proper clamping tools.	
Unit – IV	Make a panel board	09
	Make a panel board using different types of switches for a given application, Identification of crimping tools for various IC packages and Reliable Soldering Practices.	
Unit – V	Emergency actions	09
	Minimum Requirements, Reporting Emergencies, Emergency exits, Primary and secondary evacuation routes, Locations of fire extinguishers, Fire alarm pull Stations' location, Assembly points and Medical Services.	

Books

Name of Authors	**Title of the Book**	**Publisher**
R. Sengupta	Principles of Reliable Soldering Techniques	New Age International
Ray P. Prasad	Surface Mount Technology: Principles and Practice	Springer
Mel M. Schwartz	Soldering: Understanding the Basics	ASM International
John Cadick, Mary Capelli-Schellpfeffer, Dennis Neitzel	Electrical Safety Handbook 3E	Delmar
W Fordham Cooper	Electrical Safety Engineering	Newnes-Butterworths

Subject Name: Soldering & De-Soldering of Components-Lab	
Course Code : 205	Semester: II
Weekly Practicals: PR: 01 Tut: 00	Scheme of Marking TH: --
TH Exam Duration: --	Scheme of Marking PR: 50
Credit:1.5	

Content
1. Study of soldering and de soldering tools and machinery (any 2 tools) 2. Assemble the product (any 3 products) 3. Dis-assemble the product (any 3 products) 4. Safety Precautions & emergency plans (study of minimum 2 methods)

Subject Name: Electronic Measurement and Instrumentation -II Lab	
Course Code : 206	Semester: II
Weekly Practicals: PR: 01 Tut: 00	Scheme of Marking TH: --
TH Exam Duration: --	Scheme of Marking PR: 50
Credit:1.5	

Content
1. Study of the following transducer (i) PT-100 trans (ii) J- type trans. (iii) K-type trans (iv) Presser trans 2. a. Measurement of phase difference 2. b. Measurement of frequency using CRO (lissajous figure) 3. Measurement of low resistance Kelvin's double bridge. 4. Radio Receiver Measurements (any 3 parameter measurements

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1. Course Objectives

After successfully completing the vocational course, the student would have acquired relevant appropriate and adequate technical knowledge together with the professional skills and competencies in the field of Electronics Manufacturing Service so that he/she is properly equipped to take up gainful employment in this Vocation. Thus he/she should have acquired:-

A. Understanding of

(a) The relevant basic concepts and principles in basic science subjects (Physics, Chemistry and Mathematics) so that the students is able to understand the different vocational subjects.

(b) The basic concepts in engineering drawing.

(c) The concepts, principles of working of basic electronic devices and circuits.

(d) The knowledge of testing procedure of components and circuits by making use of different test instruments.

(e) The procedure of making P.C.B.

(f) The concepts and principles used in Radio/Audio/Video Systems and Communication devices and its maintenance.

B. Adequate Professional Skills and Competencies in

(a) Testing different electronic components.

(b) Testing the performance of electronic circuits.

(c) Locating the fault at component level and at the stage level.

C. A Healthy and Professional Attitude so that the student has

(a) An analytical approach while working on a job.

(b) An open mind while locating/rectifying faults.

(c) Respect for working with their own hands.

(d) Respect for honesty, punctuality and truthfulness

D. NSQF compliant skills in Qualification developed by sector skill council in Electronic sector

3. Course Structure:

The course will consist of combination of practice, theory and hands on skills in the electronics sector.

Curriculum:

The curriculum in each of the years of the programme would be a suitable mix of general education and skill components.

Skill Development Components:

- The focus of skill development components shall be to equip students with appropriate knowledge, practice and attitude, to become work

ready. The skill development components will be relevant to the industry as per its requirements.

- The curriculum will necessarily embed within itself, National Occupational Standards (NOSs) of specific job roles within the industry. This would enable the students to meet the learning outcomes specified in the NOSs.
- The overall design of the skill development component along with the job roles selected will be such that it leads to a comprehensive specialization in few domains.
- The curriculum will focus on work-readiness skills in each of the year of training.
- Adequate attention will be given in curriculum design to practical work, on the job training, development of student portfolios and project work.

General Education Component:

- The general education component adheres to the normal senior secondary and university standards. It will emphasize and offer courses which provide holistic development. However, it will not exceed 40% of the total curriculum.
- Adequate emphasis is given to language and communication skills.

B. Voc Electronics Manufacturing Services Syllabus for SecondYear-

Structure for Semester-I												
Course Code	**Course Name**	**Teaching Scheme (Hours/Week)**		**Examination Scheme and Marks**						**Credits**		
		Th	**Prac**	**ISE**	**ESE**	**TW**	**PR**	**OR**	**Total**	**TH**	**PR**	**Total**
	Fault analysis & Repair	03		50	50				100	03		03
	Good Manufacturing Concept & Practices – I	03		50	50				100	03		03
	Electronics Devices and Circuit –I	03		50	50				100	03		03
	Electronics System Packaging and Manufacturing	03		50	50				100	03		03
	Electronics Devices and Circuit-I Lab		02				50	--	50		1.5	1.5
	Fault analysis & Repairs - Lab		02				50	--	50	--	1.5	1.5
	On Job Training		18			100			100		15	15
	Total	12	22	200	200	100	100	--	600	12	18	30

Structure for Semester-II												
Course Code	**Course Name**	**Teaching Scheme (Hours/Wee k)**		**Examination Scheme and Marks**						**Credits**		
		Th	**Prac**	**ISE**	**ESE**	**TW**	**PR**	**OR**	**Total**	**TH**	**PR**	**Total**
	Good Manufacturing Concepts Practices–II	03		50	50				100	03		03
	Manufacturing & Quality Norms	03		50	50				100	03		03
	Good Manufacturing Concepts & Practices–III	03		50	50				100	03		03
	Electronics Devices Circuit –II	03		50	50				100	03		03
	Electronics Devices Circuit –II Lab		02				50	--	50		1.5	1.5
	Manufacturing Practices		02				50		50		1.5	1.5
	On Job Training		18			100			100		15	15
	Total	12	22	200	200	100	100	--	600	12	18	30

*On Job Training should be carried out in any one subject per semester as per NSDC Guide lines for following Skill Sets:

1. Field Engineer RACW (ELE/Q3105)
2. Security System Service Engineer (ELE/Q4610)
3. Pre-Sales Solar Technical Support Engineer (ELE/Q5602)
4. Purchase Executive (ELE/Q5701)
5. Quality Engineer (ELE/Q7901)

Syllabus

Name of the Course: B. Voc (Electronics Manufacturing Services)

Semester III

Subject Name: Fault Analysis and Repairs

Course Code :301	**Semester: III**	
Weekly Teaching Hours: TH: 03 Tut: 00	**Scheme of Marking TH: 100,**	**ISE: 50, ESE: 50**
	Scheme of Marking PR: --	
Credit:3		

Content		**Hours**
Unit – I	Fault Classification, Identification & Rectification	12
	Classification of fault , Identification of fault , Rectification of fault, Repairing/Replacing Module	
Unit – II	Analysis for the different types of equipment's	12
	Smartphone Air Conditioning Security systems Electronically controlled doors	
Unit – III	Hardware and Software Fault analysis	12
	Hardware and Software Fault analysis based on hardware and software component, Diagnostic and Testing Methods	
Unit – IV	Visual Inspection	09

	Earth Continuity Test Insulation Resistance Test	

Books		
Name of Authors	**Title of the Book**	**Publisher**
R. S. Khandpur	Troubleshooting Electronic Equipment	McGraw-Hill Education
Philip Kiameh	Electronic Equipment Handbook	McGraw-Hill Education

Subject Name: Good Manufacturing Concept & Practices – I

Course Code :302	**Semester: III**
Weekly Teaching Hours: **TH: 03 Tut: 00**	**Scheme of Marking TH: 100, ISE: 50, ESE: 50**
	Scheme of Marking PR: --
Credit:3	

Content		**Hours**
Unit – I	Quality Management	12
	TQM (Total Quality Management) & Kaizen Inventory Management & Logistics in brief	
Unit – II	Quality Assurance	12
	Implementation of Quality assurance Checklist for Quality Assurance	
Unit – III	Quality Analysis	12
	SWOT analysis Lean Manufacturing	
Unit – IV	The 3M Model	09
	Muda, Mura & Muri – Toyota Production System (TPS) Spatial considerations & other related concepts	

Books		
Name of Authors	**Title of the Book**	**Publisher**
David Meier, Liker	The Toyota Way Field book	McGraw-Hill Education (India) Pvt Limited
P. N. MUKHERJEE	Total Quality Management	PHI Learning

Subject Name: Electronics Devices Circuit-I

Course Code : 303	**Semester: III**
Weekly Teaching Hours: TH: 03 Tut: 00	**Scheme of Marking TH: 100, ISE: 50, ESE: 50**
	Scheme of Marking PR: --
Credit:3	

Content		**Hours**
Unit – I	Energy Bands and Charge Carrier in Semiconductor:	25
	Bonding forces and energy bands in solids, Charge Carriers in Semiconductors, Carrier Concentrations, Drift Mechanism. Excess carriers in Semiconductors: Optical Absorption, Carrier Lifetime: Direct Recombination, Steady State Carrier Generation, Quasi-Fermi Level, Diffusion of carriers and Einstein relation.	
Unit – II	Junctions:	20
	Equilibrium Conditions, Forward and Reveres Biased Junctions; Steady State Conditions. Optoelectronic Devices: Photodiode V-I characteristic, Photo detector, Solar Cells, Light Emitting Diode	

Books

Name of Authors	**Title of the Book**	**Publisher**
Donald Neaman	Electronic Circuits - Analysis and Design	Mc Graw Hill, 3rd Edition.
Ramakant Gaikwad	Op Amps & Linear Integrated Circuits	Pearson Education.
Millman Halkias		

Phillip E. Allen and Douglas R. Holberg	Integrated Electronics CMOS Analog Circuit	Oxford, 2nd Edition
Salivahan and Kanchana Bhaskaran	Design Linear Integrated Circuits	Tata McGraw Hill
1. NPTEL Course “Analog Electronic Circuits” https://nptel.ac.in/courses/108/105/108105158/		
2. NPTEL Course on “Analog Circuits” https://nptel.ac.in/courses/108/101/108101094/		

Subject Name: Electronics System Packaging and Manufacturing

Course Code :304	**Semester: III**
Weekly Teaching Hours: TH: 03 Tut: 00	**Scheme of Marking TH: 100 ISE: 50 ESE: 50**
	Scheme of Marking PR: --
Credit:3	

Content		**Hours**
Unit – I	Evolution and Classification of Printed Circuit Boards	12
	Challenges in Modern PCB Design and Manufacture, PCB fabrication methodologies (SSB, DSB and multilayer board), PCB design considerations/ design rules for analog, digital and power applications	
Unit – II	Electromagnetic interference in electronic systems and its impact	12
	Analysis of electronic circuit from noise emission point of view (both conducted and radiated emission) cross talk and reflection behavior of the circuit in time domain, Thermal management of electronic devices and systems.	
Unit – III	Semiconductor Packages:	12
	Single chip packages or modules. (SCM) Commonly used packages and advanced packages; Materials in packages, Current trends in Packaging, Multichip modules (MCM)-types; System-in package (SIP); Packaging roadmaps	
Unit – IV	Hybrid circuits	09
	Pipe and FIFOs, Shared memory, Sockets	

Books

Name of Authors	**Title of the Book**	**Publisher**

Glenn R. Blackwell	The Electronic Packaging Handbook	CRC Press
Yong Liu	Power Electronic Packaging Design, Assembly Process, Reliability and Modeling	Springer New York

Subject Name: Electronic Devices and Circuits Lab

Course Code :305	**Semester: III**
Weekly Practicals: PR: 01 Tut: 00	
	Scheme of Marking PR: 50
Credit:1.5	

Content

1. Study of Lab Equipments and Components: CRO, Multimeter, and Function Generator, Power supply- Active, Passive Components and Bread Board.
2. P-N Junction diode: Characteristics of PN Junction diode - Static and dynamic resistance measurement from graph.
3. Applications of PN Junction diode: Half & Full wave rectifier- Measurement of Vrms, Vdc, and ripple factor.
4. Characteristics of Zener diode: V-I characteristics of zener diode, Graphical measurement of forward and reverse resistance.
5. Application of Zener diode: Zener diode as voltage regulator. Measurement of percentage regulation by varying load resistor.

Subject Name: Fault Analysis & Repairs Lab

Course Code : 306	**Semester: III**
Weekly Practicals: PR: 01 Tut: 00	**Scheme of Marking TH: --**
TH Exam Duration: --	**Scheme of Marking PR: 50**
Credit:1.5	

Content

1. Categorization of faults
    a. Hardware/Software, User Induced, Component Failures
    b. L0 to L4 repairs
2. Testing electrical/electronic components in the product
3. Troubleshoot and repair of the faults identified in the product
4. Preventive Maintenance Services

Syllabus

Name of the Course: B. Voc (Electronics Manufacturing Services)

Semester IV

Subject Name: Good Manufacturing Concepts & Practices – II	
Course Code : 401	**Semester: IV**
Weekly Teaching Hours: TH: 03 Tut: 00	**Scheme of Marking TH: 100, ISE: 50, ESE: 50**
	Scheme of Marking PR: --
Credit:3	

Content		**Hours**
Unit – I	Work Study Concepts	25
	Method study, Work measurement, Sequencing of Operations and timing the flow steps, Advantages of work study	
Unit – II	Team Working	20
	Forming, Storming, Norming, Performing, Adjourning	

Books		
Name of Authors	**Title of the Book**	**Publisher**
Arvind K. Birdie, Madhu Jain	Organizational Behavior and Virtual Work Concepts and Analytical Approaches	Apple Academic Press
Brian A. Griffith	Working in Teams Moving From High Potential to High Performance	SAGE Publications

Subject Name: Manufacturing & Quality Norms

Course Code : 402	**Semester: IV**
Weekly Teaching Hours: TH: 03 Tut: 00	**Scheme of Marking TH: 100, ISE: 50, ESE: 50**
	Scheme of Marking PR: --
Credit:3	

Content		**Hours**
Unit – I	Manufacturing & Quality Norms	12
	Manufacturing & Quality Norms- keep it differently according to all applications, Manpower Deployment and Operations as per Work Instructions and criticality of the process Understanding how to form each operation and practical training of operation, Understanding accept and reject criterion of a particular operation.	
Unit – II	Manufacturing & Quality Norms – II	12
	Process in packing line-Packing line Operations sequence flow and its importance, Quality Systems - Accept, Reject criterion of various tests at OQA, Training of Assembly of electronic components - Assemble, Check, test electronic components , Various Labels and their Importance - Understanding Labels, Scanning and its importance , Packing of components/devices - Various Stages of packing, acceptance.	
Unit – III	Training of Testing	12
	Practical training of testing/checking each operation, Quality Norms of accept and practical training of electronic equipment's/Devices Acceptance/Rejection training of various defects	
Unit – IV	Rejection Norms	09
	Reject and sampling following QA norms - AQL level, Sampling techniques, as per QA sampling accept, reject numbers	

Books		
Name of Authors	**Title of the Book**	**Publisher**
Charles A. Cianfrani, John E. West	ISO 9001:2015 Explained	ASQ Quality Press
Denise E. Robitaille	ISO 9001:2015 Handbook for Small and Medium-sized Businesses	ASQ Quality Press

Subject Name: Good Manufacturing Concepts & Practices – III

Course Code : 403	**Semester: IV**
Weekly Teaching Hours: TH: 03 **Tut: 00**	**Scheme of Marking TH: 100, ISE: 50, ESE: 50**
	Scheme of Marking PR: --
Credit:3	

Content		**Hours**
Unit – I	Good Manufacturing Concepts & Practices - II	12
	Brief Introduction	
Unit – II	Total Quality Management	12
	ISO Standards & Kaizen	
Unit – III	Toyota Production System	12
	Lean Manufacturing Combination of Inventory Supply Chain	
Unit – IV	Quality and Inspection	12
	Sigma and 6 Sigma Orientation	

Books		
Name of Authors	**Title of the Book**	**Publisher**
David Meier, Liker	The Toyota Way Field book	

		McGraw-Hill Education (India) Pvt Limited
P. N. MUKHERJEE	Total Quality Management	PHI Learning
Heras-Saizarbitoria	ISO 9001, ISO 14001, and New Management Standards	Springer International Publishing

Subject Name: Electronic Devices and Circuits –II	
Course Code : 404	**Semester: II**
Weekly Teaching Hours: TH: 03 Tut: 00	**Scheme of Marking TH: 100, ISE: 50, ESE: 50**
	Scheme of Marking PR: --
Credit:3	

Content		Hours
Unit – I	MOSFET:	15
	Device structure and its operation in equilibrium, V-I characteristics. Circuits at DC, MOSFET as Amplifier and switch, Biasing in MOS amplifier circuits, small-signal operation and models, single stage MOS amplifier, MOSFET internal capacitances and high frequency model, frequency response of CS amplifier	
Unit – II	BJT:	15
	Review of device structure operation and V-I characteristics, BJT circuits at DC, BJT as amplifier and switch, biasing in BJT amplifier circuit, small-signal operation and models, single stage BJT amplifier, BJT internal capacitances and high frequency model, frequency response of CE amplifier.	
Unit – III	FEEDBACK:	15
	The general feedback structure, properties of negative feedback, the four basic feedback topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, the shunt-shunt and shunt series feedback amplifier. Oscillators: Basic principles of sinusoidal oscillators, op-amp RC oscillator circuits, LC oscillator	

Books		
Name of Authors	**Title of the Book**	**Publisher**

Millman Halkias	Integrated Electronics-Analog and Digital Circuits and Systems	Tata McGraw Hill
David A.Bell	Electronic Devices and Circuits	Oxford press
R. L. Boylstad, L. Nashlesky,	Electronic Devices and circuits Theory	PrenticeHall of India
Anil K. Maini and Varsha Agarwal	Electronic Devices and Circuits	Wiley India
Phillip E. Allen Douglas R. Holberg 5. K. R. Botkar	CMOS Analog Circuit Design Integrated Circuits	Oxford. Khanna Publication
Donald Neaman	Electronic Circuit Analysis and Design	Tata McGraw Hill

Subject Name: Electronic Devices and Circuits –II Lab	
Course Code : 405	**Semester: IV**
Weekly Practicals: PR: 01 Tut: 00	**Scheme of Marking TH: --**
TH Exam Duration: --	**Scheme of Marking PR: 50**
Credit:1.5	

Content

1. Characteristic of BJT: BJT in CE configuration- Graphical measurement of h parameters from input and output characteristics. Measurement of Av, AI, R_o and R_i of CE amplifier with potential divider biasing.
2. Measurement of Operational Amplifier Parameters: Common Mode Gain, Differential Mode Gain, CMRR, Slew Rate.
3. Applications of Op-amp: Op-amp as summing amplifier, Difference amplifier, Integrator and differentiator.
4. Field Effect Transistors: Single stage Common source FET amplifier –plot of gain in dB Vs frequency, Measurement of, bandwidth, input impedance, maximum signal handling capacity (MSHC) of an amplifier.
5. Oscillators: Sinusoidal Oscillators. Wien's bridge oscillator b. phase shift oscillator.

Subject Name: Vocational Practical	
Course Code : 406	**Semester: II**
Weekly Practicals: PR: 01 Tut: 00	**Scheme of Marking TH: --**
TH Exam Duration: --	**Scheme of Marking PR: 50**
Credit:1.5	

Content

1. Work study concepts
2. Team work concept

Savitribai Phule Pune University

Faculty of Science & Technology

Curriculum

For

Bachelor of Vocational (Engg)

First Year ELECTRONIC MANUFACTURING SERVICES

(Choice Based Credit System) (2019 Course)

(With Effect from Academic Year 2019-20)

1. Course Objectives

After successfully completing the vocational course, the student would have acquired relevant appropriate and adequate technical knowledge together with the professional skills and competencies in the field of Electronics Manufacturing Service so that he/she is properly equipped to take up gainful employment in this Vocation. Thus he/she should have acquired:-

A. Understanding of

(a) The relevant basic concepts and principles in basic science subjects (Physics, Chemistry and Mathematics) so that the students is able to understand the different vocational subjects.

(b) The basic concepts in engineering drawing.

(c) The concepts, principles of working of basic electronic devices and circuits.

(d) The knowledge of testing procedure of components and circuits by making use of different test instruments.

(e) The procedure of making P.C.B.

(f) The concepts and principles used in Radio/Audio/Video Systems and Communication devices and its maintenance.

B. Adequate Professional Skills and Competencies in

(a) Testing different electronic components.

(b) Testing the performance of electronic circuits.

(c) Locating the fault at component level and at the stage level.

C. A Healthy and Professional Attitude so that the student has

(a) An analytical approach while working on a job.

(b) An open mind while locating/rectifying faults.

(c) Respect for working with their own hands.

(d) Respect for honesty, punctuality and truthfulness

D. NSQF compliant skills in Qualification developed by sector skill council in Electronic sector

3. Course Structure:

The course will consist of combination of practice, theory and hands on skills in the electronics sector.

Curriculum:

The curriculum in each of the years of the programme would be a suitable mix of general education and skill components.

Skill Development Components:

- The focus of skill development components shall be to equip students with appropriate knowledge, practice and attitude, to become work

ready. The skill development components will be relevant to the industry as per its requirements.

- The curriculum will necessarily embed within itself, National Occupational Standards (NOSs) of specific job roles within the industry. This would enable the students to meet the learning outcomes specified in the NOSs.
- The overall design of the skill development component along with the job roles selected will be such that it leads to a comprehensive specialization in few domains.
- The curriculum will focus on work-readiness skills in each of the year of training.
- Adequate attention will be given in curriculum design to practical work, on the job training, development of student portfolios and project work.

General Education Component:

- The general education component adheres to the normal senior secondary and university standards. It will emphasize and offer courses which provide holistic development. However, it will not exceed 40% of the total curriculum.
- Adequate emphasis is given to language and communication skills.

B. Voc Electronics Manufacturing Services Syllabus for ThirdYear-

Structure for Semester-I												
Course Code	**Course Name**	**Teaching Scheme (Hours/Week)**		**Examination Scheme and Marks**						**Credits**		
		Th	**Prac**	**ISE**	**ESE**	**TW**	**PR**	**OR**	**Total**	**TH**	**PR**	**Total**
	Valuation & Storage	03		50	50				100	03		03
	Shelf Life, Ware House Operations Management & Material Transactions	03		50	50				100	03		03
	Industrial Electronics Product Design	03		50	50				100	03		03
	Pre-Production Activities	03		50	50				100	03		03
	Pre-Production Activities-Lab		02				50	--	50		1.5	1.5
	Valuation & Storage-Lab		02				50	--	50	--	1.5	1.5
	On Job Training		18			100			100		15	15
Total		12	22	200	200	100	100	--	600	12	18	30

Structure for Semester-II												
Course Code	**Course Name**	**Teaching Scheme (Hours/Week)**		**Examination Scheme and Marks**						**Credits**		
		Th	**Prac**	**ISE**	**ESE**	**TW**	**PR**	**OR**	**Total**	**TH**	**PR**	**Total**
	Entrepreneurship/	03		50	50				100	03		03
	Accounting/Management	03		50	50				100			03
	Project Work		10			200		100	300		09	09
	On Job Training		18			100			100		15	15
Total		06	28	100	100	300		100	600	03	27	30

*On Job Training should be carried out in any one subject per semester as per NSDC Guide lines for following Skill Sets:

1. Product Engineer (ELE/Q4201)
2. Incoming QC Technician (ELE/Q4401)
3. Assembly Supervisor (ELE/Q6305)
4. FPGA Design Engineer (ELE/Q8201)
5. Sales Executive-Consumer Electronics (ELE/Q3201)

Third Year Syllabus

Name of the Course: B. Voc (Electronics Manufacturing Services)

Semester I

Subject Name: Valuations & Storage	
Course Code :	**Semester: I**
Weekly Teaching Hours: Theory : 03	**Scheme of Marking Theory: 100 Marks** **Insem 30 Marks** **Endsem 70 Marks**
Credit : 3	**Scheme of Marking PR: --**

	Content	**Hours**
Unit 1	MSP430 Microcontroller Architecture and Low Power Feature	12
	Low Power 16-bit MSP430x5xx microcontroller architecture, address space, on-chip peripherals (analog and digital), and Register sets. Instruction set, instruction formats, and various addressing modes of MSP430 devices; Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, System clocks. Low Power aspects of MSP430: low power modes	
Unit 2	Real World Interfacing	12
	GPIO programming and I/O multiplexing; Interrupts and interrupt programming. Watchdog timer. Timers & Real Time Clock (RTC), PWM control. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA. Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices	
Unit 3	ARM7	12
	Introduction to ARM processors and its versions. ARM7, ARM9 & ARM11 comparison, advantages & suitability in embedded application ARM7 data flow model, programmer‟s model, modes of operations	
Unit 4	ARM7 Based Microcontroller	09
	ARM7 Based Microcontroller LPC2148: Features, Architecture (Bloc Diagram and Its Description), System Control Block (PLL and VPI divider) , Memory Map, GPIO, Pin Connect Block, timer, interfacin with LED, LCD, KEYPAD.	

Books		
Name of Authors	**Title of the Book**	**Publisher**
.Mazidi	8051 microcontroller & embedde system 3rd Edition	Pearson
Mazidi	PIC microcontroller & embedde system 3rd Edition	Pearson

Subject Name: UPS and Inverter Technician	
Course Code :	**Semester: I**
Weekly Teaching Hours: Theory : 03	**Scheme of Marking Theory: 100 Marks** **Insem 30 Marks** **Endsem 70 Marks**
Credit : 3	**Scheme of Marking PR: --**

Content		**Hours**
Unit 1	Introduction	12
	Introduction to Inverter, Block diagram of Inverter, Rectifier, its type and working principle,	
Unit 2	Working of Invertor	12
	PIV of Diode, Filter employed in rectifier Battery charger circuit, working of Inverter Oscillator, type of Oscillator, Square wave Generator PWM,	
Unit 3	Designing Invertors Part 1	12
	DC to AC Convertor/Invertor, Designing an investor,	
Unit 4	Designing Invertors Part 1	09
	Circuit using PWM UPS, Working principle, specifications, explanation wit the help of block diagram, UPS Installation Find the total Load and Select suitable Inverter/UPS	

Books	
Name of Authors	**Title of the Book**
Abraham Pressman	Switching Power Supply Design
National Instructional Media Institute, Chennai	Repair & Maintenance of Power supply, Invertor & UPS – NIMI

Subject Name: Solar and LED Technician	
Course Code :	**Semester: I**
Weekly Teaching Hours: Theory : 03	**Scheme of Marking Theory: 100 Marks** **Insem 30 Marks** **Endsem 70 Marks**
Credit : 3	**Scheme of Marking PR: --**

	Content	**Hours**
Unit 1	Conditions, collect tools and raw materials	12
	Understand the work requirement, Site condition ,Understand the installation requirement ,Materials required for installation, Quality material usage and appropriate handling mechanism	
Unit 2	Installation	12
	Installation and material usage procedure, Mounting requirements, Connection of the system and functioning, Report and document completion of work , Quality and safety procedures	
Unit 3	Coordination	12
	Company's policies on: Incentives, Delivery standards, and personnel management, Importance of the individual's role in the workflow, Reporting structure, How to communicate effectively, How to build team coordination	
Unit 4	Safety and Precaution	09
	How to maintain the work area safe and secure, How to handle hazardous material , How to operate hazardous tools and equipment, Emergency procedures to be followed such as fire accidents, etc.	

Books

Name of Authors	**Title of the Book**	**Publisher**
Adrian Kitai	Principles of Solar Cells, LEDs and Diodes	Wiley
Gregory F. Nemet	How Solar Energy Became Cheap: A Model for Low-Carbon Innovation	Routledge

Subject Name: Industrial Electronic Product Design	
Course Code :	**Semester: I**
Weekly Teaching Hours: Theory : 03	**Scheme of Marking Theory: 100 Marks** **Insem 30 Marks** **Endsem 70 Marks**
Credit : 3	**Scheme of Marking PR: --**

Contents		**Hours**
Unit 1	Introduction , Development Process, Product Planning & Conceptualization	12
Unit 2	Product Architecture and Industrial Design	12
Unit 3	Product Manufacturing & Prototyping	12
Unit 4	Economic Analysis & Managing projects, Introduction to 3-D printing and Rapid Prototyping	09

Books

Name of Authors	Title of the Book	Publisher
Bert Haskell	Portable Electronics Product Design and Development	McGraw-Hill Companies
Tony Serksnis	Designing Electronic Product Enclosures	Springer

Subject Name: Embedded System – Lab	
Course Code :	**Semester: I**
Weekly Practicals: PR: 01	**Scheme of Marking TH: --**
TH Exam Duration: --	**Scheme of Marking PR: 25, IA: 25, Total: 50**
Credit:1.5	

Sr. No.	Laboraty
1	Interfacing LPC2148 to LCD
2	UART Interfacing LPC2148 in embedded system (GSM/GPS)
3	Interfacing SD card to LPC2148
4	Interfacing EEPROM to LPC2148 using I2C protocol
5	Interfacing LPC2148 to Seven Segment / RGB LED
6	Generation of PWM signal for motor control using LPC2148
7	Interfacing TFT display to LPC2148 17. Implementing CAN protocol using LPC214

Subject Name: Pre-Production, Valuations and Storage – Lab	
Course Code :	**Semester: I**
Weekly Practicals: PR: 01	**Scheme of Marking TH: --**
TH Exam Duration: --	**Scheme of Marking PR: 25, IA: 25, Total: 50**
Credit:1.5	

Sr. No.	Laboraty
1	Production activities - Two Hand Insertion
2	Production activities - Positioning of Bins
3	House Keeping - 5S
4	Categorization of Raw Material & Consumables - Hazardous/Non-Hazardous
5	Categorization of Raw Material & Consumables - Imported/Local
6	Categorization of Raw Material & Consumables - Assembly/Parts
7	Categorization of Raw Material & Consumables - Class A/B/C
8	Categorization of Raw Material & Consumables - Good/defective

Third Year Syllabus

Name of the Course: B. Voc (Electronics Manufacturing Services)

Semester II

Subject Name: Entrepreneurship/Accounting/Management	
Course Code :	**Semester: II**
Weekly Teaching Hours: Theory : 03	**Scheme of Marking Theory: 100 Marks** **Insem 30 Marks** **Endsem 70 Marks**
Credit : 3	**Scheme of Marking PR: --**

Contents		**Hours**
Unit 1	Introduction	09
	Meaning and Nature of Management, Management Approaches, Processes, Managerial Skills, Tasks and Responsibilities of a Professional Manager	
Unit 2	Organizational Structure and Process	09
	Organizational Culture and Climate, Managerial Ethos, Organization Structure & Design, and Managerial Communication	
Unit 3	Planning and Controlling	09
	Planning Types and Process, Management by Objectives, Decision-Making Types and Models, Problem Solving Techniques, Controlling Process and Techniques	
Unit 4	Performance Evaluation Techniques	09
	Introduction to Budgeting and Budgetary Control; Performance Budgeting; Classification of Budget; Standard Costing and Variance Analysis; Balanced Scorecard; Responsibility Accounting	
Unit 5	Decision Making Techniques	09
	Cost Volume Profit Analysis; Management Accounting for Decision Making and Control; EVA and Performance Measurement; Introduction to Activity Base Costing, Targeting Costing, Life Cycle Costing; Uniform Costing	

Books		
Name of Authors	**Title of the Book**	**Publisher**
Michael Kraten	Business Planning and Entrepreneurship: An Accounting Approach	Business Expert
Ratih Hurriyati, Benny Tjahjono, Ikuro Yamamoto	Advances in Business, Management and Entrepreneurship	CRC Press/ Bulkema