DEPARTMENT OF ELECTRONICS ENGINEERING

ELECTRONICS ENGINEERING PROGRAMME

(SANDWICH PATTERN)

CURRICULUM DOCUMENT (REVISION 2019)

(Second Semester)

GOVERNMENT POLYTECHNIC MUMBAI

(An Autonomous Institute, Government of Maharashtra)

GOVERNMENT POLYTECHNIC MUMBAI

(Academically Autonoums Instititute, Government of Maharashtra)

Teaching and Examination Scheme (P19) With effect from AY 2019-20

Programme: Diploma in Electronics Engineering (Sandwich Pattern) **Term / Semester - II**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
							Theory			PR	OR	TW	Total
		L	P	TU	Total		TH	TS1	TS2				
EC19203	Basic Electronics.	3	4	--	7	7	60	20	20	25	--	25	150
EC19204	Circuit and Networks.	3	2	--	5	5	60	20	20	25	--	25	150
EC19205	Electronic Instrument and Measurements.	3	2	--	5	5	60@	20@	20@	--	25	25	150
EC19206	Digital Electronics.	3	2	--	5	5	60	20	20	25*	--	25	150
SC19110	Engineering Mathematics.	4	0	--	4	4	60	20	20	--	--	--	100
EC19207	C and Cpp. (MOOC)	--	4#		4	4#	--	--	--	--	--	--	--
	Total	**16**	**14**	**-**	**30**	**30**	**300**	**100**	**100**	**75**	**25**	**100**	**700**
Student Centered Activity (SCA)					**05**								
Total Contact Hours					**35**								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)***** Indicates assessment by External Examiner else internal practical skill test , **#** indicates Self, on- line learning Mode, **@** indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours
Self, on- line learning Mode through MOOCs /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Department Co-Ordinator
Curriculum Development,
Department of Electronics

Head of Department
Department of Electronics,

In-Charge
Curriculum Development Cell

Principal

Programme: **Diploma in Electronics Engineering (Sandwich Pattern)**										
Course Code: **EC19203**				Course Title: **Basic Electronics**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 Min.)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
3	4	-	7	60	20	20	25	-	25	150

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term

Rationale:

It is necessary for the students of electronics and related branches to study and apply the basic principles, analyze and troubleshoot simple subsystems. To acquire this level of understanding, the basic knowledge of electronic devices and circuits is essential. This course is one of the core subjects which deals with construction, working principle, application of active components.

Course Outcomes: Student should be able to

CO1	Describe the fundamentals of diode.
CO2	State different types of diodes and their applications.
CO3	Illustrate the transistor fundamentals and its biasing techniques (BJT AND FET).
CO4	Interpret the working of regulated power supply.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Semiconductor Diode:** 1.1 Classification of component on the basis of energy band theory and effect of temperature. 1.2 Different types of semiconductor and their materials. P-type and N-type semiconductors 1.3 Symbol, construction, working principle, forward and reverse biasing, V-I Characteristics and applications of following diodes: PN junction, Zener, LED, Photo diode. **Course Outcome: CO1 and CO2 Teaching Hours:09 hrs Marks:12 (R-4, U-4, A-4)**
2	**Diode application:** 2.1 Types of rectifier: Circuit, waveform and working of Half Wave, Bridge Full Wave Rectifier and Full wave rectifier using Center tapped transformer. 2.2 Parameters of rectifier: Average DC value of current and voltage, ripple frequency, ripple factor, PIV of diode, TUF, efficiency of rectifier. 2.3 Types of Filters: Waveform and working of Shunt capacitor, series inductor and Π filter. 2.4 Diode as clipper and clamper:

	(A) Circuit diagram, waveform and working of positive, negative and biased clipper. (B) Circuit diagram, waveform and working of positive, negative and biased clamper. **Course Outcome:CO2 Teaching Hours :14 Marks:16 (R-4, U-6, A-6)**
3	**Transistor Fundamentals:** 3.1 Construction and working of PNP and NPN transistors. 3.2 Transistor configuration: CB, CE, CC. 3.3 Working and characteristics of transistors in CB, CE and CC modes. 3.4 BJT Biasing : DC load line, Operating point, stabilization, concept of thermal runaway. Types of biasing: circuit and analysis of Fixed bias, base bias with Emitter feedback, Voltage divider bias. 3.5 Transistor applications: 3.5.1 Transistor as a Switch 3.5.2 Single stage CE amplifier. (circuit diagram and working) **Course Outcome:CO3 Teaching Hours :11 Marks:16 (R-6, U-6, A-4)**
4	**Field Effect Transistor:** 4.1 Symbol, construction, working and characteristics of JFET (N-channel and P-channel) and MOSFET (Depletion and enhancement type) 4.2 FET Biasing: Source self-bias, drain to source bias. 4.3 Applications of FET **Course Outcome: CO3 Teaching Hours :7 Marks:08 (R-2, U-4, A-2)**
5	**Regulated Power supply:** 5.1 Block diagram of DC regulated power supply. 5.2 Load regulation and line regulation. 5.3 Zener diode as voltage regulator. 5.4 Transistorized series and shunt regulator- circuit diagram and working. **Course Outcome: CO4 Teaching Hours :4 Marks:08 (R-2, U-2, A-4)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Semiconductor Diode	4	4	4	12
2	Diode application	4	6	6	16
3	Transistor Fundamentals	6	6	4	16
4	Field Effect Transistor	2	4	2	8
5	Regulated Power supply	2	2	4	8
	Total	**18**	**22**	**20**	**60**

List of experiments: Total 12 experiments (or turns) out of 15 experiments (or turns)

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	To plot the V-I characteristic of semiconductor P-N diode and LED.	04
2	2	CO2	To observe the waveform of half wave rectifier and Center tapped full wave rectifier	04
3	3	CO3	To plot i/p and o/p characteristics of BJT in CE Mode	04
4	5	CO4	Calculate load and line regulation of Zener regulator	04
5	1	CO1	To plot the V-I characteristic of Photo diode and Zener diode	04
6	2	CO2	To observe the waveform of half wave rectifier with LC and π Filter	04
7	2	CO2	To observe the waveform of Center tapped full wave rectifier with LC and π filter	04
8	2	CO2	To observe the waveform of Bridge wave rectifier with LC filter and without filter.	04
9	2	CO2	To observe the waveform of Bridge wave rectifier with π filter. To observe the waveform of negative clipper circuit. Draw input and output waveform	04
10	2	CO2	To observe the waveform of clipper circuit (Positive and biased) Draw input and output waveform	04
11	2	CO2	To observe the waveform of clamper circuit (Positive, negative) Draw input and output waveform	04
12	3	CO3	To plot i/p and o/p characteristics of BJT and find out input resistance and o/p resistance of BJT in CB Mode.	04
13	4	CO3	To plot the characteristic of JFET(N-channel) and MOSFET	04
14	1,2,3, 4,5	CO1, CO2, CO3, CO3	1 Mini project: suggested by Course teacher. (testing on bread board , soldering on PCB etc)	04
15	1,2,3, 4,5	CO1, CO2, CO3, CO3	Mini project: suggested by Course teacher. (trouble shooting , report preparation etc)	04
		Total		**60**

Note: Experiments No. 1 to 5, 14 and 15 are compulsory and should map all units and Cos. Remaining experiments are to be performed as per importance of the topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Electronics Principles	Malvino, Albert Paul, David (McGraw Hill Education)	0-07-462236-6
2	Principles of Electronics	Mehta V.K., Mehta Rohit (S. Chand and Company)	978-81-219-2450-2
3	Fundamentals of Electronic Devices and Circuits	Bell, David (Oxford University Press)	0-19-569428-7
4	A text book of Applied Electronics	Sedha R.S. (S. Chand)	81-219-2783-8

E-References:

1. https://ndl.iitkgp.ac.in/
2. www. electronicshub.org/tutorials/
3. www.tutorialspoint.com/
4. www.youtube.com
5. https://phet.colorado.edu/en/simulation/legacy/semiconductor

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	2	2	1
CO2	2	2	2	-	-	-	2	3	2	2
CO3	2	2	2	1	-	-	1	3	2	2
CO4	1	2	3	1	-	-	2	2	1	3

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mrs. Salunke Suvarna	Sr. Controls Engineer	Vanderlande Industries Software Pvt Ltd.Pune
2	Mrs. Chavhan Monali	Lecturer in Electronics	Government Polytechnic, Vikramgadh
3	Mrs. Puri Sanyogeeta B.	Lecturer in Electronics	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Electronics.

Head of Department
Department of Electronics.

I/C, Curriculum Development Cell

Principal

Programme: **Diploma in Electronics Engineering (Sandwich Pattern)**										
Course Code:**EC19204**				Course Title: **Circuits and Networks**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 Min)	TS1 (1Hrs)	TS2 (1Hrs)	PR	OR	TW	Total
3	2	-	5	60	20	20	25	-	25	150

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term

Rationale:

This subject is introduced to understand the basic laws and theorem used in electronics circuits and systems. Simplification and analysis of the circuit will help to strengthen the analytical abilities of students.

Course Outcomes: Student should be able to

CO1	Interpret Network laws and simple networks.
CO2	Interpret Network Conversion and Reduction
CO3	Apply theorems in solving numerical problems.
CO4	Design simple resonant and filter circuits.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Introduction to Networks and Circuits** 1.1 Definition and concept of Branch, Potential source, Current source. 1.2 Impedance, resistance, inductance, capacitance. 1.3 Mesh analysis, Super mesh analysis. (Simple numerical) 1.4 Node analysis, Super node analysis. (Simple numerical) 1.5 Principle of duality. **Course Outcome: CO1 Teaching Hours :7 hrs Marks: 08 (R- 2, U-2, A-4)**
2	**Network Conversion and Reduction** 2.1 Open circuit and short circuit impedances for T and π-networks. 2.2 T to π-network conversions: T to π-impedance conversion with derivation , π to T impedance conversion with derivation. [Numerical based on resistive network only] **Course Outcome:CO2 Teaching Hours :7 hrs Marks: 04 (R- 2 , U- 0, A-2)**

3	**Network Theorems:** Statements of Theorems and their application for solving simple electricalnetworks. 3.1 Thevenin's theorem 3.2 Norton's theorem 3.3 Superposition theorem 3.4 Maximum power transfer theorem 3.5 Millman's theorem [Numerical based on above to know importance of each theorem.] **Course Outcome:CO3 Teaching Hours : 7hrs Marks: 10 (R-2, U-4 , A- 4)**
4	**Two port Networks:** 4.1 Basic relationship for 2 port networks. 4.2 Definitions: Z parameters, Y parameters, h parameters, ABCD parameters. 4.3 Imageimpedance,iterativeimpedance. [Numericalbasedonabovetoknow importance of each set ofParameters] **Course Outcome:CO3 Teaching Hours :07 Marks: 12 (R-4, U-4, A-4)**
5	**Resonant circuits and transient response** 5.1 Definition of Q factor. 5.2 Series resonance: Frequency, bandwidth, Q-factor for resonance. Voltage and current curves, magnification at resonance. 5.3 Parallel resonant circuit: Frequency, bandwidth, Q-factor for resonance. Voltage and current curves,magnification at resonance. 5.4 DC response: Theoretical derivations to discuss response ofR-C, R-L, R-L-C circuits. **Course Outcome:CO4 Teaching Hours :8 hrs Marks: 12 (R-4, U-4, A-4)**
6	**Filters and Attenuators** 6.1 Simple constant K- filters: low pass filter, high pass filter. Reactance curves, conditions at cut off, design equations. 6.2 Band pass, band stop filters:ideology, practical conditions, Design equations. 6.3 M-derived filter: Low pass filter, high pass filter only. Design equations[No derivations, only numerical based on endequations] 6.4 Attenuators: Units -Nepers, decibels. Concept of Fixed symmetrical T and π-attenuator. [Avoid in-depth mathematical treatment for all filters and attenuators.] **Course Outcome:CO4 Teaching Hours :09 hrs Marks: 14 (R-4, U-6, A-4)**

Suggested Specifications Table (Theory):

Unit No.	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to Networks and Circuits	02	02	04	08
2	Network Conversion and Reduction	02	-	02	04
3	Network Theorems	02	04	04	10
4	Two port Networks	04	04	04	12
5	Resonant circuits and transient response	04	04	04	12
6	Filters and Attenuators	04	06	04	14
	Total	**18**	**20**	**22**	**60**

List of experiments: Total 10 experiments (or turns) out of 15 experiments (or turns)

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Perform Mesh analysis for given circuits.	02
2	1	CO1	Perform Node analysis for given circuits.	02
3	2	CO2	T to π-network conversion for the given network Theoretically with [Proof of equations] practical verification by applying same input.	02
4	3	CO3	Verify Norton's theorem and compare practical and theoretical values	02
5	3	CO3	Verify Superposition theorem and compare practical and theoretical values.	02
6	3	CO3	Verify Maximum power transfer theorem and compare practical and theoretical values	02
7	3	CO3	Verify Thevenin's theorem and compare practical and theoretical values.	02
8	4	CO3	Verify Theoretical relationship and definitions of Z /Y parameters with Practical calculations.	02
9	4	CO3	Verify Theoretical relationship and definitions of H /ABCD parameters with Practical calculations.	02
10	5	CO4	Plot resonance curves of series R-L-C circuit and find out Q, f_0 and bandwidth.	02
11	5	CO4	Plot resonance curves of parallel R-L-C circuit and find out Q, f_0 and bandwidth.	02
12	6	CO4	Calculate attenuation factor theoretically & verify practically for a T / π type attenuator.	02
13	6	CO4	Derive, design and plot frequency response of low pass filter / high pass filter	02

14	6	CO4	Plot frequency response and find cut off frequency of band pass filter with theoretical analysis.	02
15	6	CO4	Plot frequency response and find cut off frequency of band stop filter with theoretical analysis.	02
Total				**30**

Note: Experiments No. 1 to 5 (or 6) are compulsory and should map all units and CO's. Remaining 4 experiments are to be performeddepending on the importance of topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Fundamentals of Electric Circuits Theory	Chatoppadhya, S. Chand and Co. Ltd. New Delhi, 1998	8121900085
2	Networks, Fields and Circuits.	John Ryder, Prentice Hall of India Ltd., 2nd Edition, 2005	9332559511
3	Transmission Lines	Umesh Sinha, Satya Publication, 1st Edition, 2010	9788176841887
4	Network Systems	D. Roy Choudhari, New Age International, 4th edition, 2009	9781906574246

E-References:

1. https://nptel.ac.in/courses/108102042/
2. https://www.electronics-tutorials.ws/
3. https://www.youtube.com/watch?v=ZzMJtQ_7MiA
4. https://mrcet.com/downloads/digital_notes/HS/5%20Electrical%20Circuits.pdf
5. http://www.ee.iitm.ac.in/videolectures/doku.php?id=ee2015_2017nk:start

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	1				1	1	1	1
CO2	2	2	1				1	1	1	1
CO3	2	2	1	1			1	2	2	2
CO4	2	3	3	1			1	2	1	2

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Prof. Anjum Mujawar	Managing Director	Discover Projects
2	Dr. N. D. Chavan	CDC- Head,	Somaiya Polytechnic Mumbai

3	Mr. Santosh Kamble	Chief Executive Officer	Saitronics, Mumbai
4	Dr. H. M. Pardeshi	Lecturer Electronics	Government Polytechnic, Mumbai

Coordinator,
Curriculum Development,
Department of _____

Head of Department
Department of _____

I/C, Curriculum Development Cell

Principal

Programme: **Diploma in Electronics engineering (Sandwich Pattern)**										
Course Code : **EC19205**				Course Title: **Electronic Measurements and Instruments**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (1 Hr)	TS1 (30min)	TS2 (30min)	PR	OR	TW	Total
3	**2**	**-**	**5**	**60@**	**20@**	**20@**	**-**	**25**	**25**	**150**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term

Rationale:

This course is introduced to provide practical information and technical background of some of the conventional as well as specialized testing and measuring instruments. It also provides the basic concepts, principles, architecture, procedures, and techniques for the measurement of various electronic quantities using analog and digital electronic measuring instruments. The student will be familiarized for selecting and operating the appropriate measuring instrument. This subject presumes that the students are familiar with basic utilization of measuring instruments.

Course Outcomes: Student should be able to

CO1	Classify various instruments.
CO2	Draw the constructional diagram and describe the working principle of analog meter.
CO3	Describe operation of different digital meters.
CO4	Describe various functions of CRO for various applications.
CO5	Draw block diagram of signal generator and IC tester and describe its working.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Basics of Measurement :** 1.1 Classification of Instruments: Absolute , Secondary Instruments 1.2 Definitions of Static characteristics of Instruments: Accuracy, Precision, Sensitivity, Resolution, Static error, Reproducibility, Drift, Dead Zone. 1.3 Definitions of dynamic characteristics of Instruments: Speed of response, Lag, fidelity, Dynamic error. 1.4 Types of Errors- Gross, Systemic, Random. 1.5 Units of measurement of fundamental quantity. 1.6 Definition of Standards and their classification: International, Primary, Secondary. 1.7 Calibration: Definition, Need of calibration. 1.8 Importance of Grounding. Safety precautions while handling equipment's. **Course Outcomes: CO1 Teaching hours: 6 hrs. Marks: 8(R-4, U-4, A-0)**

2	**Analog DC and AC Meters :** 2.1 Classification of analog ammeter and voltmeter. 2.2 Working principle and construction of PMMC instruments: 2.2.1 Analog DC Ammeter: Shunt resistor type, ArytonShunt type. 2.2.2 Analog DC Voltmeter: Multirange voltmeter : Voltmeter sensitivity, loading effect. 2.2.3 Derivations of deflecting torque of PMMC instruments. 2.2.4 Derivation for calculation of shunt and series resistance. 2.3 Analog AC Voltmeter (No derivation). 2.4 Analog AC Ammeter. 2.5 Analog multimeter: Circuit diagram, operation. 2.6 Output power meter (AF/RF). **Course Outcomes: CO2 Teaching hours: 09 hrs. Marks : 12(R-2, U-8, A-2)**
3	**Digital Meters :** 3.1 Block diagram, operation and applications of: 3.1.1. Digital Frequency meter. 3.1.2. Digital Voltmeter. 3.1.3. Digital Multimeter. 3.2 Advantages and Disadvantages of Digital Instruments. 3.3 Comparison of analog instruments with Digital instruments **Course Outcomes: CO3 Teaching hours:11 hrs. Marks : 12(R-4, U-6, A-2)**
4	**Oscilloscope :** 4.1 CRO: Basic Block diagram and function of each block. 4.2 CRT: Construction and working. 4.3 Vertical Deflection System –Block diagram and operation. 4.4 Horizontal deflection system – Block diagram and operation. 4.5 Function of delay line. 4.6 Explanation of waveform generation 4.7 Applications of CRO: 4.7.1. Time and frequency measurement 4.7.2. Voltage measurement 4.7.3 Lissagous patterns for Phase and Frequency measurement 4.8 Concept, block diagram and Operation of: 4.8.1.Single beam dual trace CRO 4.8.2 Dual beam Dual Trace CRO 4.9 Block diagram, operation advantages and applications of Digital storage oscilloscope. **Course Outcomes: CO4 Teaching hours: 11 hrs. Marks : 16(R-4, U-6, A-6)**
5	**Analog Instruments** : 5.1 Definition and need of signal generator 5.2 Block diagram, operation and applications of : AF and RF type signal generator Function generator, Square and Pulse generator. 5.3 Block diagram, operation and applications of : Spectrum analyzer, Digital IC tester **Course Outcomes: CO5 Teaching hours: 8 hrs. Marks : 12(R-2, U-6, A-4)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Basics of Measurement	4	4	-	8
2	Analog DC and AC Meters	2	8	2	12
3	Digital Meters	4	6	2	12
4	Oscilloscope	4	6	6	16
5	Analog Instruments	2	6	4	12
	Total	**16**	**30**	**14**	**60**

List of experiments: Total 10 experiments (or turns) out of 14 experiments (or turns)

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Prepare charts of precautionary measures of handling analog meters specifying the importance of grounding.	2
2	1	CO1	Prepare charts of precautionary measures of handling digital meters specifying the importance of grounding.	2
3	2	CO2	To measure voltage current and resistance by analog multimeter.	2
4	3	CO3	To measure voltage current and resistance by Digital multimeter	2
5	4	CO4	Draw the layout of any one section of CRO trainer, check for Continuity and Fault finding	2
6	5	CO5	Draw the block diagram of Function generator. Identify the blocks from circuit. Test and verify function outputs as per specifications	2
7	4	CO4	Draw and label the front panel controls of Dual trace CRO. Measure frequency, voltage, phase difference.	2
8	4	CO4	Observe and draw the front panel controls of Digital Storage oscilloscope and test and verify functionality of controls	2
9	4	CO4	Measure frequency and phase difference of unknown signals with the help of Lissajous pattern by using CRO. Test different components and semiconductor devices using CRO	2
10	4	CO2	To measure voltage and resistance by digital multimeter. List the parameters such as resolution and sensitivity	2
11	5	CO5	To test digital ICs using digital IC tester and various modes of testing.	2
12	5	CO5	To relate use of front panel controls of AF/RF signal generator for various operations and measure frequency generated by it on CRO	2
13	5	CO5	To measure the output power of given circuit using AF/RF output power meter.	2
14	6	CO5	To Calibrate CRO.	2
15	5	CO5	Draw the front panel of Spectrum Analyzer and observe frequency.	2
		Total		**30**

Note: Experiments No. 1 to 6 are compulsory and should map all units and Cos. Remaining experiments are to be performed as per importance of the topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Modern Electronic Instrumentation & Measurement Techniques. (Ist edition 2011)	A. D. Helfrick W. D. Cooper , PHI Learning Pvt. Ltd. New Delhi	8120307526
2	Electronic Instrumentation (3rd Edition 2012)	Kalsi H.S., Tata McGraw Hill	9780070702066
3	Electrical & Electronic Measurements & Instrumentation. (14th Edition 2008)	A.K Sawhney ,Dhanpat Rai & Sons	8177001000
4	Instrumentation and Control, (3rd Edition 2012)	S K Singh Industrial , Tata McGraw Hill Education Private Limited, New Delhi	0070262225

E-References:

1) http://en.wikipedia.org/wiki/
2) www.youtube.com/ "here type name of instrument"
3) www.controlnet.com
4) www.tutorialspoint.com

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	3	1	1	1	3	1	1
CO2	2	2	3	1	1			2	2	2
CO3	1	1	2	1				2	2	2
CO4			3	3			1	2	2	2
CO5			2	1		1		1	1	1

Industry Consultation Committee:

Sr.No	Name	Designation	Institute/Organisation
1	Mr. Dinesh Kamble	Sr. Manager -Instrumentation	Knexir Consultants Pvt Ltd
2	Ms S. R. Nagargoje	Lecturer in Electronics	Govt. Polytechnic, Thane
3	Ms Shweta Sisodiya (I/C Curriculum Designer)	Lecturer in Electronics	Govt. Polytechnic, Mumbai

Coordinator,
Curriculum Development,
Department of Electronics.

Head of Department
Department of Electronics.

I/C, Curriculum Development Cell

Principal

Programme: **Diploma in Electronics Engineering (Sandwich Pattern)**										
Course Code: **EC19206**				Course Title: **Digital Electronics**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2Hrs 30Min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
3	2	-	5	60	20	20	25*	-	25	150

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term

Rationale:

This course has been designed to make the students know about the fundamental principles of digital electronics and gain familiarity with the available IC chips. This subject aims to give a background in the broad field of digital systems design and microprocessors.

Course Outcomes: Student should be able to

CO1	Convert number from one number system to another.
CO2	Realize logic circuits using Boolean expressions.
CO3	Build simple combinational logic circuits.
CO4	Verify simple sequential logic circuits.
CO5	Interpret use of different Data converters and memories.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Number Systems and Codes:** 1.1 Number system: Base or radix of number system, binary, octal, decimal and hexadecimal number system. 1.2 Binary Arithmetic: Addition, subtraction. 1.3 Subtraction using 1's complement and 2's complement. 1.4 Codes: BCD, Gray Code, Excess-3 And ASCII code. 1.5 BCD arithmetic: BCD addition. **Course Outcome: CO1 Teaching Hours: 5 hrs. Marks: 8 (R- 0, U-2, A-6)**
2	**Binary Arithmetic:** 2.1 Logic gates: Basic gates (symbol, logical expression, truth table, equivalent circuit using Diode), universal gates (symbol, logical expression, truth table), special purpose gates. 2.2 Universal gates: NOR and NAND gates as universal gates.

	2.3 Boolean algebra: Laws of Boolean algebra, De-Morgan's theorems. 2.4 Logic families: TTL, CMOS, ECL, Characteristics of logic families. **Course Outcome: CO2 Teaching Hours: 10 hrs. Marks: 12(R-4, U-4, A- 4)**
3	**Combinational Logic gates:** 3.1 Standard Boolean representation: Sum of Product (SOP) form, types, Min- term. 3.2 Introduction to K-map: Designing of 2, 3, 4 variable K-map, K-map reduction technique for Boolean expression (Minimization of Boolean functions up to 4 variables) SOP form 3.3 Design of Arithmetic circuits and code converter using K map: Half and Full adder, Half and full subtractor , gray to binary and binary to gray (up to 4 bits) 3.4 Encoder: Introduction, priority encoder, Decimal to BCD encoder. 3.5 Decoder :Introduction, types (2:4, BCD to 7 segment display decoder) 3.6 Multiplexer and Demultiplexer : Working, truth table and applications of multiplexer and demultiplexer , MUX tree, IC 74151 as MUX; DEMUX tree, DEMUX as decoder, 74155 as DEMUX. **Course Outcome: CO3 Teaching Hours: 12 hrs. Marks: 14 (R-4, U-4, A- 6)**
4	**Sequential Logic Circuits:** 4.1 Basic memory cell: R-S latch using NAND. 4.2 Triggering methods: Edge trigger and level trigger. 4.3 SR Flip-Flops: Clocked SR Flip flop with preset and clear. 4.4 JK Flip Flops: JK flip flop, D flip flop, T flip flop, excitation table, MSJK Flip flop. 4.5 Shift Register: Logic diagram of 3- bit shift registers- Serial Input Serial Output, Serial Input Parallel Output, Parallel Input Parallel Output and n-bit universal Shift Register. 4.6 Counters: Asynchronous counter :Up/down Counter, modulus of counter 4.7 Synchronous Counter: Design of 3 bit up/down counter. 4.8 Decade counter: Block schematic of IC 7490-decade counter, IC 7490 as MOD-N Counter. **Course Outcome: CO4 Teaching Hours: 12 hrs. Marks:14 (R-2, U- 6, A-6)**
5	**Data converters and Memories:** 5.1 DAC: Types, weighted resistor circuit and R-2R ladder circuit, DAC IC 0808 Specifications. 5.2 ADC: Block diagram, types and working of dual slope ADC, SAR ADC, ADC IC 0808/0809, specification. 5.3 Memory: RAM and ROM basic building blocks, read and write operation, types of Semiconductor memories. **Course Outcome: CO5 Teaching Hours: 6 hrs. Marks:12 (R- 6, U- 6, A- 0)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Number Systems and Codes.	0	2	6	8
2	Binary Arithmetic.	4	4	4	12
3	Combinational Logic gates.	4	4	6	14
4	Sequential Logic Circuits.	2	6	6	14
5	Data converters and memories.	6	6	0	12
	Total	**16**	**22**	**22**	**60**

List of experiments: Total 10 experiments (or turns) out of 15 experiments (or turns)

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	2	CO2	Verify truth table of NOT, AND, OR, EX-OR, EX NOR, NOR, NAND gates.	2
2	3	CO3	Implement and verify truth table of De-Morgan's theorem.	2
3	3	CO3	Implement simple Boolean expression on bread board.	2
4	3	CO4	Implement and verify truth table of adder and subtractor.	2
5	4	CO4	Implement and verify truth table of RS flip-flop.	2
6	5	CO5	Implement and verify DAC using IC 0808.	2
7	3	CO1, CO3	Design Binary to gray code Converter.	2
8	2	CO2	Construct AND, OR and NOT using NAND /NOR gates.	2
9	3	CO3	Verify truth table of 8:1 multiplexer using IC 74151.	2
10	3	CO3	Design and implement 2:4 decoder.	2
11	3	CO3	To convert given BCD input to binary output and to study LED display using 7447 seven segment decoder/ driver.	2
12	4	CO4	Verify truth table of D flip flop & T flip flop.	2
13	4	CO4	To verify truth table of 3-bit SISO Shift register.	2
14	4	CO4	Verify 3-bit Ring counter using shift register.	2
15	All	CO3, CO4	Micro project.	2
		Total		**30**

Note: Experiments No. 1 to 5 and 15 are compulsory and should map all units and Cos .Remaining experiments are to be performed as per importance of the topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Modern digital electronics.	R.P.Jain,Tata McGraw Hill education, 4 th edition,2013	978-0-07-066911-6
2	Principals of Electronics.	Malvino, Tata McGraw Hill,	0-07-462236-6
3	Digital Design.	M.Moris Mano,PHI Publications,4 thedition 2013	81-203-0835-2
4	Digital electronics circuits and systems.	V.K.Puri, Tata McGraw Hill,1997	0-07-463317-1
5	DigitalElectronics.	Rangnekar S, 1st edition, 2001.	81-88057-03-7

E-References:

1. https://ndl.iitkgp.ac.in/
2. **https://nptel.ac.in**
3. **https://www.allaboutcircuits.com/**
4. **https://www.tutorialspoint.com.**

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	2	1	1	1
CO2	3	3	3	3	1	1	3	3	3	2
CO3	2	3	3	3	1	2	3	3	3	2
CO4	3	3	3	3	2	2	3	3	3	2
CO5	2	2	2	2	2	2	3	2	3	2

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Programme : **Diploma in CE/ME/CO/IF/EC/EE/IS(Sandwich Pattern)**										
Course Code: **SC19110**				Course Title: **ENGINEERING MATHEMATICS**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 Min.)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
4	**--**	**--**	**4**	**60**	**20**	**20**	**--**	---	**--**	**100**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term

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Rationale:

This subject is kept under the branch of sciences. This subject intends to teach student basic facts ,concepts, principles, and procedure of mathematics as a tool to analyze engineering problems and as such lays down foundation for understanding the engineering and core technology subject.

Course Outcomes: Student should be able to

CO1	Define the basic principles of function, limits, derivatives, complex number and relations between two variables.
CO2	Apply rules, concept and properties to solve the problems
CO3	Solve the given problems of integration using suitable method.

Course Content Details:

Unit No	Topics / Sub-topics
1	**1. Function** 1.1 Definition of variable,constant,intervals such as open,closed,semi-open etc 1.2 Definition of function,value of function and types of functions and simple examples **Course Outcome: CO1 Teaching Hours : 10 hrs Marks: 10 (R- 4, U-4, A-2)**
2	**2. Limits** 2.1 Definition of neighbourhood,concept and definiton of limit 2.2 Limits of Algebraic function 2.3 Limits of Trigonometric Functions with simple examples **Course Outcome: CO1 Teaching Hours : 10 hrs Marks: 10 (R- 2 , U-4 , A-4)**
3	**3. Derivatives & Application of derivative** 3.1 Definition of the derivative. 3.2 Derivatives of standard function.(No proof by first principle) 3.3 Differentiation of sum, difference, product and quotient of two or more functions 3.4 Differentiation of composite function with simple example. 3.5 Second order derivative. 3.6 Geometrical Meaning of Derivative 3.7 Tangents & Normals to the curve, 3.8 Maxima & minima of the function 3.9 Radius of curvature **Course Outcome: CO2 Teaching Hours : 10 hrs Marks:10 (R-4 , U- 4 , A-2)**
4	**4. Integration & Application of integration** 4.1 Definition of integration as antiderivative ,Integration of standard function 4.2 Rules of integration(Integration of sum, difference,scalar multiplication) without proof 4.3 Integration by substitution 4.4 Integration of composite function 4.5 Definiton of definite integral 4.6 Properties of definite integral with simple problems 4.7 Area under the curve 4.8 Area bounded by two curves **Course Outcome: CO3 Teaching Hours :10 hrs Marks:10 (R-4, U- 4 , A-2)**
5	**5. Complex Number:-** 5.1 Definition of complex number Cartesian ,Polar ,Exponential form of complex number 5.2 Algebra of complex number :-Equality , addition ,Substraction ,Multiplication & Division with simple examples **Course Outcome: CO2 Teaching Hours :10hrs Marks:10 (R- 2 , U-4 , A-4)**
6	**6. Numerical Analysis** 6.1 Solution of Algebraic equations using – i) Bisectional method ii) Regular – Falsi method , iii) Newton- Raphson method 6.2 Solution of simultaneous equation (i) Gauss elimination method (ii) Jacobi's method (iii) Gauss-Seidal method **Course Outcome: CO2 Teaching Hours : 10 hrs Marks: 10 (R- 2 , U- 4 , A- 4)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Function**	04	04	02	10
2	**Limits**	02	04	04	10
3	**Derivatives & Application of Derivatives**	04	04	02	10
4	**Integration & Application of Integration**	04	04	02	10
5	**Complex Number**	02	04	04	10
6	**Numerical Analysis**	02	04	04	10
	Total	**18**	**24**	**18**	**60**

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Mathematics for Polytechnic Students	S.P.Deshpande, Pune Vidyavardhini Graha Prakashan	-
2	Mathematics for Polytechnic Students (Volume I)	H.K.Dass, S.Chand Prakashan	9788121935241
3	Companions to Basic Maths	G.V.Kumbhojkar, Phadke Prakashan	10-B07951HJDQ 13-B07951HJDQ
4	Applied Mathematics	N.Raghvendra Bhatt late, Tata McGraw Hill Publication Shri R Mohan Singh	9789339219567, 9339219562

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1. www.math-magic.com
2. www.Scilab.org/-SCI Lab
3. www.mathworks.com/Products/Matlab/-MATLAB
4. www.wolfram.com/mathematica/-Mathematica
5. https://www.khanaacademy.org/math?gclid=CNqHuabCys4CFdoJaAoddHoPig
6. www.dplot.com/-Dplot
7. www.allmathcad.com/-Math CAD
8. www.easycalculation.com
9. https://www.vedantu.com/ncert-solutions/ncert-solutions-class-12-maths
10. MYCBSEGUIDE

CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			1			1	1		1
CO2	3			1			1	1		1
CO3	3			1			1	1		1

CO Vs PO and CO Vs PSO Mapping (MECHANICAL ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3			1			1	1	
CO2	3			1			1	1	
CO3	3			1			1	1	

CO Vs PO and CO Vs PSO Mapping (COMPUTER ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			1			1	1	1	
CO2	3			1			1	1	1	
CO3	3			1			1	1	1	

CO Vs PO and CO Vs PSO Mapping (INFORMATION TECHNOLOGY)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			1			1	1		1
CO2	3			1			1	1		1
CO3	3			1			1	1		1

CO Vs PO and CO Vs PSO Mapping (ELCTRONICS ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			1			1		1	1
CO2	3			1			1		1	1
CO3	3			1			1		1	1

CO Vs PO and CO Vs PSO Mapping (ELECTRICAL ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			1			1		1	
CO2	3			1			1		1	
CO3	3			1			1		1	

CO Vs PO and CO Vs PSO Mapping (INSTRUMENTATION ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3			1			1	1	1
CO2	3			1			1	1	1
CO3	3			1			1	1	1

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