Government Polytechnic, Mumbai

Department of Electronics Engineering

Semester II

(Course Contents)

For P-23 Curriculum

Programme: Diploma in Electronics Engineering

(Sandwich Pattern)

Government Polytechnic,Mumbai

(Academically Autonomous Institute,Government of Maharashtra)

Name of the Programme: Diploma in Electronics Engineering
Teachingand Examination Scheme(P23)
Duration of Programme: 6 Semester
Semester: Second

With Effect From Academic Year: 2023-24
Duration: 16 WEEKS
Scheme: P23

Sr No	Course Code	Course Title	Course Type	Total KS Hrs for Semester	Learning Scheme: Actual Contact Hrs./Week CL	TL	LL	Self-Learning (TermWork +Assignment)	National Learning Hrs/Week	Credits	Assessment Scheme: Paper duration(hrs.)	Theory: FA-TH T1 Max	FA-TH T2 Max	SA-TH Max	Total Max	Total Min	Based on LL & TL: Practical FA-PR Max	FA-PR Min	SA-PR Max PR	SA-PR Max OR	SA-PR Min	Based On Self Learning: SLA Max	SLA Min	Total Marks
1	EC 23102	Basic Electronics	DSC	2	3	-	4	1	8	4	2:30	20	20	60	100	40	25	10	25@	-	20	25	-	175
2	EC 23103	Electronic Instruments and Sensors	DSC	2	3	-	2	1	6	3	2:30	20	20	60	100	40	25	10	-	25@	10	25	-	175
3	EC 23104	Digital Electronics	DSC	-	3	-	4	1	8	4	2:30	20	20	60	100	40	25	10	25#	-	10	25	-	175
4	SC 23502	Engineering Mathematics	AEC	1	3	2	-	1	6	3	2:30	20	20	60	100	40	25	10	-	-	-	25	-	150
5	EC 23105	EDA Tool	DSC	-	-	-	4	-	4	2	-	-		-	-	-	-	-	50@	-	20	-	-	50
6	EC 23601	C Programming	SEC	-	2	-	2	-	4	2	-	-	-	-	-	-	25	10	25#	-	10	-	-	50
7	CE 23301	Environmental Studies	VEC	2			2	2	4	2	-	-		-	-	-	25	10		25@	10	25	-	75
Total				**07**	**14**	**2**	**18**	**6**	**40**	**20**					**400**		**150**		**125**	**50**		**125**		**850**

Abbreviations: CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, FA-Formative Assessment, SA-Summative Assessment, IKS-Indian Knowledge System, SLA-Self Learning Assessment **Legends** :@ Internal Assessment,#External Assessment, *#On Line Examination,@$Internal Online Examination

Note: 1 FA-TH represents marks of two class tests of 20marks each conducted during the semester.
2 If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as"Detained"in that semester
3 If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work
4 Notional Learning hours for the semester are(CL+LL+TL+SL)hrs *16Weeks
5 1credit is equivalent to 30 Notional hrs.
6 *Self learning hours shall not be reflected in the Time Table

Course Category: Discipline Specific Course Core(DSC) 4, Discipline Specific Elective(DSE) 0, Audit Course(AUC) 0, Value Education Course(VEC) 1, Intern /Apprenti /Project /Community(INP) 0, Ability Enhancement Course(AEC) 1, Skill Enhancement Course(SEC) 1, Interdisciplinary elective(IDE) 0

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CDC Co-ordinator
G. P. Mumbai

CDC Co-ordinator.
Electronics engg Department

H.O.D.
Electronics engg Department

CDC Incharge.
DTE Cell

Principal,
G.P.Mumbai

Programme : Diploma in EC												
Course Code: EC 23102					Course Title: Basic Electronics							
Compulsory / Optional: Compulsory												
Teaching Scheme and Credits						Examination Scheme						
CL	TL	LL	SLH	NLH	Credits	FA-TH	SA-TH (3 Hrs.)	FA-PR	SA		SLA	Total
									PR	OR		
3	-	4	1	8	4	40	60	25	25@	-	25	175

Total IKS Hrs. for course: 2hrs.

-Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents an average of two class tests of 30 marks each conducted during the term.
2. SA-TH represents the end term examination.
3. FA-PR represents the term work
4. SA-PR represents the end term practical examination.

I. 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.

II. Industry / Employer Expected Outcome

Basic electronics plays a crucial role in various industries.So there must be good understanding of concepts of electronics and problem solving skill .

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

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.

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Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's	Topics / Sub-topics
1	**TLO 1a.** Explain conductors,insulators and semiconductors. **TLO 1b.** Differentiate between P type and n-type semiconductor. **TLO 1c.** Explain working principle,characteristics and applications of semiconductor diode. **TLO 1d.** Differentiate between P-N junction diode and zener diode. **TLO 1e.** State applications of different diodes	**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 P-N juncion diode -Symbol, construction, working principle, forward and reverse biasing, V-I Characteristics ,diode current equation and applications . 1.4 Special purpose diodes: Zener, LED, Photodiode construction,working ,V-I characteristics and applications. **Course Outcome: CO1,CO2** **Teaching Hours: 7 hrs** **Marks: 12**
2	**TLO2a.** Describe working of Half wave,center tapped full wave and Bridge full wave rectifier with neat diagram. **TLO2b.** State need of filters. **TLO2c.** Explain working of shunt capacitor,series induct-or and Pi filter **TLO2d.** Interprete output waveforms of Clipper and Clamper circuit.	**Diode Applications** 2.1 Types of rectifier: Circuit, waveform and working of Half Wave, Full Wave(Center tapped and Bridge) rectifier. 2.2 Parameters of rectifier: Average DC value of current and voltage, ripple frequency, ripple factor, PIV of diode, TUF, efficiency of rectifier (no derivations) ,simple Numerical s on parameters. 2.3 Types of Filters: Waveform and working of Shunt capacitor, series inductor and Π filter 2.4 Clipper and clamper using diode: (A) Circuit diagram, waveform and working of positive and negative clipper. (B) Circuit diagram, waveform and working of positive and negative Clamper **Course Outcome: CO2** **Teaching Hours :10 hrs** **Marks: 14**
3	**TLO3a.** Understand the working principle of transistor. **TLO3b.** Differentiate different transistor configurations. **TLO 3c.** Explain concept of DC load line and explain factors affecting Q point. **TLO3d.**Analyse different BJT biasing techniques. **TLO3e.** Explain applications of transistor as switch and amplifier.	**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 :12hrs** **Marks: 16**

4	**TLO4a.** Explain working of FET for given application. **TLO 4b.** Explain given type of FET biasing method. **TLO4c.** Explain working of given type of MOSFET. **TLO 4d.** Differentiate the working principle of FET and MOSFET on basis of transfer characteristics.	**4.1 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 : 6 hrs** **Marks: 8**
5	**TLO 5a.** Describe working of the given transistorized regulator. **TLO5 b.** Describe working of block diagram of DC regulated power supply. **TLO 5c.** Calculate output voltage of given voltage regulator circuit.	**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 Types of IC voltage regulator: Fixed and variable (introduction) 5.5 78XX ,79XX series & LM317 :Pin diagram, working and specifications. 5.6 Simple Numerical's on Variable voltage regulators **Course Outcome: CO4** **Teaching Hours :9 hrs** **Marks: 10**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO a.** To plot V-I Characteristics of P-N junction diode . **LLO b.** To find cut-in voltage for P-N junction diode . **LLO c.** Interpret results from graph.	Test performance of semiconductor P-N diode.	2	CO1
2	**LLO a.** To plot V-I characteristics of zener diode . **LLO b.**Compare P-N junction diode and zener diode **LLO.c** Identify region of operation of zener diode	Test performance of Zener diode	2	CO1
3	**LLO a.** To Plot V-I characteristics LED **LLO b** Identify forward voltage drop of LED	Test performance of Light emitting Diode	2	CO1
4	**LLO a.** Build circuit on bread board . **LLO b.** Explain working of given rectifier **LLO c.**Analyse output waveform of rectifier	Build /Test half wave rectifier on bread board.	2	CO2
5	**LLO a.** Build circuit on bread board **LLO b.** Observe waveforms of CTFWR Rectifier.	Build /Test Center tapped full wave rectifier on bread board.	2	CO2

6	**LLO a.** Explain working of bridge rectifier. **LLO b.** Observe waveforms of Bridge rectifier.	Buid /test Bridge rectifier on bread board.	2	CO2
7	**LLO a.** Build filter using rectifier. **LLO b.** Explain working of shunt capacitor filter with half wave rectifier	Build /test Shunt capacitor filter with half wave rectifier.	2	CO2
8	**LLO a.** Identify need of filter. **LLO b.** build filter using FWR and observe output.	Build /test LC filter with full wave rectifier to measure Ripple factor	2	CO2
9	**LLO a.** Identify need of filter. **LLO b.** build filter using FWR and observe output.	Buid /test π filter with Bridge rectifier	2	CO2
10	**LLO a.** Build circuit and observe output waveform. **LLO b.** Identify use of diode in given circuit.. **LLO c.** Differentiate between positive and clipper.	Assemble Positive/negative clipper circuit on bread board and test performance.	2	CO2
11	**LLO a.** Interprete differenece between clipper and clamper. **LLO b.** Observe output waveform of Clamper. **LLO c.** Explain working of clamper.	.Assemble Positive/negative clamper circuit on bread board and test performance	2	CO2
12	**LLO a.** Explain working of transistor as switch. **LLO b.** Observe waveforms .	To test performance of Transistor as switch.	2	CO3
13	**LLO a.** State BJT configurations **LLO b.** Identify configuration of BJT. LLO c. Identify region of operations of BJT in CE mode. LLO d.Plot Input and output characteristics of BJT in CE mode.	Test performance of BJT working in CE mode.	2	CO3
14	**LLO a.** Study the characteristics of CB configuration. **LLO b.** Determine input and output resistance	Test performance of BJT working in CB mode	2	CO3
15	**LLO a.** Compare BJT and JFET. **LLO b.**Plot Characteristics of JFET. **LLO c.** Identify region of operation of JFET	To plot Drain characteristics of JFET.	2	CO3
16	LLO a. Compare JFET and MOSFET LLO b.Working of specified MOSFET LLO c. Identify region of opearations.	Test performance of MOSFET and plot characteristics	2	CO3
17	**LLO a.** Build circuit on bread board. **LLO b.** Working of zener voltage regulator. LLO c.	Test performance of zener diode as voltage regulator with varying load and line voltage	2	CO4
18	LLO a.Identify different sections of D.C power supply LLO b.Explain specifications of 78xx and 79xx IC	Buid /Test specified voltage DC supply using 78XX/ 79XX IC.	2	CO4

Note: 14 to 16 experiments should be performed in a term for completion of TW

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): (Minimum 10 Assignment)

1. Collect information of different diodes and their specifications.
2. Prepare a chart of comparison of P-N junction diode ,Zener diode,LED and photo-diode.
3. Build simple circuit using diode and observe its output. (use LED/P-N junction diode/Zener Diode)

4. Prepare a chart of Comparision of HWR,CTFWR and Bridge Rectifier.
5. Write applications of capacitor filter, inductor filter ,LC filter
6. Design clipper circuit for 5Vp-p input and 3V output.
7. Design clamper circuit for 12Vp-p input and 3V output.
8. Collect datasheet of LED, P-N junction diode, Zener Diode.
9. Collect datasheet of transistors (BC547,2N4403.2N5457,IRF3205)
10. Design variable DC power supply (0-12 V)

VI. Specification Table:

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	2	6	6	14
3	Transistor Fundamentals	6	6	4	16
4	Field Effect Transistor	2	4	2	8
5	Regulated Power supply	2	4	4	10
	Total	**16**	**24**	**20**	**60**

V1I.Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- Rubrics for continuous assessment based on process and product related performance indicators (25 marks)

Summative Assessment (Assessment of Learning)

- End term examination, Viva-voce, Workshop performance (25 marks)

VIII. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
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

Legends: - High:03, Medium:02, Low:01, No Mapping: --

IX. Suggested Learning Materials / Books

Sr. No	Author	Title	Publisher
1	Malvino, Albert Paul, David	Electronics Principles	(McGraw Hill Education)
2	Mehta V.K., Mehta Rohit	Principles of Electronics	(S. Chand and Company)
3	Bell, David	Fundamentals of Electronic Devices and Circuits	(Oxford University Press)
4	Sedha R.S.	Fundamentals of Electronic Devices and Circuits	(S. Chand)

X. Learning Websites & Portals

Sr. No	Link/portal	Description
1	https://ndl.iitkgp.ac.in/	National digital library of india.
2	www. electronicshub.org/tutorials/	Basic electronics Tutorials related to capacitors,resistors,filters,Op-amp
3	www.tutorialspoint.com/	Online tutorials,Courses and Le library
4	www.youtube.com	
5	https://phet.colorado.edu/en/simulation/legacy/semiconductor	Concepts of semiconductors ,diodes & transistor.

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr.Saurav Deore	AVI	SPL India pvt. ltd
2	Mrs. Avanti M. Ghadge	Lecturer in Electronics	G.P.Thane
3	Smt.Sanyogita B.Puri	Lecturer in Electronics	G.P.Mumbai
4	Smt.Padavi.T.Y	Lecturer in Electronics	G.P.Mumbai

Coordinator
Curriculum Development,
Department of Electronics Engineering

Head of Departments
Department of Electronics Engineering

I/C, Curriculum Development Cell

Principal

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CDC Co-ordinator
G. P. Mumbai

Programme : Diploma in ELECTRONICS ENGINEERING													
Course Code: EC23202					Course Title: Electronic Instruments and Sensors								
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Examination Scheme							
						FA-TH		SA-TH (3 Hrs.)	FA-PR	SA		SLA	Total
CL	TL	LL	SLH	NLH	Credits	T1	T2			PR	OR		
3	-	2	1	6	3	20	20	60	25	-	25	25	175

Total IKS Hrs. for course: 2hrs.

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:

1. FA-TH represents an average of two class tests of 30 marks each conducted during the term.
2. SA-TH represents the end term examination.
3. FA-PR represents the term work
4. SA-PR represents the end term practical examination.

I. Rationale:

Modern automated instrumentation system is an emerging field, used for data sensing, acquisition, transmission, analysis and control in various practical applications. Analog and digital instruments are mainly used to measure different process control parameters. The physical quantities/parameters are be converted into electrical signal with the help of various types of sensors and transducers and also used to maintain electronic control and automation system. Handling Test and Measuring Instrument is the essential activity of the diploma engineering pass outs (also called technologists) when they work in any electronic automation industry.

II. Industry / Employer Expected Outcome

The aim of this course is to help the student to maintain electronic automated system in process and manufacturing industries.

III. Course Outcomes:

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Interpret the characteristics and various measuring standards of instruments.
CO2	Use the relevant instrument to measure specified parameters.
CO3	Interpret working of various types of sensors and transducers.
CO4	Use various types of transducers and sensors to measure quantities.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's	Topics / Sub-topics
1	**TLO 1a.** Classify the given measuring Instrument. **TLO 1b.** Determine static and dynamic characteristics of the measuring Instruments with the given data. **TLO 1c.** Identify the standards for calibration of the given instrument with justification. **TLO 1d.** Explain with sketches the generalized procedure for calibration of the given instrument.	**1 Fundamentals of Electronics Measurements** 1.1 Fundamentals of Electronics Measurements 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 Definition of Standards and their classification: International, Primary, Secondary. 1.6 Calibration: Definition, Need of calibration **Course Outcome:CO1** **Teaching Hour:6 Hrs. Marks: 08**
2	**TLO 2a.** Determine resolution, sensitivity and accuracy of the given digital display. **TLO 2b.** Convert the PMMC instrument into DC ammeter for the given range. **TLO 2c.** Convert the PMMC instrument into DC voltmeter for the given range. **TLO 2d.** Explain with sketches the working of given type of ohm meter **TLO 2e.** AC voltmeter. **TLO 2f.** Prepare specification of the given analog meter.	**2 Analog and Digital Meters** 2.1 Indicating and display device: DArsonval movement, PMMC, moving iron, LCD, LED 2.2 Analog and Digital Meters: Type of Analog and Digital Meters, voltmeter, ammeter, ohm meter, extension of measuring range of meters, applications of meters **Course Outcome:CO1** **Teaching Hour:10 hrs Marks: 12**
3	**TLO3.a** Explain with sketches the working of the given blocks and type of oscilloscope. **TLO3.b** Explain with sketches the procedure to measure the given parameters using CRO.	**3 Oscilloscope and Function Generator** 3.1 CRO: Basic Block diagram and CRO, CRT, vertical deflection system, horizontal deflection system, Need of delay line, time base generator 3.2 Applications of CRO: 3.2.1 Time and frequency measurement

	TLO3.c Describe the function of the given blocks of signal/function generator. **TLO3.d** Explain with sketches the procedure to test the given types of signals using the relevant type test and measuring instrument. **TLO3.e** Select CRO, DSO, Spectrum analyzer and function generator for specified application with justification. **TLO3.f** Prepare specification for the given instrument	3.2.2 Voltage measurement 3.2.3 Lissagous patterns for Phase and Frequency measurement 3.2.4 Component testing using CRO 3.3 Block diagram of Dual trace and beam CRO 3.4 DSO: Block diagram of DSO and applications of DSO 3.5 Function Generator 3.6 Block diagram of function generator and applications of function generator 3.7 Spectrum analyzer: Block diagram of Spectrum analyzer and its applications **Course Outcome:CO2** **Teaching Hour:12 hrs Marks: 14**
	TLO4.a Describe the function of the given block of instrumentation system with the help of suitable block diagram. **TLO4.b** Select relevant transducers for given application with justification. **TLO4.c**Differentiate the features transducers and sensors for the given quantity measurement. **TLO4.d** Explain with sketches the working principle of given type of thermal Sensor. **TLO4.e**Select the relevant transducer for the given range of displacement **TLO4.f** measurement with justification.	**4 Sensors and Transducers** 4.1 Instrumentation System: Instrumentation System: Block diagram of instrumentation system, function of each block 4.2 Sensors and Transducers: basic definition, difference, classification of sensors 4.3 Thermal, optical, magnetic and electric sensors 4.4 Transducer : Need of transducer, types of transducer: Primary, secondary, active, passive, analog. digital resistive, capacitive, inductive (LVDT, RVDT), piezoelectric transducer, selection criteria of transducer **Course Outcome:CO3** **Teaching Hour:12 hrs Marks: 14**
	TLO5.a Explain with sketches the working principle of the given transducers. **TLO5.b** Select suitable transducer for the given level measurement with Justification. **TLO5.c** Select the relevant sensor for the given range of temperature measurement with justification. **TLO5.d** Select the relevant transducer for the given range of pressure measurement with justification **TLO5.e** Select the relevant sensor/ transducer for the specified application with justification.	**5 Applications of Sensors and Transducers** 5.1 Level measurement: Level measurement: Need of level measurement, float type, capacitive type working principle, and construction of each. 5.2 Temperature measurement: thermister, RTD (Pt-100), thermocouple: seeback and peltier effects(J.K.R,S,T types) 5.3 Pressure measurement: Types, Bourdon tube, Bellows, Diaphragm, pressure measurement using Bourdon tube and LVDT 5.4 Flow measurement: types, Variable head flow meter: Venturimeter, orifice plate meter, Variable area flow meter : Rota-meter, electromagnetic flow meter 5.5 Special transducers and measurement: Humidity measurement using hygrometer, pH measurement **Course Outcome:CO4** **Teaching Hour:8 hrs Marks: 12**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr. No.	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	Use analog meters to measure voltage, current and resistance	To measure voltage, current and resistance by analog multimeter.	2	CO2
2	Use digital meters to measure voltage, current and resistance	To measure voltage, current and resistance by Digital multimeter	2	CO2
3	Select the relevant range of CRO for various measurement by varying positions of front panel knobs.	Draw the layout of any one section of CRO trainer, check for Continuity.	2	CO3
4	Select the relevant CRO for various measurement by varying positions of front panel knobs.	Draw and label the front panel controls of Dual trace CRO. Measure frequency, voltage, phase difference.	2	CO2
5	Use function generator to generate different types of waveforms.	Draw and label the front panel controls of function generator to generate different types of waveforms and observe them on CRO.	2	CO2
6	Use DSO to measure amplitude and frequency of the given input signal.	Draw and label the front panel controls of DSO Measure frequency, voltage, phase difference.	2	CO2
7	Generate Lissajous pattern on CRO to measure frequency and phase of the given input signal.	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	CO2
8	Interpret relation between Linear displacement and output voltage using LVD'T.	To Test relation between Linear displacement and output voltage using LVD'T.	2	CO3
9	Analyze applied pressure using strain gauge.	To measure applied pressure using strain gauge.	2	CO3
10	Use RTD (Pt-100) to measure temperature.	To measure temperature using RTD (Pt-100).	2	CO3,4
11	Use thermocouple to measure temperature of liquid.	To measure temperature using thermocouple.	2	CO4
12	Analyze bourdon tube and LVDT to measure applied pressure	To measure applied pressure using bourdon tube and LVDT.	2	CO3,4
13	Analyze flow of fluid using Venturi tube.	To measure flow of fluid using Venturi tube.	2	CO4
14	Use rotameter to measure flow of liquid.	To measure flow of liquid using rotameter.	2	CO4
15	Use orifice plate 10 measure flow of fluid.	To measure flow of fluid using orifice plate 10.	2	CO4

Note: 10 experiments should be performed in a term for completion of TW

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): (Minimum 10 Assignments)

a. **Analog and digital meters:** Build and test voltmeter (0-10V. mA, 5000hms) using PMMC.

b. **Analog and digital meters:** Build and test ammeter (0-100 mA)using PMMC.

c. **Signal conditioning:** Design D.C signal conditioning circuit using Wheatstone bridge and implement that on PCB.

d. **Function Generator:** Build and Test function generator using IC 8038(sine wave, square wave, triangular wave upto 100 kHz) on the PCB.

e. **Oscilloscope Function generator, Spectrum analyzer:** Survey of different electronic instruments.

VI. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Fundamentals of Electronics Measurements	2	2	4	08
2	Analog and Digital Meters	2	6	4	12
3	Oscilloscope and Function Generator	2	4	8	14
4	Sensors and Transducers	2	6	6	14
5	Applications of Sensors and Transducers	2	4	6	12
Total		10	22	28	60

V1I.Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

Rubrics for continuous assessment based on process and product related performance indicators (25 marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (25 marks)

VIII. Suggested COs - POs Matrix Form

CO	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO- 1	PSO- 2	PSO- 3
CO1				2	1	1	2	1		1
CO2		3	3	3	2	2	3	3	3	3
CO3		2	3	3	3	2	2		1	1
CO4		3	2	2	2	2	2	1	2	3
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

IX. Suggested Learning Materials / Books

Sr. No	Author	Title	Publisher
1.	Sawhney, A K.	Electrical and Electronic Measurements and Instrumentation	Dhanpat Rai & Sons,New Delhi 2005, ISBN: 13-9788177000160
2.	Kalsi, H.S.	Electronic Instrumentation |	McGraw Hill, New Delhi, 2010 ISBN:13-9780070702066
3.	David. A. Bell	Electronic Instrumentation and Measurements	Ox lord University Press, New Delhi, 2013, ISBN: 10:0-19-569614-X
4.	Helfrick, A.D. Cooper, W.D.	Modem Electronic Instrumentation and Measurement Techniques	Pearson Eduction India," Edition, New Delhi, 2015 , ISBN-13: 978-9332556065

X. Learning Websites & Portals

Sr. No	Link / Portal	Description
1	www.instrumentationcontrolbox.com	Unit and measurement,
2	www.circuitstoday.com	Electronics Mini projects
3	www.myklassroom.com/Engineering.../Electronics-&-Instrumentation-Engg.-(EIE)	Concept of Electronic measurement
4	www.en.wikipedia.org/wiki/List_of electrical and electronic_measuring_equipment	Concept of Electronic measurement
5	www.tutorialspoint.com	Basic tutorials & Instruments
6	www.electronics-tutorials.com	Basics of Electronics

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr. Sourabh Deore	Associate Project Engineer	AVI-SPL India Pvt. Ltd
2	Mrs. S. M. Patil	Sel. Grade Lecturer in Electronics	Government Polytechnic, Pen
3	Dr. H. M. Pardeshi	Sel. Grade Lecturer in Electronics	Government Polytechnic, Mumbai
4	Ms. T.K. Balsaraf	Lecturer in Electronics	Government Polytechnic, Mumbai

Coordinator
Curriculum Development,
Department of Electronics Engineering

Head of Departments
Department of Electronics Engineering

I/C, Curriculum Development Cell

Principal

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CDC Co-ordinator
G. P. Mumbai

Programme : Diploma in Electronics engineering	
Course Code:EC23104	Course Title: DIGITAL ELECTRONICS
Compulsory / Optional: Compulsory	

Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2.30Hrs.)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
3	-	4	1	8	4	20	20	60	25	25#	-	25	175

Total IKS Hrs. for course: 3Hrs.

-Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents an average of two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.
3. FA-PR represents the term work
4. SA-PR represents the end term practical examination.

I. 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.

II Industry / Employer Expected Outcome

By incorporating digital tools used in the industry, curriculum design ensures that students graduate with the skills required by employers, contributing to a smoother transition from academia to the professional engineering world and enhancing their practical skills in a controlled environment.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Understand concept of number systems, code conversion and Binary operations.
CO2	Realize logic circuits using Boolean expressions
CO3	Build simple combinational logic circuits.
CO4	Build and Verify simple sequential logic circuits.
CO5	Interpret use of different Data converters and memories.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's	Topics / Sub-topics
1	**TLO 1a. convert the number into the specified number system.** **TLO 1b.** perform binary arithmetic operations on binary numbers. **TLO 1c.** Perform binary subtraction using 1's complement and 2's complement with examples. **TLO 1d.** convert of coded numbers into other special code. **TLO 1e** perform BCD addition of numbers of decimal numbers.	**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 and code conversion: BCD, Gray Code, Excess-3 And ASCII code. 1.5 BCD arithmetic: BCD addition **Course Outcome: CO1** **Teaching Hours: 5 hrs** **Marks: 8**
2	**TLO2a.** Understand Logic gates with symbols and truth table. **TLO2b.** Develop basic gates using NAND and NOR Gate as universal gate circular motion. **TLO2c.** Simplify the given expression using Boolean laws and develop logical circuits using Boolean expression. **TLO2d.** Compare the salient characteristics of the given Logic families.	**LOGIC GATES AND LOGIC FAMILIES:** 2.1 Logic gates: Basic gates (symbol, logical expression, truth table), 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 :10hrs** **Marks: 12**

3	**TLO3a**. Develop standard logic circuit in SOP form for the given logical expression. **TLO3b.** Minimize the given logic expression using K-map. **TLO 3c.** Design Adder, Subtractor and gray code converter Using K-map technique. **TLO3d.** Develop the specified code converter. **TLO3e.** Understand MUX/DEMUX Technique and develop MUX/DEMUX Tree for the given numbers of input and output lines.	**COMBINATIONAL LOGIC CIRCUITS:** **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. **Course Outcome: CO3** **Teaching Hours :12hrs** **Marks: 14**
4	**TLO4a.** Understand R-S Latch circuit using NAND and relevant triggering techniques. **TLO 4b**.Understand S-R AND JK flip flop to design MSJK, D and T flip flop. **TLO4c.**Construct different types of shift registers. **TLO 4d**. Construct Decade counter, ,Ring counter, Twisted ring counter	**SEQUENTIAL LOGIC CIRCUITS:** 4.1 Difference between combinational and sequential circuits 4.2 Basic1 bit memory cell 4.3 Triggering methods: Edge trigger and level trigger 4.4 SR Flip-Flops: Clocked SR Flip flop with preset and clear 4.5 JK Flip Flops: JK flip flop, D flip flop, T flip flop, MSJK Flip flop 4.6 Shift Register: Logic diagram of 3- bit shift registers- Serial Input Serial Output, Serial Input Parallel Output, Parallel Input Parallel Output , Parallel Input Serial Output 4.7 Counters: Asynchronous counter :Up/down Counter, modulus of counter, Decade counter, Ring counter, Twisted ring counter **Course Outcome: CO4** **Teaching Hours :12 hrs** **Marks: 14**

5	**TLO 5a.** Calculate the output voltage of the R-2R ladder for the given specified digital input. **TLO 5b.**Calculate the output voltage of the weighted resistor DAC for the given specified digital input. **TLO 5c.**Explain with circuit diagram the working principle of the given type of ADC. **TLO 5d.**Explain with circuit diagram the working principle of the given type of memories.	**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. Successive Approximation Register ADC, ADC IC 0808/0809, specification **5.3** Memory: Types of Semiconductor memories. RAM and ROM basic building blocks, read and write operation **Course Outcome: CO5** **Teaching Hours :6 hrs** **Marks: 12**

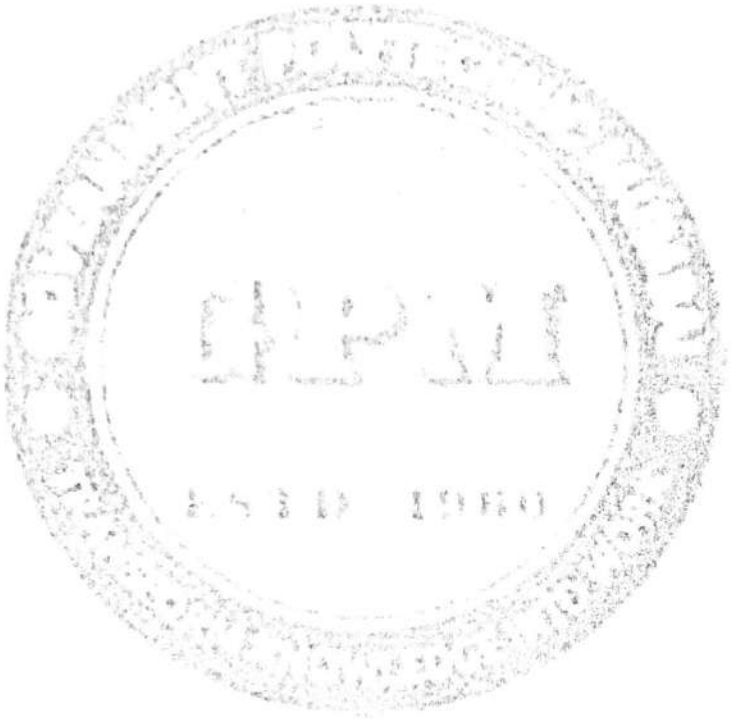
IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO a.** Identify IC number as per logical function. **LLO b.** Use Bread board, IC and power supply. **LLO c.** Verify truth table of basic gates and universal gates.	Verify truth table of NOT, AND, OR, EX-OR,EX NOR, NOR, NAND gates.	4	CO2
2	**LLO a.** Identify IC number as per logical function. **LLO b.** Use Bread board,IC and power supply. **LLO c.** Verify truth table of De-Morgan's theorem.	Implement and verify truth table of De-Morgan's theorem.	4	CO3
3	**LLO a.** Identify IC number as per logical function. **LLO b.** Use Bread board, IC and power supply. **LLO c.** Verify truth table of simplified equation .	Implement simple Boolean expression on bread board.	4	CO2
4	**LLO a.** Identify IC number as per logical function. **LLO b.** Use Bread board, IC and power supply. **LLO c.** Verify truth table of universal gates.	Construct AND, OR and NOT using NAND /NOR gates.	4	CO2

5	**LLO a.** Identify IC number as perlogical circuit. **LLO b.** Use Bread board, IC and powersupply. **LLO c.** Verify truth table of Half and Fulladder.	Implement and verify truth table of Half adder and Full adder.	4	CO3
6	**LLO a.** Identify IC number as perlogical circuit. **LLO b.** Use Bread board, IC and powersupply. **LLO c.** Verify truth table of Half and Fullsubtractor.	Implement and verify truth table of Half subtractor and Full subtractor.	4	CO3
7	**LLO a.** Identify IC number as per logicalcircuit. **LLO b.** Use Bread board, IC and powersupply. **LLO c.** Verify truth table of Binary to Graycode converter.	Design Binary to gray code Converter and gray to binary.	4	CO1,CO3
8	**LLO a.** Use Bread board, IC andpower supply. **LLO b.**. Verify truth table and observedisplay output.	Construct and test BCD to 7 SEGENT Decoder using IC 7447/7448.	4	CO3
9	LLO a. Identify IC number as perlogical circuit. LLO b. Use Bread board, IC and powersupply. LLO c. Verify truth table RS flip flop.	Implement and verify truth table of RS flip-flop using NAND gate.	4	CO4
10	LLO a. Identify IC number as perlogical circuit. LLO b. Use Bread board, IC and powersupply. LLO c. Verify truth table D flip flop	Verify truth table of D flip flop & T flip flop using IC 7476.	4	CO4
12	LLO a. Use Bread board, IC andpower supply. LLO b. verify T.T. of 3 Bit counter	Implement 3 bit ripple counter using IC 7476.	4	CO4
13	LLO a. Use Bread board, IC andpower supply. LLO b. verify T.T. of MSJK FF	Construct and verify MSJK flip flop T.T . using 7476	4	CO4
14	LLO a. Use Bread board, IC andpower supply. LLO b. verify T.T. of D AND T FF	Verify truth table of D and T flip flop using IC7476	4	CO4

15	LLO a. Use Bread board, IC andpower supply. LLO b. verify T.T. of Decade counter	Construct and verify T.T . of Decade counter using 7490	4	CO4

Note: 10 to 12 experiments should be performed in a term for completion of TW



V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): (Minimum 10 Assignments)

1. Convert decimal number into other number system .
2. Prepare chart of basic gates with logic symbol and truth table.
3. Prepare chart of Universal gates with logic symbol and truth table.
4. Draw basic gates using NAND and NOR GATE.
5. Prepare chart of De-Morgan's theorem.
6. Realize logical circuit for given Boolean expression .
7. Simplify given Boolean expression using Boolean laws.
8. Design half adder and full adder using K-map.
9. Design half subtractor and full subtractor using K-map.
10. Design multiplexer /demultiplexer using Tree concept.
11. Explain S-R flip flop with T.T.
12. Describe working principle of master slave FF with race around condition.
13. Explain T and D type flip flop and triggering methods.
14. Classify shift register and draw their logical block diagram,
15. Draw 4 bit ripple counter with waveform.
16. Draw block diagram of RAM and explain read and write operation.
17. Design circuit for LED flasher.
18. Build circuit to test 7 segment display.

VI. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	NUMBER SYSTEMS AND CODES	2	0	6	8
2	LOGIC GATES AND LOGIC FAMILIES	4	4	4	12
3	COMBINATIONAL LOGIC CIRCUITS	4	4	6	14
4	SEQUENTIAL LOGIC CIRCUITS	4	6	4	14
5	DATA CONVERTERS AND MEMORIES	4	8	0	12
	Total	**18**	**22**	**20**	**60**

V11.Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- Rubrics for continuous assessment based on process and product related performance indicators (25 marks)

Summative Assessment (Assessment of Learning)

- End term examination, Viva-voce, Workshop performance

VIII. Suggested COs - POs Matrix Form(Information technology /Computer Engineering)

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Disciplie Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	2	1	1	--	--	1
CO2	1	2	3	2	--	--	--	1	2	1
CO3	3	2	1	1	1	--	1	1	1	1
CO4	3	--	1	1	1	--	1	2	2	2
CO5	2	--	1	2	1	--	1	1	2	2

Legends: - High:03, Medium:02, Low:01, No Mapping: --

IX. Suggested Learning Materials / Books

Sr. No	Author	Title	Publisher
1	R.P.Jain,	Modern digital electronics.	McGraw Hill Publishing . 4 th edition,2013
2	Malvino A.P. ,Leach D.P.	Principals of Electronics.	McGraw Hill, New Delhi ,2014
3	Salivahanan.s.,Arivazhagan S.	Digital circuits and designs	Vikas publishing House, New Delhi
4	PURI V.K.	Digital electronics	McGraw Hill ,New Delhi,2016
5	Maini Anil K.	Digital electronics : principles and Integrated circuits	Wiley India Delhi
6	Floyd ,Thomas	Digital Fundamentals	Pearson Education India, New Delhi

X. Learning Websites & Portals

Sr. No	Link / Portal	Description
1	www.allaboutcircuits.com	Concept of number system ,gates and combinational and sequential circuits
2	www.codesand tutorials .com	Concept of number system ,gates and combinational and sequential circuits
3	www.people.edu.sju.com	Problems :binary arithmatic
4	www.mathsysfun.com	Binary number system
5	www.tutorialspoint.com	Concept of number system ,gates and combinational and sequential circuits
6	www.nptel.ac.in.com	Concept of number system ,gates and combinational and sequential circuits

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr. S.N. Isal	Director	Techmahodey
2	MS. Avanti Ghadge	Lecturer in Electronics	Government Polytechnic. Thane
3	Mrs. A.D. Kalyankar	Lecturer in Electronics	Government Polytechnic. Mumbai
4	Ms. T. Y. Padavi	Lecturer in Electronics	Government Polytechnic. Mumbai

Coordinator
Curriculum Development,
Department of Electronics Engineering

Head of Departments
Department of Electronics Engineering

I/C, Curriculum Development Cell

Principal

APPROVED COPY
CDC Co-ordinator
G. P. Mumbai

	Programme : Diploma in EE / EC / IS / CE / ME / CO / IF / RT		
Course Code: SC23502		Course Title : ENGINEERING MATHEMATICS	
	Compulsory / Optional: Compulsory		

Learning Scheme and Credits						Assessment Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2Hrs.30 Min)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
3	2	--	1	6	3	20	20	60	25	--	--	25	150

Total IKS Hrs. for course: 01 Hrs

Abbreviations: CL- ClassRoom Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination
Note:
1. FA-TH represents Total of two class tests of 20 marks each conducted during the term.
2. FA-PR represents Tutorial Term work of 25 Marks
3. SLA represents self learning Assessment of 25 Marks
4. SA-TH represents the end term examination of 60 Marks

I. Rationale

An Engineering Mathematics course covering integration, definite integration, differential equations, numerical methods, and probability distribution, equips engineering students with essential problem-solving tools. It enables them to model and analyze complex systems, make informed decisions and address real-world engineering challenges effectively.

II. Industry / Employer Expected Outcome

Engineers applying Mathematics should proficiently solve complex real-world problems, enhancing decision-making, design and innovation with precision and efficiency.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning.

CO1	Solve the broad-based engineering problems of integration using suitable methods.
CO2	Use integration to find area, volume, mean value and root mean square value for given engineering related problems.
CO3	Apply the differential equation to find the solutions of given programme specific problems.
CO4	Apply numerical methods to solve programme specific problems.
CO5	Use probability distributions to solve elementary engineering problems.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's.	Topics / Sub-topics
1	TLO 1.1 Solve the given simple problem(s)based on rules of integration. TLO 1.2 Evaluate the given simple integral(s) using substitution method. TLO 1.3 Integrate given simple functions using the integration by parts. TLO 1.4 Solve the given simple integral by partial fractions.	**Unit-I Indefinite Integration** 1.1 Simple Integration: Rules of integration and integration of 1.2 standard functions 1.3 Integration by substitution. 1.4 Integration by parts. 1.5 Integration by partial fractions
	Course Outcome : CO1	**Teaching Hours : 9** **Marks: 10**
2	TLO 2.1 Solve given examples based on definite Integration. TLO 2.2 Use properties of definite integration to solve given problems. TLO2.3Utilize the concept of definite integration to find the following (a)Area under the curve (b)Area between given two curves (c) Volume of revolution (d) Mean value (e) Root mean square value	**Unit- II Definite Integration and Applications** 2.1 Definite Integration: Definition, rules of definite integration with simple examples 2.2 Properties of definite integral (without proof) and simple examples. 2.3 Applications of integration: area under the curve, area between given two curves, volume of revolution, mean value and root mean square value.
	Course Outcome : CO2	**Teaching Hours : 10** **Marks: 14**
3	TLO3.1 Find the order and degree of given Differential equations. TLO3.2 Form simple differential equation for given elementary engineering problems. TLO3.3 Solve given differential equations using the methods of Variable separable and Exact Differential Equation (Introduce the concept of partial differential equation). TLO3.4 Solve given Linear Differential Equation. TLO3.5 Solve given programme specific problems using the category of differential equation.	Unit-**III** Differential Equation 3.1 Concept of Differential Equation. 3.2 Order, degree and formation of Differential equations 3.3 Methods of solving differential equations:Variable separable form, Homogeneous D.E., Exact Differential Equation, Linear Differential Equation 3.4 Application of differential equations and related engineering problem(s).
	Course Outcome : CO3	**Teaching Hours : 10** **Marks: 14**

4	TLO 4.1 Find roots of algebraic equations by using appropriate methods. TLO 4.2 Solve the system of equations in three unknowns by using given methods. TLO 4.3 Apply the concept of numerical integration to solve given engineering problems. TLO 4.4 Solve problems using Yukti bhasa iterative methods for finding approximate square root. (IKS)	**Unit-IV: Numerical Methods and Numerical Integrations** 4.1 Solution of algebraic equations: Bisection method, Regula falsi method and Newton—Raphson method. 4.2 Solution of simultaneous equations containing three Unknowns by Gauss elimination method. 4.3 Solution of simultaneous equations containing three Unknowns by iterative methods: Gauss Seidal and Jacobi's method. 4.4 Numerical Integration: Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8 th rule. (Without proof) 4.5 Yukti bhasa iterative methods for finding approximate square root. (IKS)
	Course Outcome : CO4	**Teaching Hours : 8** **Marks: 12**
5	TLO 5.1 Solve given problems based on repeated trials using Binomial distribution. TLO 5.2 Solve given problems when number of trials are large and probability is very small. TLO 5.3 Utilize the concept of normal distribution to solve related engineering problems.	**Unit-V: Probability Distribution** 5.1 Binomial distribution. 5.2 Poisson's distribution. 5.3 Normal distribution.
	Course Outcome : CO5	**Teaching Hours : 8** **Marks: 10**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO1.1Solve simple problems of Integration by substitution	1	Integration by substitution	2	CO1
LLO2.1Solve integration using by parts	2	Integration by parts	2	CO1
LLO3.1Solve integration by Partial fractions	3	Integration by partial fractions.	2	CO1
LLO4.1Solve examples on Definite Integral Based on given methods.	4	Definite Integral based on given methods.	2	CO2
LLO5.1Solve problems on properties of Definite integral.	5	Properties of definite integral	2	CO2
LLO6.1Solve given problems for finding The area under the curve, area between two curves and volume of revolution.	6	Area under the curve, area between two curves and volume of revolution.	2	CO2
LLO7.1Solve examples on mean value and Root mean square value.	7	Mean value and root mean square value.	2	CO2
LLO8.1Solve examples on order, degree And formation of differential equation.	8	Order, degree and formation of differential equation.	2	CO3
LLO9.1Solve first order first degree D.E. Using variable separable method	9	Variable separable method and homogeneous method.	2	CO3

and homogeneous method.				
LLO10.1Solve first order first degree D.E. Using exact differential equation and linear differential equation.	10	Exact differential equation and linear differential equation.	2	CO3
LLO11.1Solve engineering application Problems using differential equation.	11	Applications of differential equations.	2	CO3
LLO12.1Solve problems on Bisection Method and Regula falsi method.	12	Bisection Method and Regula Falsi Method	2	CO4
LLO13.1Solve problems on Newton-Raphson method and Gauss elimination method.	13	Newton-Raphson method and Gauss elimination method.	2	CO4
LLO14.1Solve problems on Jacobi's method and Gauss Seidal Method.	14	Jacobi's method and Gauss Seidal Method.	2	CO4
LLO 15.1 Solve examples on Trapezoidal rule,Simpson's1/3rd rule and Simpson's3/8 th rule.	15	Trapezoidal rule,Simpson's 1/3rd rule And Simpson's 3/8thrule.	2	CO4
LLO16.1Solve problems on Bisection method, Regula falsi method, Newton- Raphson method using spread sheet .	16	Bisection method, Regula falsi method, Newton-Raphson method problems using spreadsheet.	2	CO4
LLO17.1UseYukti bhasa iterative methods For finding approximate value of square root and cube root. (IKS)	17	Yukti bhasa iterative methods for Finding approximate value of square root and cube root. (IKS)	2	CO4
LLO18.1Solve engineering problems using Binomial distribution.	18	Binomial Distribution	2	CO5
LLO19.1Solve engineering problems using Poisson distribution.	19	Poisson Distribution	2	CO5
LLO20.1Solve engineering problems using Binomial distribution.	20	Normal Distribution	2	CO5

Note: 1. Take any 10-12 tutorials out of 20 and ensured that all the units are covered. 2. Take tutorial in the batch size of 20 to 30 students. 3. Give students at least 10 problems to solve in each tutorial.

Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

- Choose a real world problem and formulate a differential equation to model it.
- Solve the formulated differential equation and interpret the solution in the context of the problem
- Collect examples based on real world applications of Integration
- Collect examples based on real world applications of Definite Integration
- Consider a fair six-sided die. Define a discrete random variable X as the number obtained when rolling the die. Construct the probability distribution table for X
- Collect examples based on real world applications of Newton Raphson Method.
- Collect examples based on real world applications of Binomial Distribution.
- Collect examples based on real world applications of Poisson Distribution.
- Collect examples based on real world applications of Normal Distribution.

- Collect examples based on real world applications of Differential Equations
- Collect examples based on real world applications of Gauss Seidal Method.
- Collect examples based on real world applications of Gauss Jacobi's Method

Attempt any 5-7 Assignment, out of the given list

V. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Indefinite Integration	2	4	4	10
2	Definite Integration and Applications	2	4	8	14
3	Differential Equation	2	4	8	14
4	Numerical Methods and Numerical Integrations	2	4	6	12
5	Probability Distribution	2	4	4	10
	Total	10	20	30	60

VI. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- TH- Progressive /Periodic Test test each of 20 Marks
- TL - Continuous Assessment of Tutorials for 25 Marks
- SL - Continuous Assessment of Self Learning for 25 Marks

Summative Assessment (Assessment of Learning)

- **TH** - Term End examination of 60 Marks

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1		-	1		1			
CO2	3	1			1		1			
CO3	3	2	1	1	1	1	1			
CO4	2	3	2	2	1	1	1			
CO5	2	2	1	1	2	1	2			

Legends: - High:03, Medium:02, Low:01, No Mapping: --

VII. Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	Grewal B.S.	Higher Engineering Mathematics	KhannapublicationNewDelhi,2013ISBN : 8174091955
2	Dutta. D	A text book of Engineering Mathematics	NewagepublicationNewDelhi,2006 ISBN:978-81-224-1689-3
3	Kreysizg, Ervin	Advance Engineering Mathematics	WileypublicationNewDelhi2016ISBN: 978-81-265-5423-2
4	Das H.K.	Advance Engineering Mathematics	SChandpublicationNewDelhi2008 ISBN: 9788121903455
5	S.S. Sastry	Introductory Methods of Numerical Analysis	PHILearning Private Limited, NewDelhi. ISBN-978-81-203-4592-8
6	C.S. Seshadri	Studies in the History of Indian Mathematics	Hindustan Book Agency (India) P19 Green Park Extension NewDelhi.ISBN978-93- 80250-06-9
7	Marvin L.Bittinger David J.E lenbogen ScottA. Surgent	Calculus and Its Applications	Addison-Wesley10thEditionISBN-13: 978-0-321-69433-1
8	Gareth James, Daniela Witten,Trevor Hastie Robert and Tibshirani	An Introduction to Statistical Learning with Applications in R	Springer NewYork Heidelberg Dordrecht LondonISBN978-1-4614-7137-0ISBN 978-1-4614-7138-7(eBook)

VIII. Learning Websites & Portals

Sr.No	Link /Portal	Description
1	https://www.wolframalpha.com/	Solving mathematical problems, performing calculations, and visualizing mathematical concepts.
2	http://www.sosmath.com/	Free resources and tutorials
3	http://mathworld.wolfram.com/	Extensive math encyclopedia with detailed explanations of mathematical concepts
4	https://www.mathsisfun.com/	Explanations and interactive lessons covering various math topics, from basic arithmetic to advanced
5	http://tutorial.math.lamar.edu/	Comprehensive set of notes and tutorials covering a wide range of mathematics topics, including calculus
6	https://www.purplemath.com/	Purple math is a great resource for students seeking help with algebra and other foundational math
7	https://www.brilliant.org/	Interactive learning in Mathematics
8	https://www.edx.org/	Offers a variety of courses
9	https://www.coursera.org/	Coursera offers online courses in applied mathematics from universities and institutions around the
10	https://ocw.mit.edu/index.htm	The Massachusetts Institute of Technology (MIT) offers free access to course materials for a wide range

IX.Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr.Santosh Bhandekar	Lecturer in Mathematics	Government Polytechnic, Osmanabad
2	Mr.Abhijit S.Patil	Lecturer in Mathematics	Government Polytechnic ,Mumbai
3	Mr.Vinod S.Patil	Lecturer in Mathematics	Government Polytechnic ,Mumbai

A.S.Patil V.S.Patil

Coordinator,
Curriculum Development,
Department of Sci. & Humanities

C&A Thorat

Head of Department
Department of Sci. & Humanities

I/C, Curriculum Development Cell

Principal

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CDC Co-ordinator
G. P. Mumbai

Programme : Diploma in ELECTRONICS ENGINEERING													
Course Code: EC23105					Course Title: Electronic Design Automation Tools								
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (3 Hrs.)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
-	-	4	-	4	2	-	-	-	-	50@	-	-	50

Total IKS Hrs. for course: 2hrs.

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:

1. FA-TH represents an average of two class tests of 30 marks each conducted during the term.
2. SA-TH represents the end term examination.
3. FA-PR represents the term work
4. SA-PR represents the end term practical examination.

I. Rationale:

This course introduces students to the fundamental principles of circuit design and simulation using Electronic Design Automation (EDA) tools. Enhance capabilities to build, analyze, and optimize electronic circuit. gaining practical experience in a virtual environment. Which will help them for troubleshooting large circuits without actual implementation that can minimizes implementation cost drastically.

II. Industry / Employer Expected Outcome

IO1	Students gain the skills to work in PCB designing and Manufacturing industries
IO2	Students using EDA tools will be well-prepared to contribute effectively to electronic design projects, ensuring the creation of reliable, manufacturable, and high-performance electronic systems.

III. Course Outcomes:

Students will be able to achieve and demonstrate the following COs on completion of course based learning

CO1	Simulate and interpret Electronics Circuit using Multisim simulator tool.
CO2	Simulate and interpret code using Keil µVision environment.
CO3	Interface microcontrollers with various peripherals

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's	Topics / Sub-topics
1	TLO 1.1 Verify the laws and principles of electrical circuits 1.2 Design and simulate Electrical circuits. 1.3 Design and analyze the various electronic circuits 1.4 Verify the laws and principles of Digital circuits 1.5 Design and simulate combinational and sequential circuits 1.6 design single sided PCB for basic circuits.	**1. Multisim simulator:** 1.1 installation process of Multisim Simulator software 1.2 procedure for design, simulate and analyze circuits 1.2.1 Electrical Circuits. 1.2.2 Electronics Circuits 1.2.3 Digital Circuits **1.3. PCB Design** 1.3.1 Transferring the design for PCB layout 1.3.2 Board outline selection, Part placement 1.3.3 Layer management 1.3.4 PCB file generation 1.3.5 Procedure for single sided PCB **Course Outcome:CO1** **Teaching Hour: 34 Hrs. Marks: -08**
2	TLO2.1 Familiarized with Keil Integrated Development Environment (IDE). TLO2.2 Simulate programs in Keil µVision Environment	**2. Keil µVision IDE** 2.1 Keil µVision Environment 2.2 Installation and setup of Keil µVision. 2.3 Overview of the IDE features. 2.4 Project creation and management. **Course Outcome: CO2** **Teaching Hour: 16 Hrs Marks: -12**

3	TLO3.1 Familiarized with Proteus Simulator software TLO3.2 Simulate interfacing electronic circuits using Proteus	**3. Proteus Simulator Software:** 3.1. Overview of Proteus simulation software 3.2 Installation and setup 3.3 Introduction to the Proteus environment and interface 3.4 Creating and managing projects 3.5 Building and simulating interfacing circuit **Course Outcome: CO3** **Teaching Hour: 14 hrs** **Marks: -**

IV.Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr. No.	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Verify the laws and principles of electrical circuits LLO1.2 Measure dc Current and voltage using nodal and mesh analysis.	Verify KCL and KVL laws using Multisim	2	CO1
2	LLO 2.1 Measure cut off voltage LLO 2.2 Find type of material used for manufacturing diode.	Plot VI Characteristics of a PN Junction Diode (IN 4001) using Multisim	2	CO1
3	LLO 3.1 Identify the zener breakdown voltage LLO 3.2 Understand the impact of load resistance on the zener breakdown.	Plot VI Characteristics of a Zener Diode using, Multisim	2	CO1
4	LLO 4.1 Select appropriate components from the Multisim library for the rectifier circuit. LLO 4.2 Simulate Half Wave Rectifier circuit. LLO 4.3 Analyze simulation results to understand the rectification process and waveform characteristics.	Design a Half Wave Rectifier using Multisim	2	CO1
5	LLO 5.1 Select appropriate components from the Multisim library for the rectifier circuit. LLO 5.2 2 Simulate Half Wave Rectifier circuit.	Design a Full Wave Rectifier using Multisim	2	CO1

	LLO 5.2 Analyze simulation results to understand the rectification process and waveform characteristics.			
6	LLO 6.1 Simulate Basic gates LLO 6.2 Analyze and interpret simulation results to verify the truth tables of different logic gates.	Verify Truth table of all Gates using Multisim	2	CO1
7	LLO 7.1 Simulate half and full adder circuit using gates. LLO 7.2 Develop skills in identifying and rectifying errors in the designed circuits.	Design Half and full adder using Multisim	2	CO1
8	LLO 8.1 Simulate any digital circuit using gates LLO 8.2 Verify the laws and principles of Digital circuits.	Verify De-morgan's laws using Multisim	2	CO1
9	LLO 9.1 Simulate Flip flops circuit using NAND gate LLO 9.2 Analyze and interpret simulation results to verify the truth tables of given Flip-flops.	Design SR, JK, T and D flip-flop using Multisim	2	CO1
10	LLO 10.1 Simulate your circuit LLO 10.2. Prepare PCB Layout LLO 10.3 Design one sides PCB.	Micro Project- Design a single sided PCB for any one electronic circuit	16	CO1
11	LLO 11.1Simulate programs using Keil µVision's simulation features to verify the correctness of arithmetic and logical operations	Simulate program for arithmetic and logical operations using Keil µVision	4	CO2
12	LLO 12.1 Simulate programs using Keil µVision's	Simulate program to blink LED for 1 second using Keil µVision	4	CO2
13	LLO 13.1Simulate programs using Keil µVision's	Simulate program to generate square wave using Keil µVision	4	CO2
14	LLO 14.1Simulate programs using Keil µVision's	Simulate program to transfer Byte from one memory location to other using Keil µVision	4	CO2
15	LLO 15.1 Simulate circuit to interface an LED with the 8051 microcontrollers LLO 15.2 Ensure proper connection and compatibility	Interface LED with microcontroller 8051 and observed the output using proteus simulator	2	CO3

	between the microcontroller and the LED			
16	LLO 16.1 Simulate circuit to interface pushbutton and LED. LLO 16.2 Differentiate between input and output devices.	Interface pushbutton to control LED with microcontroller 8051 and observed the output using proteus simulator	2	CO3
17	LLO 17.1 Simulate circuit to interface relay. LLO 17.2 Understand the functionality of a relay	Interface relay with microcontroller 8051 and observed the output using proteus simulator	2	CO3
18	LLO 18.1 Simulate a circuit to interface 7- Segment LED with the 8051 microcontrollers	Interface 7- segment LED Display with microcontroller 8051 and observed the output using proteus simulator	2	CO3
19	LLO 19.1 Simulate a circuit to interface DC motor with the 8051 microcontrollers LLO 19.2 observed the output changes by changing delay in the program	Interface DC with microcontroller 8051 and observed the clockwise and anticlockwise rotation using proteus simulator	2	CO3
20	LLO 20.1 Simulate a circuit to interface LCD with the 8051 microcontrollers LLO 20.2 Learn configure the microcontroller pins for interfacing with LCD.	Interface LCD display with microcontroller 8051 and observed the output using proteus simulator	4	CO3
		Total	64	

V. Suggested Micro Project

Design PCB of any one circuit from the list given below.

1. To verify Kirchhoff's current and voltage laws.
2. Design, Construct and Test Positive Clipper circuit.
3. Design, Construct and Test Negative Clipper circuits circuit.
4. Design Circuit to test a Zener Diode as Voltage Regulator.
5. Design circuit verify output characteristics of transistor.
6. Design bridge type full wave rectifier.
7. Half Adder, Full Adder,
8. Half Subtractor and Full Subtractor

9. 4-bit Parallel Adder using IC 7483
10. 4-bit Parallel Subtractor using IC 7483
11. BCD to Excess-3 code conversion and vice-versa
12. Design 5-bit magnitude comparator using IC 7485
13. 4- bit Synchronous up counters
14. 3:8 Encoder
15. 4- bit shift Register.
16.

VI. Assessment Methodologies/Tools

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (50 marks)

VIII. Suggested COs - POs Matrix Form

Course Outcomes (Cos)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO- 1	PSO- 2	PSO- 3
CO1	3	3	3	3	3	1	3	1	3	3
CO2	3	3	3	3	3	1	3	1	3	3
CO3	3	3	3	3	3	1	3	1	3	3
Legends: - High:03, Medium:02, Low:01, No Mapping:										

VII. Suggested Learning Materials / Books

Sr. No	Author	Title	Publisher
1.	James W. Nilsson and Susan Riedel	Introduction to Multisim for Electric Circuits	Pearson Publications
2.	Electronics Workbench group	NI Multisim user Manual	National Instruments
3.	Ming-Bo Lin	Principles and Applications of Microcomputers	CreateSpace Independent Publishing

VIII. Learning Websites & Portals

Sr. No	Link / Portal	Description
1	https://www.ni.com/en/support/downloads/software-products/download.multisim.html#452133	Installation of Multisim Simulator
2	https://www.keil.com/demo/eval/c51.htm	Download and Install Keil µVision
3	https://www.geeksforgeeks.org/how-to-download-and-install-proteus-software-on-windows/	Download and Install Proteus software on windows

IX. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr. Yogesh Pingle	Director	YPP Technology
2	Dr. G. J. Joshi	Sl. Grade Lecturer,	Government Polytechnic Nashik
3	Ms. P. A. Khnade	Lecturer in Electronics	Government Polytechnic, Mumbai
4	Mr. V. Y. Patil	Lecturer in Electronics	Government Polytechnic, Mumbai

Coordinator
Curriculum Development,
Department of Electronics
Engineering

Head of Departments
Department of Electronics
Engineering

I/C, Curriculum Development Cell

Principal
Government Polytechnic, Mumbai

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CDC Co-ordinator
G. P. Mumbai

Programme : Diploma in Electronics Engineering (Sandwich Pattern)													
Course Code : EC23601					Course Title : C Programming								
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (3Hrs.)	FA-PR	SA		SLA	Total
										PR	OR		
2	-	2	-	4	2	-	-	-	25	25#	-	-	50

Total IKS Hrs. for course:

Abbreviations: CL- ClassRoom Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

I. Rationale

In today's information technology era, computer Technology plays an important role. Computer applications are all pervasive in day to day life of human being. It became compulsory to all employable to have sound knowledge of how computer works and process data and information.This subject covers from the basic concept of C to pointers in C.This course will acts "programming concept developer" for students.It will also act as"Backbone"for subjects like OOPS,VB,Windows Programming,JAVA,OOMD,etc.

II. Industry / Employer Expected Outcome

Students should be able to develop application in C programming.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Illustrate the Flowchart and describe an algorithm for a given program.
CO2	Understand I/O statements in C
CO3	Use Conditional and iterative statements in C programs
CO4	Demonstrate arrays and strings
CO5	Demonstrate the use of user defined functions to solve real time problems
CO6	Understand Structures and unions and Files.
CO7	Describe the use of pointers

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's	Topics / Sub-topics
1	**TLO 1.1:** Explain what is algorithm how to write the algorithm and pseudocode. **TLO 1.2**: Explain how to write algorithms for different problems like – (i) Exchange the values of two variables with and without temporary variable, (ii) Counting positive numbers from a set of integers, (iii) Summation of set of numbers, (iv) Reversing the digits of an integer, (v) Find smallest positive divisor of an integer other than 1, (vi) Find G.C.D. and L.C.M. of two as well as three positive integers, (vii) Generating prime numbers. **TLO 1.3:** Explain what is flowchart and different symbols used in flowchart and how to develop the flowchart.	**Program Logic development** 1.1 Fundamentals of algorithms: Notion of an algorithm. Pseudo-code conventions like assignment statements and basic control structures. 1.2 Algorithmic problems: Develop fundamental algorithms for (i) Exchange the values of two variables with and without temporary variable, (ii) Counting positive numbers from a set of integers, (iii) Summation of set of numbers, (iv) Reversing the digits of an integer, (v) Find smallest positive divisor of an integer other than 1, (vi) Find G.C.D. and L.C.M. of two as well as three positive integers, (vii) Generating prime numbers. 1.3 Flow chart: Draw flow charts for all algorithms developed **Course Outcome- CO1 Teaching Hours – 4**
2	**TLO 2.1:** Explain the different programming approaches - Procedural approach, Object Oriented approach, Event Driven approach with examples. **TLO 2.2 :** Explain what is structure of C with diagram and each section of the diagram. Explain the use of comments and compilation of the program. **TLO 2.3:** Explain Data Concepts: Variables, Constants, data types like: int, float char, double and void with different example programs. Qualifiers: short and long size qualifiers,	**Basics of C programming** 2.1 Different approaches in programming: Procedural approach, Object Oriented approach, Event Driven approach. 2.2 Structure of C: Header and body, Use of comments, Compilation of a program. 2.3Data Concepts: Variables, Constants, data types like: int, float char, double and void. Qualifiers: short and long size qualifiers, signed and unsigned qualifiers. Declaring variables, Scope of the variables according to block, Hierarchy of data types. 2.4 Operators in C: Logical, Arithmetic,

	signed and unsigned qualifiers. Declaring variables, Scope of the variables according to block, Hierarchy of data types with different example programs. **TLO 2.4:** Explain different operators in C - Logical, Arithmetic, Bitwise, Relational, Assignment with example programs. **TLO 2.5**: Explain different Input output statements - Input and output using printf() and scanf() character I/O.(Programs based on I/O) with different example programs.	Bitwise, Relational, Assignment 2.5 Basic Input output: C program structure, Input and output using printf() and scanf(), character I/O. (Programs based on I/O) **Course Outcome- CO2 Teaching Hours – 4**
3	**TLO 3.1:** Explain different Decision making like - If Statement, If else statement, Nesting of if-else using syntax and examples and student should be able to write programs. **TLO 3.2:**Describe branching statement The switch statement with syntax and examples. **TLO 3.3:** Explain the looping statement While loop, Do-while loop, For loop with syntax and example programs. **TLO 3.4:**: Describe the Ternary operator with syntax and example programs. **TLO 3.5:** Explain the Go to statement with syntax and example programs. **TLO 3.6:** Explain the use of break and continue statements with syntax and example programs.	**Control Structures** 3.1 Decision making: If Statement, If else statement, Nesting of if-else 3.2 branching: The switch statement 3.3 Looping: While loop, Do-while loop, For loop 3.4 Ternary operator 3.5 Go to statement 3.6 Use of break and continue statements **Course Outcome- CO3 Teaching Hours – 4**
4	**TLO 4.1:** Explain One dimension, two dimension and multidimensional arrays with syntax and example programs. **TLO 4.**2: Describe and explain Array declaration with examples. **TLO 4.**3: Explain Array initiatialisation with examples. **TLO 4.**4: Describe and explain calculating the length of an array with examples.	**Arrays and Strings** 4.1 One dimension, two dimension and multidimensional arrays 4.2 Array declaration 4.3 Array initialization 4.4 calculating the length of an array

	TLO 4.5: List and explain different operations on array. **TLO 4.6**: List different String input/output. **TLO 4.7** : List different String operations. **TLO4.8**: Explain Array of strings	4.5 Operation on array 4.6 String input/output 4.7 String operations 4.8 Array of strings **Course Outcome- CO4 Teaching Hours – 5**
5	**TLO 5.1:** Uses and concept of Library functions. **TLO 5.2** : List different String functions (comparison, concatenation, length) with example programs **TLO 5.3**: User-defined functions and example programs. **TLO 5.4** : Define Local & global variables and give examples. **TLO 5.5**: Describe Parameter passingwith example programs **TLO5.6**: Name and explain different Storage classes	**Functions** 5.1 Concept of library functions 5.2 String functions (comparison, concatenation, length) 5.3 User-defined functions 5.4 Local & global variables 5.5 Parameter passing 5.6 Storage classes **Course Outcome- CO5 Teaching Hours – 5**
6	**TLO 6.1:** Explain Basic Concept of Structure and Union and Files. **TLO 6.2** : Describe Structure declaration, initialization with examples. **TLO 6.3** : Explain Structure within structure with example program. **TLO 6.4** : Describe Structure within structure with example programs. **TLO 6.5** :: DescribeArray of Structure. **TLO 6.6** :Describe and Explain Union. **TLO 6.7**: Describe and Explain Creating a file. **TLO 6.8** : List and explain CRUD operations on File.	**Structure and Union and Files** 6.1 Basic Concept 6.2 Structure declaration, initialization 6.3 Structure within structure 6.4 Nested Structures 6.5: Array of Structure 6.6 Union 6.7 Creating a file 6.8 CRUD operations on File. **Course Outcome- CO6 Teaching Hours: 6**

7	**TLO 7.1**: ExplainBasic concept of Pointers. **TLO 7.2**: Describe Pointer & arrays **TLO 7.3**: Describe Pointer & functions **TLO 7.4**: ExplainPointer arithmetic	**Pointers** 7.1Basic concept 7.2Pointer & arrays 7.3Pointer & functions 7.4 Pointer arithmetic **Course Outcome- CO7 Teaching Hours: 4**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant Cos
1	**LLO a**: AbletoWrite an algorithm and draw the flow chart To find out number is odd or even. **LLO b:** Able to Write an algorithm and draw the flow chart to find out factorial value of a number. **LLO c:**Able to Write an algorithm and draw the flow chart To check a number is prime number or not.	Write an algorithm and draw the flow chart for following: a) To find out number is odd or even. b) To find out factorial value of a number. c) To check a number is prime number or not.	2	CO1
2	**LLO a**: Able to write program to find out number is odd or even. **LLO b**: Able to write programto find out factorial value of a number. **LLO c**: Able to write program to check a number is prime number or not.	Program based on Input/output statement. a) To find out number is odd or even. b) To find out factorial value of a number. c) To check a number is prime number or not.	2	CO2

3	**LLO a**: Understand and write program to find whether the input number is even or odd. **LLO b**: Understand and write program to find whether the number entered is positive or negative. **LLO c**: Understand and write program tofind the greatest number among three numbers usingnested if d) Program that asks user an arithmetic operator („+“,“-„,“*“ or „/“) and take two operands and perform the corresponding calculation on the operands using switch case	Program using control structures: Branching a) To find whether the input number is even or odd. b) To find whether the number entered is positive or negative. c) To find the greatest number among three numbers using nested if d) Program that asks user an arithmetic operator („+“,“-„,“*“ or „/“) and take two operands and perform the corresponding calculation on the operands using switch case	2	CO3
4	**LLO a**: Understand and write program to find the sum of first n natural numbers where n isentered by user. **LLO b**: Understand and write program to Find Number of Digits in a Number. **LLO c**: Understand and write program to check whether a number is palindrome or not. **LLO d**: Understand and write program to Generate Multiplication Table.	Program using control structures: Looping(using loops) To find the sum of first n natural numbers where n isentered by user. b) To Find Number of Digits in a Number. c) To check whether a number is palindrome or not. d) To Generate Multiplication Table.	2	CO3
5	**LLO a**: Understand and write program to accept values in 2-Dimensional 3 by 3 arrays anddisplay the sum of all the elements. **LLO b**: Understand and write program to compute the sum of all elements stored in an arrayusing pointers	Program for arrays – a) to accept values in 2-Dimensional 3 by 3 arrays and display the sum of all the elements. b)Program to compute the sum of all elements stored in an arrayusing pointers	2	CO4
6	**LLO**:Able to write Program using array of strings.	Program using array of strings.	2	CO4

7	**LLO :**Able to writeProgram to perform different operations on string.	Program to perform different operations on string.	2	CO4
8	**LLO a**: Understand and write program using function (call by value) to swap to numbers **LLO b**: Understand and write program to find square of given number using functions.	Program using function (call by value) a) to swap to numbers b) to find square of given number	2	CO5
9	**LLO a**: Understand and write program using structure and union to store information of 3 students (Name, Roll No, Marks) **LLO b**: Understand and write programto store information of 2 employees (empid, name, salary) and display the details of the employee having salary greater thanRs. 5000.	Program using structure and union a) To store information of 3 students (Name, Roll No, Marks) b) To store information of 2 employees (emp_id, name, salary) and display the details of the employee having salary greater than Rs. 5000.	2	CO6
10	**LLO**: Able to write Programto print following pattern * ** ****	Write a program to print following pattern * ** ****	2	CO6
11	**LLO**: Understand and Able to writeProgram using pointer.	Program using pointer.	2	CO7
12	**LLO**: Understand and Able to write Programusing pointer Arithmetic.	Program using pointer Arithmetic.	2	CO7
13	**LLO**: Understand and Able to write Programto perform CRUD operations on Files	Write a program to perform CRUD operations on Files	2	CO6
14	LLO: Understand and Able to do Mini Project .	Mini Project	4	ALL
		Total	30	

V. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Program Logic development	NA			
2	Basics of C programming				
3	Control Structures				
4	Arrays and Strings				
5	Functions				
6	Structure and Union				
7	Pointers				
	Total				

VI. Assessment

Methodologies/Tools

Formative assessment (Assessment for Learning)

- Rubrics for continuous assessment based on process and product related performance indicators(___25 marks)

Summative Assessment (Assessment of Learning)

- End term examination, Viva-voce, Workshop performance (_25_marks)

VII. COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	-	-		2	1	-	2		1
CO2	1	3	2	2	-	-	1		2	-

CO3	-	2	-	-	1	1	2	2	-	-
CO4	2	-	2	--	-	2	-	1	-	-
CO5`	2	-	-	2	2	-	1	-	2	-
CO6	-	2	-	-	3	1	-	1		1
CO7	1	-	1	2	-	-	1	-	1	-

Legends: - High:03, Medium:02, Low:01, No Mapping: --

VIII. Suggested Learning Materials / Books

Sr. No	Author/ Publisher	Title	ISBN
1	Brian W. Kernighan, Dennis Ritchie Prentice Hall	The C Programming language	978-0131103627
2	E. Balgurusamy The Mc-Graw Hill	Programming in ANSI C	978-9339219666
3	YashawantKanetkar BPB Publications	Let us C	978-9387284494

IX. Learning Websites & Portals

Sr.No	Link / Portal
1	https://www.w3schools.com
2	https://www.tutorialspoint.com
3	www.cppinstitute.org/
4	https://www.programiz.com › c-programming
5	https://www.javatpoint.com › c-programming-language-tutorial
6	https://beginnersbook.com › 2015/02 › simple-c-programs
7	https://www.udemy.com › c-programming-for-beginners

X. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr.Yogesh Pingale	Director, YPP Technology	Industry Expert
2	Dr. Hemant Kasturiwale	Od, ExTC N DS, Thakur Engg.clg	Academic Expert
3	Dr. H.M.Pardeshi	HOD, Information Technology	Institute Course Expert
4	Ms. N. A. Wankhade	Lecturer, Information Technology	Institute Course Expert

Coordinator, Curriculum Development, Department of Electronics Engineering

Head of Department Department of Electronics Engineering

I/C, Curriculum Development Cell

Principal

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CDC Co-ordinator G.P. Mumbai

Programme : Diploma in CE/CO/EC/EE/IT/IS/LG/LT/ME/RT												
Course Code: CE 23301					Course Title ENVIROMENTAL STUDIES							
Compulsory / Optional: Compulsory												
Teaching Scheme and Credits						Examination Scheme						
CL	TL	LL	SLH	NLH	Credits	FA-TH	SA-TH (2:30 Hrs.)	FA-PR	SA		SLA	Total
									PR	OR		
-	-	2	2	4	2	-	-	25	-	@25	25	75

Total IKS Hrs. for course: 2

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents an average of two class tests of 30 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

Environmental studies is the interdisciplinary academic field which systematically studies human interaction with the environment in the interests of solving complex problems. It is a broad field of study that includes also the natural environment, built environment, and the sets of relationships between them. The turn of the twentieth century saw the gradual onset of its degradation through depletion of resources such as air, water and soil; the destruction of ecosystems and the extinction of wildlife by our callous deeds without any concern for the well-being of our surrounding. We are today facing a grave environmental crisis. It is therefore necessary to study environmental issues to realize how human activities affect the environment and what could possibly be the remedies or precautions which need to be taken to protect the environment.

II. Industry / Employer Expected Outcome

Select an industry which is potential pollution causing but following all the norms of CPCB/MPCB and study its pollution mitigation methods

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Identify various terms related with environment and importance of the course.
CO2	Identify and distinguish Ecosystems and Biodiversity.

CO3	Identify various types of Environmental Pollutions and specify solutions to environmental problems
CO4	Analyze various Environmental Issues and suggest sustainable development
CO5	Identify measures taken by the GOIto protect environment

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO)	Topics / Sub-topics
1	**TLO1.1** Explain the Scope and Importance of the environmental studies **TLO1.2** Explain the importance/significance of the environmental studies **TLO 1.3** Describe the need for creating public awareness **TLO 1.4** Describe the of ways creating public awareness	**Introduction to Environmental Studies** 1.1 Definition, Scope and Importance of the environmental studies 1.2 Importance/significance of the environmental studies irrespective of course 1.3 Need for creating public awareness about environmental issues 1.4 Ways/means/methods of creating public awareness 1.5 Some important terms related with Environmental Studies **Course Outcome : CO1 Teaching Hours :4 hrs**
2	**TLO2.1** Explain the concept of Ecosystem **TLO2.2** Explain the classification of Ecosystem **TLO2.3** Explain the basic structure and functions of ecosystem **TLO2.4** Describe energy flow in ecosystem **TLO2.5** State the definition of Biodiversity **TLO2.6** Explain the levels of biodiversity **TLO2.7** Explain the Threats to biodiversity **TLO2.8** Explain the Conservation of biodiversity	**Ecosystems and Biodiversity** 2.1 Concept of Ecosystem 2.2 Classification 2.3 Structure and functions of ecosystem: Basics 2.4 Energy flow in ecosystem:Gross primary product and Net primary product, Autotrophic levels and Bioaccumulation 2.5 Definition of Biodiversity 2.6 Levels of biodiversity: Genetic, Species, Community & Ecosystem 2.7 Threats to biodiversity:Habitat destruction, Invasive species, Genetic pollution, Overexploitation, Hybridization, Climate change & Overpopulation 2.8 Conservation of biodiversity: In-situ & Ex-situ **Course Outcome: CO2Teaching Hours :8 hrs**
3	**TLO3.1** Explain the definition of environmental pollution **TLO3.2** Explain the Air pollution **TLO3.3** Explain the Water Pollution **TLO3.4** Explain the Soil Pollution **TLO3.5** Explain the Noise Pollution	**Environmental Pollution** 3.1 Definition of environmental pollution 3.2 Air pollution: Definition, sources, effects, prevention 3.3 Water Pollution: Definition, sources, effects, prevention 3.4 Soil Pollution: Definition, sources, effects, prevention 3.5 Noise Pollution: Definition, sources, effects, prevention **Course Outcome:CO3Teaching Hours :6 hrs**

4	**TLO4.1** Explain the development Goals **TLO4.2** Explain the Water conservation with method **TLO4.3** Explain the Rain water harvesting **TLO4.4** Explain the Climate Change: **TLO4.5** Explain the Climate Change: **TLO4.6** Explain the Nuclear Accidents and Holocaust **TLO4.7** Explain the Concept of Carbon Credits and its advantages	**Environmental Issues and Sustainable Development** 4.1 Concept of development and Seventeen Sustainable development Goals 4.2 Water conservation and its method 4.3 Rain water harvesting 4.4 Climate Change: Causes 4.5 Global warming, Acid rain, Ozone Layer Depletion. 4.6 Nuclear Accidents and Holocaust 4.7 Concept of Carbon Credits and its advantages **Course Outcome:CO4Teaching Hours :8 hrs**
5	**TLO5.1** Explain the Brief description of various Environmental Acts **TLO5.2** Explain the EIA Clearance procedure **TLO5.3** Explain the Montreal protocol and ozone cell, Wetlands **TLO5.4** Explain the Green Building and rating systems	**Environmental Protection** 5.1 Brief description of the following acts and their provisions: • Environmental Protection Act, 1986 • Air (Prevention and Control of Pollution) Act, 1981 • Water (Prevention and Control of Pollution) Act, 1974 • Wildlife Protection Act 1972 • Forest Conservation Act, 1980 &1988 5.2 EIA Clearance procedure 5.3 Montreal protocol and ozone cell, Wetlands, CDM approval, PARIVESH, Genetic Engineering Appraisal Committee (GEAC) Clearances, Hazardous Waste Import and Export Clearances 5.4 Introduction to Green Building and rating systems **Course Outcome:CO5Teaching Hours :4 hrs**

V. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Laboratory Learning Outcomes (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO 1.1** Follow safety rules in environmental studies laboratory.	a) Definition, Scope and Importance of the environmental studies&Some important terms related with Environmental Studies b) Importance/significance of the environmental studies irrespective of course	2	CO1
2	**LLO2.1** Identify the need for creating public awareness about environmental issues and to find Ways/means/ methods of creating	a) Need for creating public awareness about environmental issues b) Ways/means/methods of creating public awareness	2	CO1

	public awareness			
3	**LLO 3.1** Determine the Concept of Ecosystem, Classification, Structure and functions of Ecosystem **LLO 3.2** Identify the Energy flow in ecosystem	a) Concept of Ecosystem, Classification, Structure and functions of ecosystem: Basics, b) Energy flow in ecosystem: Gross primary product and Net primary product, Autotrophic levels and Bioaccumulation	4	CO2
4	**LLO 4.1** Explain the Definition of Biodiversity and to study Levels of biodiversity, Threats to biodiversity **LLO 4.2** Explain the	a) Definition of Biodiversity, Levels of biodiversity: Genetic, Species, Community & Ecosystem, Threats to biodiversity: Habitat destruction, Invasive species, Genetic pollution, Overexploitation, b) Hybridization, Climate change & Overpopulation, Conservation of biodiversity: In-situ & Ex-situ	4	CO2
5	**LLO 5.1** Explain the Definition of environmental pollution **LLO 5.2** Explain the types of environmental pollution	a) Definition of environmental pollution, Air pollution: Definition, sources, effects, prevention b) Water Pollution: Definition, sources, effects, prevention	4	CO3
6	**LLO 6.1** Explain the Soil Pollution **LLO 6.2** Explain the Noise Pollution	a) Soil Pollution: Definition, sources, effects, prevention b) Noise Pollution: Definition, sources, effects, prevention	2	CO3
7	**LLO 7.1** Explain the Sustainable development Goals **LLO 7.2** Explain the Rain water harvesting	a) Concept of development and Seventeen Sustainable development Goals, Water conservation and its method b) Rain water harvesting, Climate Change: Causes	4	CO4
8	**LLO 8.1** Describe the concept of Global warming, Acid rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust **LLO 8.2** Describe the concept of Carbon Credits and its advantages	a) Global warming, Acid rain, Ozone Layer Depletion,Nuclear Accidents and Holocaust b) Concept of Carbon Credits and its advantages	4	CO4

9	**LLO 9.1** Describe briefly various Environmental Acts **LLO 9.2** Describe Environmental Acts	a) Brief description of the following acts and their provisions, Environmental Protection Act, 1986, Air (Prevention and Control of Pollution) Act, 1981 b) Water (Prevention and Control of Pollution) Act, 1974, Wildlife Protection Act 1972, Forest Conservation Act, 1980 &1988	2	CO5
10	**LLO 10.1** Explain the EIA Clearance procedure **LLO 10.2** Explain the Montreal protocol and ozone cell, Wetlands, CDM approval, PARIVESH, Genetic Engineering Appraisal Committee (GEAC) Clearances, Hazardous Waste Import and Export Clearances	a) EIA Clearance procedure b) Montreal protocol and ozone cell, Wetlands, CDM approval, PARIVESH, Genetic Engineering Appraisal Committee (GEAC) Clearances, Hazardous Waste Import and Export Clearances	2	CO5

Note: if any

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. One write-up on each unit (altogether five in number) that summarizes the whole chapter and presents all the important points/material on it.
2. 10 MCQs (twenty questions each) at the start of each tutorial based on the topic of previous tutorial unit
3. project report on any one project of the following:

a) Visit to a local area to document environmental assets suchas river/ forest/ grassland / hill / mountain

b) Visit to a local polluted site: Urban/Rural/Industrial/Agricultural

c) Study of common plants, insects, birds

d) Study of simple ecosystems of ponds, river, hill slopes etc

Formative assessment (Assessment for Learning) for PR and SLA

- Rubrics for continuous assessment based on process and product related performance indicators(___ marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (marks)

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e) Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CO1	3	3	--	1	3	1	2	1	3	
CO2	3	3	--	1	3	1	2	1	3	2
CO3	3	2	--	1	3	1	2	1	3	2
CO4	3	2	--	1	3	1	2	1	3	2
CO5	3	3	--	1	3	1	2	1	3	2

Legends: - High:03, Medium:02, Low:01, No Mapping: --

f) Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
01	AninditaBasak	Environmental Studies	Pearson Education
02	R. Rajgopalan	Environmental Studies from Crises to Cure	Oxford University Press
03	Dr. R. J. Ranjit Daniels, Dr. JagdishKrishnaswamy	Environmental Studies	Wiley India

g) Learning Websites & Portals

Sr.No	Link / Portal	Description
1	https://www.engineeringcivil.com	Civil Engg. Portal
2	https://moef.gov.in/	For environmental Info
3	www.youtube.com/	For Various subjects
4	http://civildigital.com	
5	http://www.quora.com	
6	http://www.nationallibrary.gov.in	

h) Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Shri. S D Borkar	Deputy Engineer	PWD
2	Shri. Sudhir Nimbalkar	Assistant Engineer	BMC
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Dr D K Gupta	HOD in Civil Engg.	Govt. Polytechnic Mumbai

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