Government of Karnataka
Department of Collegiate and Technical Education

C-20 Second Year Diploma Curriculum
Electronics and Communications Engineering

Curriculum Development Cell, DTE
2021-22

Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Curriculum Structure

III Semester Scheme of Studies- Diploma in Electronics and Communications Engineering

Sl. No.	Course Category / Teaching Department	Course Code	Course Name	Hours per week			Total contact hrs /week	Credits	CIE Marks		SEE Marks		Total Marks	Min Marks for Passing (including CIE marks)	Assigned Grade	Grade Point	SGPA and CGPA
				L	T	P			Max	Min	Max	Min					
Integrated Courses																	Both SGPA & CGPA
1	PC/EC	20EC31P	Analog Electronics	3	1	4	8	6	60	24	40	16	100	40			
2	PC/EC	20EC32P	Logic Design using Verilog	3	1	4	8	6	60	24	40	16	100	40			
3	PC/EC	20EC33P	Communication Systems	3	1	4	8	6	60	24	40	16	100	40			
4	PC/EC	20EC34P	Electronic Measurements and Testing Techniques	3	1	4	8	6	60	24	40	16	100	40			
Audit Course																	
5	AU/KA	20KA31T	ಸಾಹಿತ್ಯ ಸಿಂಚನ-II/ ಬಳಕೆ ಕನ್ನಡ-II	2	0	0	2	2	50	20	-	-	50	20			
Total				**14**	**4**	**16**	**34**	**26**	**290**	**116**	**160**	**64**	**450**	**180**			

PC: Programme Core:: AU-Audit Course:: KA: Kannada:: L: Lecture:: T: Tutorial:: P: Practice

Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Curriculum Structure

IV Semester Scheme of Studies- Diploma in Electronics and Communications Engineering

Sl. No.	Course Category / Teaching Department	Course Code	Course Name	Hours per week			Total contact hrs /week	Credits	CIE Marks		SEE Marks		Total Marks	Min Marks for Passing (including CIE marks)	Assigned Grade	Grade Point	SGPA and CGPA
				L	T	P			Max	Min	Max	Min					
Integrated Courses																	Both SGPA & CGPA
1	PC/EC	20EC41P	PCB Design & Fabrication	3	1	4	8	6	60	24	40	16	100	40			
2	PC/EC	20EC42P	Wireless Communication	3	1	4	8	6	60	24	40	16	100	40			
3	PC/EC	20EC43P	Embedded C Programming	3	1	4	8	6	60	24	40	16	100	40			
4	PC/EC	20EC44P	Industrial Automation	3	1	4	8	6	60	24	40	16	100	40			
Audit Course																	
5	AU/EC	20EC45T	Indian Constitution	2	0	0	2	2	50	20	-	-	50	20			
Total				**14**	**4**	**16**	**34**	**26**	**290**	**116**	**160**	**64**	**450**	**180**			

***PC: Programme Core:: AU-Audit Course:: L: Lecture:: T: Tutorial:: P: Practice**

3rd SEMESTER

Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Electronics and Communication	**Semester**	III
Course Code	20EC31P	**Type of Course**	Programme Core
Course Name	Analog Electronics	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

1. Rationale

Analog electronics is a branch of electronics that deals with a continuously variable signal. It is widely used in radio and audio equipment along with other applications where signals are derived from analog sensors before being converted into digital signals for subsequent storage and processing. Analog Electronics offers a very elegant design with many components and would effectively act as an impetus to the digital world.

2. Course Outcomes/Skill Sets: On successful completion of the course, the students will be able to:

CO-01	Identify the components in a given analog electronic circuit and list their characteristics and uses.
CO-02	Study the given analog circuit and using the data sheets/specification sheets, list alternative electronic components for the given circuit.
CO-03	Construct an analog electronic circuit for a given application and demonstrate the working of that circuit either in Real or Simulated environment.
CO-04	Test a given circuit for a desired result/outcome, identify the problem and troubleshoot to obtain the desired result/outcome.

3. Course Content

Week	**CO**	**PO**	**Lecture (Knowledge Criteria)**	**Tutorial (Activity Criteria)**	**Practice (Performance Criteria)**
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1,3,4	1,3, 4,6, 7	Power Supplies 1.Need, Types – Unregulated, Regulated – Linear, Switched, Battery, Selection Criteria of different power supplies 2. RPS & UPS – Online & Offline – Block Diagram and its working principle 3. SMPS – Block diagram and its working principle	Refer Table 1	1. Build 5V/12V Regulated Power Supply. 2a) Identify the components in a SMPS. 2b) Identify front panel control & indicators of UPS
2	1,3,4	1,3, 4,6, 7	Wave Shaping Circuits. 1. RC Integrator & RC Differentiator. 2. Clippers - Series, Shunt & Biased.	Refer Table 1	1. Generate the following waveforms from sinusoidal waveform. a. Trapezoidal waveform.

			3. Clampers – Positive Voltage & Negative Voltage, Voltage Multipliers – doubler, Tripler.		b. Positive Cycle. 2. Construct and verify voltage doubler and tripler circuit to multiply the input voltage.
3	1,2,3,4	1,3, 4,6, 7	Special Purpose Devices. 1. Features & Applications of Tunnel Diode, Varactor Diode. 2.Features & Applications of Gunn diode & PIN diode, Solar cell 3. Features & Applications of Schottky diode & UJT.	Refer Table 1	1. Identify & test all special purpose diodes and interpret their data sheets. 2. Simulate/Analyse Schottky diode/PIN diode/Gunn Diode/Varactor Diode application circuits.
4	1,2,3,4	2,3, 4,6, 7	Transistor Amplifiers. 1. Introduction, DC load line, Operating point, Need for biasing, Stabilization, stability factor. 2. Types of biasing-voltage divider bias for BJT. 3. Classification of Amplifiers-based on use, frequency, coupling methods & mode of operations (advantages, disadvantages)	Refer Table 1	1a. Demonstrate Numbering System of Semiconductor Devices. 1b. Identify Transistors in different packages and interpret their datasheets. 2a.Construct/Simulate a AND/OR Gate using transistors 2b. Design and construct voltage divider biasing circuit to fix an operating point and test the voltages
5	3,4	1,3, 4,6	1. Common Emitter Transistor Amplifier-Working, Voltage gain, phase reversal. 2. RC Coupled transistor amplifier-frequency response. 3. Power amplifiers- classification, principle & performance criteria of power amplifiers.	Refer Table 1	1.Construct voltage divider biased single-stage RC coupled CE amplifier and plot frequency response 2. Simulate the RC coupled amplifier using BJT. Verify the same using FET.
6	3,4	1,2, 5,6, 7	1. Working of Class A–Series-fed amplifier and transformer-coupled amplifier. Expression for output power and maximum power efficiency 2.Class B- Push pull Amplifier and complementary-symmetry push-pull amplifier. Expression for output power and maximum power efficiency. 3. Working of Class AB and Class C amplifiers. Stages of practical power amplifier, Concept and expression for voltage gain of multistage amplifiers.	Refer Table 1	1. Demonstrate and document the working of a power amplifier using video or simulator. 2. Construct and Demonstrate/Simulate the working of push pull amplifier. Verify the same using FET.

7	1,2,3	1,4, 6	1. Op-amp: Block diagram, Symbol, Basic differential amplifier- Working principle. 2. Modes of operation-Single ended, Common mode & Differential mode, Ideal and practical characteristics. 3.Op-amp parameters: Input offset voltage, input offset current, power supply rejection ratio, CMRR, Input and output impedance, gain, gain-bandwidth product, slew-rate	Refer Table 1	1. Identify Op-amp IC, its pins and Interpret its data sheet. 2. Conduct an experiment to find the practical characteristics of Op-amp and compare them with ideal characteristics.
8	3,4	1,4, 6	1. Open-loop configuration: Comparator-inverting, non-inverting, applications, disadvantages. 2. Closed-loop configuration: virtual ground, applications - inverting, non-inverting amplifier. 3. Voltage follower, summing & difference amplifiers.	Refer Table 1	1. Construct and test an op-amp circuit to obtain Inverting & Non inverting output. 2. Construct a circuit to obtain the Sum/Difference of all input voltages.
9	3,4	1,3, 4,6	1. Construct and verify Op-amp as Differentiator, Integrator. 2. Op-amp as Schmitt trigger and precision rectifier, Gain of Multistage Op-Amp Circuits. 3. Sinusoidal Oscillators, Types of Oscillations, LC Tank circuit and stability.	Refer Table 1	1. Construct a circuit to obtain triangular wave and spike from square wave. 2. Build an op-amp circuit to generate clock pulses and verify its working.
10	3,4	1,3, 4,6	1. Concept of feedback and types, Barkhausen criteria. 2. Types of Oscillators, Working of Hartley oscillator using BJT/Op-amp and its applications. 3. Working of Colpitts and crystal oscillator using BJT/Op-amp and their applications	Refer Table 1	1. Construct/Simulate Hartley oscillator using BJT. Verify the same using op-amp. 2. Construct, test and Troubleshoot Colpitts oscillator using BJT/op-amp.
11	3,4	1,3, 4,6	1. Working of RC phase-shift and Wein-bridge oscillators using Op-amp and their applications. 2. Filters: Classification, Applications & Advantages of Active over Passive Filters. 3. Filter Terminology, frequency response of 1st order Butterworth LPF, HPF (No Derivation).	Refer Table 1	1. Design and implement /Simulate RC phase shift oscillator for generating a frequency of 1khz using BJT. Verify the same using op-amp. 2. Conduct an experiment to plot the frequency response of LPF & HPF.

12	3,4	1,3, 4,7	1. Frequency response of 1st order Butterworth BPF and Band Elimination Filter, BEF (No Derivation). 2. Instrumentation amplifier-Need for instrumentation amplifier, Working of instrumentation amplifier circuit. 3. Phase Locked Loop (PLL): voltage to frequency converter, PLL operation with mention of its applications	Refer Table 1	1. Build an Instrumentation Amplifier Circuit to detect and Amplify Analog/Bio-Potential Signals (using simulator or video to be displayed) 2. Verify the working of PLL using a simulator.
13	1,3,4	1,3, 4	1. IC 555 Timer: Internal diagram, Pin Configuration. Interpret Datasheets. 2. IC 555 timer as Astable multivibrator. 3. IC 555 timer as monostable multivibrator.	Refer Table 1	1. Verify the working of IC 555 timer as astable multivibrator. 2. Verify the working of IC 555 timer as monostable multivibrator.
Total in hours			**39**	**13**	**52**

Note: 1) In Practice sessions Video demonstration should be followed by MCQs/Quiz/Subjective questions and the evaluation has to be documented.

2) In Practice sessions, all discrete circuits should be simulated using suitable software before its construction and verification.

TABLE 1: Suggested activities for tutorials

The list is shared as an example and not inclusive of all possible activities of the course.

The list of activities for one week can be shared among teams in a batch of students.

Week. No.	**Suggested activities for tutorials**
01	1. Gather knowledge and give a presentation on the type of power supply used in mobile charger, desktop computer and laptop with its specifications and Justify. 2. Build a Notch Filter to reject 50 Hz noise in power supplies and demonstrate it in the class. 3. Identify the type of UPS used in the lab, its specifications, analyze its load carrying capacity related to its power factor and prepare a report on it.
02	1. Design and build a circuit that can store maximum voltage of the input signal (Peak Detector) and demonstrate it in the class. 2. Prepare a report on any one application of peak detector in daily life, also compare the nature of output of a rectifier and a peak detector. 3. Prepare a video of a circuit which increases the input voltage 4 times. (Quadrupler).

03	1. Give a presentation on the use of opto isolator to detect DC or control AC signals and data. 2. Demonstrate the use of PIN diode as a switch in domestic applications. 3. Build a power supply switching circuit using optocouplers.
04	1. Prepare a report on applications of each type of amplifier and present it. 2. Demonstrate any one real life application of an amplifier.
05	1. Prepare a report and explain a specific application of emitter follower in daily life. (Ex: as switching circuit, isolator circuit, voltage buffer, impedance matching circuit). 2. Prepare a presentation on comparison of power amplifiers.
06	1. Prepare a video/report on any one real life application of a power amplifier. 2. Build and demonstrate radio player amplifier circuit. 3. Give a presentation on low noise amplifiers.
07	1. Explain the criteria for selecting an op-amp for a given application. 2. Identify at least 5 electronic circuits using op-amp and present the details of its working.
08	1. Prepare a report on comparison of transistor amplifier and op-amp. 2. Demonstrate the operation of auto cut for manual stabilisers using 741 IC.
09	1. Explain how an op-amp can be used in applications such as A/D converters, wave shaping circuits etc. 2. Prepare a report on Schmitt trigger applications such as switch debouncing, noise removal etc.
10	1. Demonstrate the operation of a variable audio frequency oscillator using op-amp 741. 2. Explain the working of FM radio jammer.
11	1. Discuss the problems to design and analyse 1st order butterworth filters. 2. Demonstrate how LEDs can be made to blink on the beats of music.
12	1. Prepare a report on different applications of instrumentation amplifier 2. Explain the operation of Frequency Shift Keying (FSK) generator using PLL 565.

13	1. Study the latest technological changes in this course and present the impact of these changes on industry. 2. Demonstrate the use of IC 555 timer in traffic light controller. 3. List the real life applications of IC 555 timer and explain any one application.

LINKS FOR REFERENCE.

1. https://www.teamwavelength.com/power-supply-basics/
2. https://www.tutorialspoint.com/electronic_circuits/electronic_circuits_smps.htm
3. www.electronicshub.org
4. https://images.app.goo.gl/xb2JnuqBKyaLgwi6A (Tutorial 6)
5. https://youtu.be/mgoCeOCjiBI (Experiment 7)
6. https://www.circuitstoday.com/
7. https://elec-club-iitb.github.io/blog/2016/09/get-electrified-2/
8. https://bestengineeringprojects.com/frequency-shift-keying-fsk-generator-using-pll-565/
9. https://images.app.goo.gl/cbkCDCHJngANwiyF6
10. http://www.allaboutcircuits.com
11. http://www.allaboutcircuits.com/videos

E-WEBSITES FOR REFERENCE

1. Electronic Tutorials
2. Spark fun-Learning section
3. All about circuits
4. Electronics theory
5. Electronics Lab
6. Instructables

4. CIE and SEE Assessment Methodologies

Sl. No	**Assessment**	**Test Week**	**Duration** In minutes	**Max marks**	**Conversion**
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
				Total CIE Marks	60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. Format for CIE (1, 2, 3) Written Test

Course Name		Test	I/II/III	Sem	III/IV
Course Code		Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			
	6			

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

5.(a)Format for CIE-(4,5) Skill Test -Practice.

SL. No.	COs	Particulars/Dimension	Marks
1	1,2	Identify and test the given Electronic components - 10 Marks Interpret datasheet of any one Electronic component -10 Marks	20
2	3	Test the working of electronic circuit using simulation.	20
3	3 ,4	Conduct an experiment on analog circuit a) Writing the circuit diagram, tabular column, formula - 10 Marks b) Build the circuit -10 Marks c) Test, troubleshoot and demonstrate working of the circuit - 10 Marks d) Result - 10 Marks	40
4	1,2,3, 4	PortFolio evaluation of Practice sessions through rubrics	20
		Total Marks	**100**

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
	Average Marks= (8+6+2+2)/4=4.5						**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	1. Electronic Devices and Circuits, S. Salivahanan , N. Sereshkumar , McGraw Hill Education (India) Private Limited, ISBN - 9781259051357
2	Op-amps and linear integrated circuits, Ramakanth A. Gayakwad, ISBN- 9780132808682
3	Principles of Electronics, Rohit Mehta and V K Mehta, S. Chand and Company Publishing, ISBN-9788121924504
4	Electronic Devices and Circuits, David A. Bell, Oxford University Press, ISBN9780195693409
5	Fundamentals of Electrical and Electronics Engineering, B. L. Theraja, S. Chand and Company Publishing. REPRINT 2013, ISBN-8121926602.

8. SEE Scheme of Evaluation

SL. No.	COs	Particulars/Dimension	Marks
1	1.2	Identify and test the given Electronic components - 10 Marks Interpret datasheet of any one Electronic component -10 Marks	20
2	3	Test the working of electronic circuit using simulation.	20
3	3 ,4	Conduct an experiment on analog circuit a) Writing the circuit diagram, tabular column, formula - 10 Marks b) Build the circuit -10 Marks c) Test, troubleshoot and demonstrate working of the circuit - 10 Marks d) Result - 10 Marks	40
4	1,2,3, 4	Viva-Voce	20
		Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers	Intel Core i5 11th gen/8GB RAM/1 TB HDD/256GB SSD/ Graphics 2 GB	20
2	MATLAB /PSPICE/Electronic Workbench Software for simulation		
3	Regulated Power Supply (Single)	1A/2A 0-30V	10
4	Regulated Power Supply (Dual)	1A/2A 0-30V	10

5	DC Voltage supply	(+/-5v, +/-12V, +/-15V	10
6	Digital multimeters		10
7	Function/Signal generator		10
8	Dual trace oscilloscope	Upto 20-30MHz	10
9	Electronic consumables (Diode, Transistor(npn and pnp), Resistors, Inductors, Capacitors, Special purpose diodes,etc)		Consumables as required
10	Step down transformers	6-0-6v 12-0-12v	10 each
11	OP-amps	741 IC	20
12	IC 555		10
13	Single strand wire/ patch cards	Different lengths	
14	Probes		10
15	Breadboard/Analog trainer kit		10

Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Electronics and Communication	**Semester**	III
Course Code	20EC32P	**Type of Course**	Program Core
Course Name	Logic Design using Verilog	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

1. Rationale

Digital Electronics is a field of electronics involving the study of digital signals and engineering of devices that use or produce them. It is very important in today's life because if digital circuits are used instead of analog circuits the signals can be transmitted without degradation due to noise. Also in a digital system information stored is easier than that of analog systems. The functionality of digital circuits can be changed easily with the help of software without changing the actual circuit. Verilog, a Hardware Description Language, is used for describing digital electronic circuits and systems. It is used for verification of digital circuits through simulation, for timing analysis, for test analysis and for logic synthesis**.**

2. Course Outcomes: On successful completion of the course, the students will be able to:

CO-01	List the types of Verilog modeling and the use of each model for specific application
CO-02	Design and construct a sequential circuit for a given application and test the circuit to obtain the desired result/output.
CO-03	Compare and contrast combinational and sequential circuits and simulate a given circuit using Verilog descriptions to test to obtain the desired result/output
CO-04	List the various types of A to D, D to A converters along with memory and for a given application select the appropriate converters and/or memory types to be used to obtain the given result/output.

3. Course Content

Week	**CO**	**PO**	**Lecture (Knowledge Criteria)**	**Tutorial (Activity Criteria)**	**Practice (Performance Criteria)**
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	1,4,5, 6,7	1. VLSI - Introduction, Importance & Need. HDL- Introduction, Importance, Need & Types. 2. Introduction to Verilog HDL, Types of modeling- Switch level, Structural, Data flow and Behavioral. 3. Basic Concepts- Lexical conventions, comments, keywords, identifiers, strings.	Refer Table 1	1. Familiarization of Xilinx software. 2. Familiarization of FPGA/CPLD KIT.

2	1	1,2,4	1. Data types -Value Set, Wires, Nets, Registers, Vectors, Integers, Real, Time, Parameters, Arrays, Strings. 2. Operators- Arithmetic, Logical, Relational, Bit-wise. 3. Reduction, Shift, Concatenation, Replication, Conditional operators. Operator Precedence.	Refer Table 1	1. Demonstrate and Practice simple examples using different data types. 2. Compute the output for expressions having different operators using simple programs.
3	1,3	1,2,3, 6	1. Program structure- Module declaration, port declaration, port connection. 2. Gate level modeling for basic gates. 3. Gate level Verilog description for half adder, full adder.	Refer Table 1	Write the verilog code, simulate and download to FPGA/CPLD kit for the following 1. 2 input basic gates using gate level modelling. 2. Full adder and full subtractor using gate level modelling.
4	1,3	1,2,3, 4,6	1. Data flow modeling- Continuous assignment, Module instantiations, net declaration, delays, expressions. 2. Data flow Verilog description of multiplexer and demultiplexer. 3. Data flow Verilog description for 4-bit comparator	Refer Table 1	Write the verilog code, simulate and download to FPGA/CPLD kit for the following. 1. 4:1 Mux and 1:4 Demux using data flow modeling. 2. Comparator using data flow modeling.
5	1,3	2,3,4, 6	1. System tasks-display, strobe, monitor, reset, stop, finish. Compiler directives- include, define. Behavioral modeling- Always and Initial statements. 2. Procedural Assignments- Blocking and non-blocking assignments. Timing Control-Delay, Event 3. Conditional statements-if, if-else, Case, Loops- While, For, Repeat, Forever.	Refer Table 1	1a.Write and execute simple programs to illustrate conditional statements. 1b. Write and execute simple programs to illustrate loops. 2. Write the verilog code, simulate and download to FPGA/CPLD kit for a 4-bit ALU with any 2 arithmetic and logical operations.
6	1,3	1,2,3, 4,6	1. Behavioral Verilog description for BCD to seven segment decoder for common anode display using if-else, Case. 2. Traffic light controller using Behavioral description. 3. Test bench- Need, Importance, testbench for half adder.	Refer Table 1	1. Write the verilog code, simulate and download to FPGA/CPLD kit for a BCD to seven segment decoder using case statement. 2. Write and simulate a Test bench for half adder.

7	2	1,2,3, 4,6,7	1. Sequential circuits - Introduction. Flip flops- types, SR flip flop- Gate level circuit using NAND gates, truth table, working, timing diagram. 2. JK, JK-MS flip flops-Logic circuit, truth table, working, timing diagram. 3. D, T flip flops-Logic circuit, truth table, working, timing diagram. Relevance of Asynchronous inputs to flip-flops.	Refer Table 1	1. Construct and test clocked SR Flip flop using NAND gates in digital trainer kit. 2. Implement D and T Flip flops using JK flip flop in digital trainer kit and observe the timing diagram.
8	2,3	1,2,3, 4	1. Verilog description of SR flip flops using data flow modeling. 2. Verilog description of JK flip flop using behavioral modeling. 3. Registers- Classification of registers, realization of simple (3 or 4 bit) SISO using flip-flops.	Refer Table 1	Write the verilog code, simulate and download to FPGA/CPLD kit for the following. 1. SR, JK flip flops using data flow modeling 2.D, T flip flops using behavioral modeling
9	2,3	1,2,3, 4,6,7	1. Realization of SIPO, PISO and PIPO using flip flops. 2. Concept of universal shift-register. Ring counter and Johnson's counter (3 bit). 3. Verilog description of any one shift register using any modeling.	Refer Table 1	Construct and verify the working of the following using suitable IC in digital trainer kit 1. SISO, SIPO, PISO and PIPO(4-bit) shift registers. 2. Ring and Johnson counter(4-bit).
10	3	1,3,4, 6,7	1. Counters - definition, classification, modulus. Working and realization of asynchronous (3 bit/4 bit) counters using flip-flops. 2. Working and realization of synchronous (3-bit/ 4-bit) counters and their comparison. 3. Realization of partial mod (mod n) counters-asynchronous, synchronous.	Refer Table 1	Construct and verify the working of the following using digital trainer kit 1. 3 bit ripple counter using IC 7476. 2. 4 bit counter as a frequency divider.
11	3,4	1,2,6, 7	1. Realization of higher-mod counters using lower-mod counters. Concept of up/ down counters. 2. Verilog description of any one counter using any modeling. 3. Data converters- Need for DAC and ADC, DAC specifications, types, working of Weighted resistor type.	Refer Table 1	1. Write the verilog code, simulate and download to FPGA/CPLD kit for an up/down counter using behavioral modeling. 2. Construct/Simulate and verify the working of R-2R DAC.
12	4	1,2,3, 4,6,7	1. ADC specifications. types, working of Flash ADC.	Refer Table 1	1. Construct/Simulate and verify the working of Flash ADC.

			2. Working of Successive approximation and dual slope ADCs. 3. Memory devices- Introduction, classification based on different criteria, read and write operations.		2. Illustrate the storing and retrieving of data in RAM using suitable IC.
13	4	1,2,3, 4,7	1. Introduction to PLDs- PAL, PLA, CPLD, FPGA, ASIC. IC Design Verification – Types & Stages. 2. PAL- Architecture, Implementation of a Boolean expressions using PAL. 3. PLA-Architecture, Implementation of a Boolean expressions using PLA.	Refer Table 1	1. Implementation of Boolean expressions using PAL. 2. Implementation of Boolean expressions using PLA.
Total in hours			**39**	**13**	**52**

Note: 1) In Practice sessions Video demonstration should be followed by MCQs/Quiz/Subjective questions and the evaluation has to be documented.

2) In Practice sessions, all circuits should be simulated using suitable software before its construction and verification.

TABLE 1: Suggested activities for tutorials

The list is shared as an example and not inclusive of all possible activities of the course.

The list of activities for one week can be shared among teams in a batch of students.

Week No.	**Suggested activities for tutorials**
01	1. Explain the typical design flow for VLSI IC Circuits. 2. Give a presentation on comparison of different types of HDLs. 3. Give a presentation on comparison of different types of modeling in Verilog.
02	1. Prepare a report on declaration and initialization of variables of different data types in Verilog. 2. Prepare a report on hierarchy of operators.
03	1. Explain basic components of a module? Which components are mandatory? 2. Prepare a report on Hierarchical names for variables. 3. Write and explain a Verilog code for 4:1 mux and 1:4 demux using gate level modeling.

04	1. Write and explain the Verilog code for full adder using data flow modeling. 2 Write and explain the Verilog code for 8:1 mux using data flow modeling.
05	1.Give a presentation on the differences between tasks and functions 2. Illustrate the use of system tasks with examples. 3. Illustrate the use of gate delays to model timing for a simple logic equation.
06	1. Compare if-else and case statements with the help of examples. 2. Compare all loops with the help of examples. 3. Write and explain the verilog code for full subtractor and 1:8 demux using behavioral modeling. 4. Explain the Verilog Test bench with an example to verify the HDL designs.
07	1. Prepare a report on differences between Combinational and Sequential circuits with examples. 2. Give a presentation on application of flip flop as bounce elimination switch. 3. Demonstrate the working of flip flop as a one bit memory element.
08	1. Prepare a report on flip flop ICs and their features. 2. Give a presentation on eliminating race -around condition in JK flip flop. 3. Compare the advantages and disadvantages of all flip flops.
09	1. Prepare a report on shift register ICs and their features. 2. Give a presentation on applications of shift registers in real life. 3. Demonstrate the working of IC 7495 as shift register.
10	1. Prepare a report on differences between asynchronous and synchronous counters. 2. Give a presentation on how counters can be used in a simple car parking system. 3. Give a presentation on implementation of footfall counter for various purposes
11	1. Prepare a report & explain the specifications of DAC and ADC ICs. 2. Give a presentation on any application of DAC in real life. 3. Give a presentation on any application of ADC in real life.

12	1. Prepare a report & explain the types of RAM and ROM. 2. Give a presentation on usage of RAM and ROM in different digital devices.
13	1. Study the latest technological changes in this course and present the impact of these changes on industry. 2. Prepare a report on CPLD, FPGA and ASIC and its applications. 3. Give a presentation on importance or scope of Design Verification in Integrated circuit designs.

LINKS.

1. https://verilogguide.readthedocs.io/en/latest/verilog/testbench.html
2. https://youtu.be/XES0QUi8ttY(week 11, exp 2)
3. https://www.youtube.com/watch?v=krmXg-WTbIU (week 12, exp 1)
4. http://www.asicguru.com/verilog/tutorial/system-tasks-and-functions/68/.
5. https://youtu.be/vHlg__QLGIQ (week 7,exp 3)
6. https://youtu.be/AtX5x53FcLI (week 9,exp 3)
7. https://youtu.be/Bx_4rsUAGoM
8. https://www.irisys.net/people-counting.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
				Total CIE Marks	60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. Format for CIE (1,2,3) Written Test

Course Name	**Logic Design Using Verilog**	Test	I/II/III	Sem	III/IV
Course Code	**20EC32P**	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					
Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks
I	1				

	2			
II	3			
	4			
III	5			
	6			
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.				

5. (a) Format for CIE-4 Skill Test -Practice.

SL. No.	COs	Particulars/Dimension	Marks
1	1	List the types of Verilog modelling and the use of each model for specific application.	20
2	3	Write two Verilog programs on combinational circuits for a given application -40 Marks Simulation - 20 Marks Download to FPGA kit - 10 Marks	70
3	1,3	PortFolio evaluation of Practice sessions through rubrics	10
		Total Marks	**100**

5. (b) Format for CIE-5 Skill Test - Practice.

SL. No.	COs	Particulars/Dimension	Marks
1	2	Write a Sequential circuit for a given application -20 Marks Conduction using DTK -20 Marks Output -10 Marks	50
2	3	Write a Verilog program on Sequential circuits for a given application - 10 Marks Simulation -5 Marks Output - 5 Marks	20
3	4	Identify various types of A to D, D to A converters/ memory for a given application & select the appropriate converters/ memory types needed to obtain the required output.	20
4	2,3,4	Portfolio evaluation of Practice sessions through rubrics.	10
		Total Marks	**100**

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
						Average Marks= (8+6+2+2)/4=4.5	**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Fundamentals of Digital Logic with Verilog Design by Stephen Brown and Zvonko Vranesic
2	Verilog HDL by Samir Palnikar
3	Introduction to Verilog-Peter M Nyasulu
4	Verilog Tutorial-Deepak Kumar Tala

8. SEE Scheme of Evaluation

SL. No.	COs	Particulars/Dimension	Marks
1	1	List the types of Verilog modelling and the use of each model for specific application	10
2	3	Write a Sequential circuit for a given application -10 Marks Conduction using DTK -10 Marks Output -10 Marks	30
3	2	Write a Verilog program for a given application - 10 Marks Simulation - 10 Marks Download to FPGA kit- - 10 Marks	30
4	4	Identify various types of A to D, D to A converters and memory and for a given application & select the appropriate converters and/or memory types needed to obtain the given output.	10
5	1,2, 3,4	Viva-Voce	20
		Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers	Intel Core i5 11th gen/8GB RAM/1 TB HDD/256GB SSD/ Graphics 2 GB	20
2	Xilinx software		
3	Digital trainer kits		20
4	Verilog kits		20
5	Dual trace oscilloscope	20-30MHz	10
6	Digital multimeters		05
7	Patch cards	different length	250
8	Digital IC Tester		02
9	ICs 7400,7402,7404,7408,7432,7486,7442, 7445,7446,7474,7476,7427,7489,7490, 7494,7495,74141,74148,74153,74157, 74155,74193,74194,DAC0808,ADC-0800,741		10 each

Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Electronics and Communication	**Semester**	III
Course Code	20EC33P	**Type of Course**	Programme Core
Course Name	Communication Systems	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

1. Rationale

The communication system describes the information exchange between any two points. The process of transmission and reception of information is called communication. Without communication the world ceases to exist. Information or Data can be transmitted and received across any part of the world by adapting suitable techniques, process and medium, hence making the world reachable and smaller through Technology.

2. Course Outcomes : On successful completion of the course, the students will be able to :

CO-01	Identify all the components of a communication system, list their role and characteristics in the system.
CO-02	Propagate a signal through a transmission medium to obtain a desired output for given conditions in the communication system.
CO-03	Construct an analog/digital communication system for a given application and demonstrate its working either in a Real or Simulated environment.

3. Course Content

Week	**CO**	**PO**	**Lecture (Knowledge Criteria)**	**Tutorial (Activity Criteria)**	**Practice (Performance Criteria)**
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	1,4,5	**Network theorems** 1. Superposition theorem- statement and explanation with an example. 2. Maximum Power Transfer theorem- statement and explanation with an example. 3. Thevenin's theorem and Norton's theorem-statements and explanation with an example each.	Refer Table 1	1. Construct and verify maximum power transfer theorem. 2. Construct and verify Thevenin's theorem.

2	1,3	1,2,4,6	**Resonance** 1. Series resonance - circuit diagram, phasor diagram, resonance plot and characteristics. 2. Condition for series resonance, expression for frequency of resonance. Parallel resonance- circuit diagram, phasor diagram. 3. Parallel resonance-resonance plot and characteristics, Condition for resonance, expression for frequency of resonance.	Refer Table 1	1. Construct a series/parallel resonant circuit and plot its frequency response. 2. Construct a series/parallel resonant circuit and find its bandwidth and Q factor.
3	1,3	1,2,4,6	**Filters** 1. Classification of filters, cut-off frequency, pass band and stop band. 2. Ideal characteristics curve of passive LPF, HPF, BPF and BRF. 3. Circuit diagram & formula for cut-off frequency of T and Π configurations of LPF and HPF.	Refer Table 1	1. Construct and test the passive low-pass T-type filter circuit for a given cut-off frequency. 2. Construct and test the passive high pass Π -type filter circuit for a given cut-off frequency.
4	1,3	1,2,4,6	**Attenuators** 1. Classification and applications of attenuators. Definition of Bel, Decibel and Neper. 2. Symmetrical T type attenuator- Circuit diagram, expression for attenuation. 3.Symmetrical Π type attenuator- Circuit diagram, expression for attenuation	Refer Table 1	1. Construct and test T type attenuator circuit for the given attenuation & Ro. 2.Construct and test Π type attenuator circuit for the given attenuation & Ro.
5	1,2,3	2,3,4,5	**Transmission Media** 1. Need, different types of transmission media(guided, unguided), Transmission lines- Electrical model, Primary constants - R, L, G and C , Secondary constants - Characteristic Impedance and Propagation Constant. 2. Optical fiber -principle of operation, Numerical aperture, Angle of acceptance, Classification, fiber losses. 3..Basic components of Fiber optic system, splices, connecters , couplers and switches.	Refer Table 1	1. Demonstrate PC to PC communication using Fiber Optic Digital Link. 2. Demonstrate installation , testing, repair and power budgeting of fiber optic cable (using simulator/video)
6	1,2,3	1,4,5,6	**Antennas** 1. Concept of electric and magnetic fields in a dipole, antenna terminology- polarization, radiation pattern, antenna gain, directive gain, directivity, power gain, antenna resistance.	Refer Table 1	1. Video demonstration and documentation on the working of the dipole antenna and observe its radiation pattern.

			2. Antenna efficiency, beam width, bandwidth, isotropic radiators. Effects of ground on antennas, effect of antenna height, Antenna types, examples and applications. 3. Working of Dish Antenna, Feed mechanisms-Cassegrain and Horn feed.		2. Video demonstration and documentation of antenna types with examples and applications.
7	2,3	1,4,5,6	**Wave Propagation** 1. Wave Propagation: Fundamentals of Electromagnetic Waves, electromagnetic spectrum. 2. Modes of wave propagation-ground wave propagation and sky wave propagation and space wave propagation, comparison. A**nalog modulation** 3. Block diagram of communication system, Need for modulation and types of analog modulation techniques.	Refer Table 1	1. Video demonstration and documentation on the fundamentals of electromagnetic waves and electromagnetic spectrum. 2. Video demonstration and documentation on the need for modulation and demodulation techniques.
8	3	1,2,3,4,6	1. AM Transmitter and Receiver -block diagram & waveforms. 2. Expressions for modulating signal, Carrier signal, modulated signal, modulation index and power. 3. Frequency Transmitter and Receiver-block diagram, waveform, Expressions for frequency deviation, modulation index.	Refer Table 1	1. Construct and verify amplitude modulation and demodulation using kit. 2. Construct and verify frequency modulation and demodulation using kit.
9	1,3	1,3,4,5,6,7	**Digital communication** 1. Block diagram of digital communication system. Definition of information capacity, entropy, bit-rate, baud rate and bandwidth of digital data. 2. Sampling- Sampling theorem for low pass and band pass signals, Nyquist criterion and aliasing effect. 3. Explain Analog pulse modulation techniques-PAM, PPM, PWM using waveforms.	Refer Table 1	1. Verify sampling theorem for low pass signals using kit. 2. Conduct an experiment to study the effect of aliasing using kit.

10	1,3	1,2,3 ,4,6	**Digital Coding** 1. Quantization -process, classification. Quantization noise and companding process. 2. PCM and DPCM system. 3. Delta modulation and adaptive delta modulation system.	Refer Table 1	1. Perform an experiment to study Pulse Code Modulation and Demodulation using kit. 2. Generation of Delta modulated signal using kit.
11	1,3	1,2,4 ,6	1. Baseband transmission - significance of inter symbol interference (ISI) and eye pattern. Digital modulation techniques-types. 2. Generation and detection of Binary ASK and Binary FSK. 3. Generation and detection of Binary PSK and QPSK.	Refer Table 1	1. Perform an experiment to generate and detect BASK signal using kit. 2. Perform an experiment to generate and detect BPSK signal using kit.
12	1,3	1,2,6 ,7	**Multiplexing** 1. FDM & TDM- concept applications 2. PAM/TDM system -Block diagram, transmission bandwidth, synchronization, crosstalk and guard time. 3. Digital multiplexers-Principle, classification and performance factors.	Refer Table 1	1. Demonstrate TDM using Fiber Communication System. 2. Video demonstration and documentation of FDM and TDM.
13	3	1,2,4 ,6	**Error detection & correction** 1. Errors-types, redundancy, error control schemes. 2. Error control codes- types, Parity check bit coding, error detection methods-LRC. 3. VRC, CRC, Checksum with examples.	Refer Table 1	1. Video demonstration and documentation of error detection and correction. 2. Video demonstration and documentation on LRC, VRC, CRC.
Total in hours			**39**	**13**	**52**

Note: 1. In Practice sessions Video demonstration should be followed by MCQs/Quiz/Subjective questions and the evaluation has to be documented.

2. In Practice sessions, all discrete circuits should be simulated using suitable software before its construction and verification.

TABLE 1: Suggested activities for tutorials

The list is shared as an example and not inclusive of all possible activities of the course.

The list of activities for one week can be shared among teams in a batch of students.

Week No.	Suggested activities for tutorials
01	1. Write a report on implementation fields of all the theorems. 2. Solve problems on all theorems.
02	1. Give a presentation on demonstrations of series and parallel resonance. 2. Solve problems on series and parallel resonance.
03	1. Write a report on the needs of LPF, HPF, BPF, BRF and their comparison. 2. Give a presentation on the working of BPF & BRF. 3. Solve problems on Filters.
04	1. Give a presentation on the relationship between Bel, Decibel and Neper. 2. Give a presentation on the importance of attenuators in communication circuits.
05	1. Prepare a report on properties of light and its significance in optical communication. 2. Visit a nearest telephone exchange, collect and prepare a handwritten brief report on optical fibers for the communication purpose with specifications. 3. Present a report on the FIBERNET broadband and compare it with traditional broadband.
06	1. Give a presentation on miniature antennas. 2. Demonstrate how a mobile phone antenna performance can be improved. 3. Study the technical paper and present it. **https://documentcloud.adobe.com/link/review?uri=urn:aaid:scds:US:3d5cab35-a6d0-49e4-b4b3-06c745d34d98**
07	1. Give a presentation on uses of each range of frequency in the Electromagnetic spectrum. 2. Give a presentation on different types of wave propagation. 3. Demonstration and explain different waveforms in Analog modulation.
08	1. Give a presentation on working of superheterodyne receiver. 2. Prepare a report on the merits, demerits and applications of AM and FM. 3. Collect the specifications of FM receivers and explain it.
09	1. Give a presentation on comparison of analog and digital communication. 2. Collect and prepare a report on the functional blocks in the digital communication system such as scramblers, unscramblers, equalizers with applications. 3. Give a presentation on types of sampling.

10	1. Give a presentation on advantages, disadvantages and applications of PCM and DPCM. 2. Give a presentation on advantages, disadvantages and applications of delta modulation and adaptive delta modulation.
11	1. Prepare a report on the type of digital modulation technique used for voice signal transmission in telephone systems. 2. Give a presentation on generation and detection of DPSK. 3. Give a presentation on comparison of digital modulation techniques.
12	1. Give a presentation on applications of TDM and FDM. 2. Prepare a report on the type of multiplexing used in mobile communication with specifications of multiplexer.
13	1. Study the latest technological changes in this course and present the impact of these changes on industry. 2. Give a presentation on the merits, demerits and applications of all error detection methods.

Links.

1. https://www.gopracticals.com/electrical/basic-electrical/verify-thevenin-theorem/
2. https://youtu.be/Ok7DJGuOulQ
3. https://youtu.be/B_u3sGbpM8M
4. https://documentcloud.adobe.com/link/review?uri=urn:aaid:scds:US:3d5cab35-a6d0-49e4-b4b3-06c745d34d98
5. https://www.wikihow.com/Design-a-Simple-Antenna
6. https://youtu.be/r4NikIMA4dQ
7. https://youtu.be/8P6DBAxbQxY
8. https://youtu.be/00ZbuhPruJw

4. CIE and SEE Assessment Methodologies

Sl. No	**Assessment**	**Test Week**	**Duration** In minutes	**Max marks**	**Conversion**
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
				Total CIE Marks	60
Semester End Examination (Practice)			180	100	40
				Total Marks	**100**

5. Format for CIE (1, 2, 3) Written Test

Course Name	**Communication Systems**	Test	I/II/III	Sem	III/IV
Course Code	**20EC33P**	Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			
	6			

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

5. (a).Format for CIE-4 Skill Test -Practice

SL. No.	**COs**	**Particulars/Dimension**	**Marks**
1	1	Conduct an experiment on Network Theorems/ Resonance/ Filters/ Attenuators Writing schematic diagram -20 Marks Conduction -30 Marks Result - 10 Marks	60
2	2	Conduct an experiment on Transmission media/Antennas	30
3	1,2	Portfolio evaluation of Practice sessions through Rubrics	10
		Total Marks	**100**

5. (b).Format for CIE-5 Skill Test-Practice

SL. No.	**COs**	**Particulars/Dimension**	**Marks**
1	2	Explain propagation of signals through transmission media to obtain desired output.	20
2	3	Demonstrate an analog/digital modulation / demodulation technique Write schematic diagram (2 Circuits) -30 Marks Conduction using kit -20 Marks Result -20 Marks	70
3	2,3	Portfolio evaluation of Practice sessions through Rubrics	10
		Total Marks	**100**

6. **Rubrics for Assessment of Activity (Qualitative Assessment)**

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
	Average Marks= (8+6+2+2)/4=4.5						**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. **Reference:**

Sl. No.	Description
1	Electronic communications - George Kennady
2	Advanced Electronics Communication System. - Wayne Tomosi
3	Understanding communication systems - Texas Instruments
4	Fiber Optic Communication Systems, - Dr.R.K.Singh, Wiley India
5	Principles of Electronic Communication Systems - Louis E. Frenzel, Tata McGraw Hill
6	Digital and analog communication systems - K.Sham Shanmugam, Wiley India

8. SEE Scheme of Evaluation

SL. No.	**COs**	**Particulars/Dimension**	**Marks**
1	1	Conduct an experiment on Network Theorems/ Resonance/ Filters/ Attenuators Writing schematic diagram -15 Marks Conduction - 15 Marks Result -10 Marks	40
2	2	Identify the type of Transmission media/Antenna used in a given application	10
3	3	Demonstrate an analog/digital modulation / demodulation technique Write schematic diagram -10 Marks Conduction using kit - 10 Marks Result - 10 Marks	30
4	1,2,3	Viva-voce	20
		Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers	Intel Core i5 11th gen/8GB RAM/1 TB HDD/256GB SSD/ Graphics 2 GB	20
2	MATLAB/PSPICE/Electronic Workbench Software Simulator		
3	Amplitude modulation and demodulation trainer kits		05
4	Frequency modulation and demodulation trainer kits		05
5	Generation and detection BASK,BFSK,BPSK trainer kits		05 each
6	Regulated Power supply	(1A/2A, 0-30V)	10
7	Dual trace oscilloscope	up to 20 to 30MHz	10
8	Digital multimeters		10
9	Function/Signal generators		10
10	Step down transformer, Capacitors, Resistors, Inductors, BJT, Opamp IC-741, Regulator IC-7812, Diode		Consumables as required
11	Single strand wire/Patch cards (different lengths)		150
12	Probes		10
13	Analog trainer kit		5
14	DC Voltage supply	(+/-5v, +/-12V, +/-15V)	10
15	Kit to demonstrate Sampling theorem and aliasing effect		05
16	Kit to demonstrate PCM		05
17	Delta Modulation and Detection trainer kit		05
18	Adaptive Delta Modulation and Detection trainer kit		05
19	Optical fiber communications trainer kit to cover all the experiments.		05
20	Computers	Pentium and higher,8GB RAM,512 HDD	20
21	Tool kit		02 set

Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Electronics and Communication	**Semester**	III
Course Code	20EC34P	**Type of Course**	Programme Core
Course Name	Electronic Measurements and Testing Techniques	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

1. Rationale

The instruments used to measure any Electrical/Electronic quantity are known as measuring instruments. The standards of measurements are very useful for calibration of measuring instruments. They help in minimizing the errors in the measuring systems. Testing Techniques are means of enhancing troubleshooting and the ability to learn skills. It keeps electronic equipment in working condition and ensures safety. The damage of the equipment can be significantly reduced.

2. Course Outcomes : At the end of the Course, the student will be able to:

CO-01	List the types of measurement and common errors that occur while using electronic measuring systems and demonstrate use of statistical analysis to validate specific output from measuring and testing equipment.
CO-02	Explain the standards used for calibration and demonstrate calibration of a measuring and/or testing equipment to ensure it provides reliable output.
CO-03	Select an appropriate sensor or transducer for a given application and demonstrate its use to measure and record the readings for a given project.
CO-04	Test a given lab equipment, identify the reasons for error, troubleshoot or calibrate to ensure the equipment provides the correct reading

3. Course Content

Week	**CO**	**PO**	**Lecture (Knowledge Criteria)**	**Tutorial (Activity Criteria)**	**Practice (Performance Criteria)**
			3 hours/week	1 hour/week	4 hours/ (2 hours/batch twice in a week)
1.	1	1,4,6	1. Necessity of measurements-direct and indirect methods, Static characteristics of an instrument. 2. Dynamic characteristics of an instrument. Generalized electronic measurement system-Block diagram. 3. Errors–classification of errors, sources of errors.	Refer Table 1	1. Find the static characteristics of analog voltmeter/ multimeter. 2. Find the dynamic characteristics of analog voltmeter/multimeter.
2	1, 2, 4	1,4,5, 7	1. Statistical analysis- arithmetic mean, deviation, average deviation, standard deviation, probability of errors and limiting errors. 2. Problems on Statistical analysis.	Refer Table 1	1. Identify the errors and do the calibration for setting up an analog multimeter before performing measurement.

			3. Calibration, Error check, understand specification sheet of digital multimeter.		2. Troubleshoot and service the Digital trainer kits.
3.	1, 2, 4	1,4 ,5	1. Standards-primary, secondary, working and IEEE standards. 2. Bridges- Comparison of AC and DC bridges. Applications of AC and DC bridges. 3. Wheatstone bridge-Explanation and applications.	Refer Table 1	1. Build a Wheatstone bridge to find unknown resistance. 2. Construct a circuit to measure AC voltage by voltage divider method.
4	2, 3	1,2 ,3, 4,6	1. Electrical Transducers- necessity, selection, classification- active and passive, analog and digital, primary and secondary. 2. Strain gauge-principle, gauge factor, features of bonded, unbonded, foil type strain gauges. 3. Load Cell, capacitive transducer-principle & features.	Refer Table 1	1. Video demonstration and documentation on multi-function meter used for measuring any electrical parameter. 2. Calibrate a load cell to measure the weight of any object. Use suitable components and/or programming to accomplish the task.
5	2, 3	3,4 ,5, 7	1. Hall effect transducers, LVDT, thermistor. 2. Thermocouple, piezoelectric transducers, position sensors. 3. Proximity sensors, digital optical encoders & PIR sensors.	Refer Table 1	1. Build a temperature sensor circuit using a thermistor. 2. Build a simple application using position/proximity sensor.
6	1, 2	1,4 ,7	1. PMMC meters- principle, DC ammeters and multi range ammeters. 2. DC voltmeters using PMMC, multi range voltmeters, loading effect and voltmeter sensitivity. 3. Electrodynamometer -principle, ammeter, voltmeter.	Refer Table 1	1. Construct a circuit to verify KVL and measure voltages using analog voltmeter. 2. Construct a circuit to verify KCL and measure currents using analog ammeter.
7	1, 2	1,4 ,5, 7	1. Electronic voltmeter- Chopper amplifier type voltmeter. 2. AC voltmeter- full-wave rectifier, Peak responding and true RMS voltmeters. 3. Ohmmeters- series and shunt type, concept of calibration of meters.	Refer Table 1	1. Study of Regulated DC power supply and measurement of standard voltages at various stages of RPS. 2. Identify and rectify the various faults in the Regulated DC power supply.

8	1, 4	1,2 ,4, 5	1. Digital instruments –Introduction, Ramp type DVM. 2. Automatization in digital meters-automatic polarity indication, automatic decimal point positioning, automatic ranging and zeroing. 3. Electronic counters-block diagram.	Refer Table 1	1. Video demonstration and documentation on testing life cycle of electrical loads using Electronic Counter. 2. Troubleshoot and perform minor repair practices on Decade Boxes (Rotary switches, connectors, components connectivity etc).
9	1, 2, 4	1,4 ,5, 6	1. Digital frequency meter, Time interval measurement. 2. Digital LCR meter, digital multimeter. 3. Microprocessor based instruments, IEEE 488 GPIB instruments.	Refer Table 1	1. Calibrate LCR meter and perform measurement of Resistance, capacitance, and inductance and verify with actual value. 2. Troubleshoot and rectify any analog circuit using simulation software (Multisim)
10	1, 2, 4	1,4 ,5, 6	1. Cathode Ray Oscilloscope-block diagram, working of CRT. 2. Dual trace CRO, CRO probes, applications of CRO. 3. DSO-block diagram, features, Sampling oscilloscope.	Refer Table 1	1. Study the front panel controls of CRO and do its calibration 2. Demonstrate the use of CRO to measure phase difference between two waveforms and obtain the lissajous patterns.
11	1, 2, 4	1,4 ,7	1. Function generator- block diagram and applications. 2. Standard RF signal generator, sweep frequency generator. 3. Harmonic distortion, harmonic analyzing instruments.	Refer Table 1	1. Demonstrate the analysis of different waveforms (amplitude, phase, frequency) from a function generator using CRO. 2. Demonstration and documentation on the working of a spectrum analyser. (Video/simulator)
12	1, 4	1,5 ,7	1. Electrical grounding and shielding-concept, interference, shielding of cabinets. 2. Precautions to prevent instrument damage, general precautions for instrument safety. 3. Testing and troubleshooting-introduction**,** generalized troubleshooting.	Refer Table 1	1. Do it yourself (DIY) a probe and use the probe to test the circuit continuity in PCB.

13	1, 2, 4	1,4 ,5, 7	1. Precautions to be taken to achieve personnel safety during servicing. 2. Testing Techniques, electronic repair tools. 3. Explain Basic steps of electronic equipment service and maintenance. a) Study of basic procedure of service and maintenance b) Circuit tracing techniques	Refer Table 1	1. Do it yourself (DIY) an antistatic wrist strap useful to handle electronic component.
Total in hours			**39**	**13**	**52**

Note: 1) In Practice sessions Video demonstration should be followed by MCQs/Quiz/Subjective questions and the evaluation has to be documented.
2) In Practice sessions, all discrete circuits should be simulated using suitable software before its construction and verification.

TABLE 1: Suggested activities for tutorials

The list is shared as an example and not inclusive of all possible activities of the course.

The list of activities for one week can be shared among teams in a batch of students.

Week No.	**Suggested activities for tutorials**
01	1. Give a presentation on ways of reducing systematic and random errors. 2. List the basic tools (electronic repair tools) required for servicing electronic equipment and their purpose.
02	1. Present the specification sheets of voltmeter/ammeter/ohmmeter. 2. Demonstrate the procedure to calibrate DC power supply.
03	1. Identify the faults in Digital ICs and Troubleshoot using digital IC tester/ Logic Probe 2. Prepare a report on IEEE standards.
04	1. Give a presentation on applications of strain gauge and explain any one. 2. Prepare a report on advantages and disadvantages of capacitive transducers.
05	1. Write a report on various kinds of transducers used in Biomedical Instrumentation. 2. Demonstrate the application of any sensor.

06	1. Give a presentation on KVL and KCL and use of voltmeter and ammeter in taking readings. 2. Solve problems on extending range in ammeter and voltmeter.
07	1. Give a presentation on comparison of commercially available electronic voltmeters. 2. Prepare a report on calibration of meters.
08	1. Discuss pros and cons of Digital instruments. 2. Prepare a report on comparison of analog and digital instruments.
09	1. Give a presentation on performance testing on digital multimeters. 2. Collect and present service manuals of measuring instruments. 3. Present the applications of IEEE 488 GPIB instruments.
10	1. Give a presentation on applications of CRO. 2. Give a presentation on the Technical specification of CRO. 3. Collect and present the specifications of DSO.
11	1.Suggest cost-quality effective of any 4 measuring instruments by preparing comparative statements containing function, specification, make, market-price, and warranty 2. Collect and present the specifications of signal generator.
12	1. Prepare a report on the grounding and shielding of any lab equipment (ex. oscilloscope). Also present the consequences if not done so. 2. Do minor repair practices on Decade Boxes (Rotary switches, connectors, components connectivity etc.,)
13	1. Study the latest technological changes in this course and present the impact of these changes on industry. 2. Discuss about Trouble shooting chart.

LINKS

1. https://www.webassign.net/labsgraceperiod/ncsuplseem2/lab_1/manual.html
2. https://youtu.be/i4sI_dBWH50
3. https://blog.matric.com/pcb-testing-methods
4. https://www.youtube.com/watch?v=AUTcWsR6pwU
5. https://www.youtube.com/watch?v=x4B6_1C4gEQ
6. https://www.youtube.com/watch?v=-0Pre73mp7A
7. https://www.youtube.com/watch?v=lgvCMd5nMw4
8. https://www.youtube.com/watch?v=Evw5AqUYJcg
9. https://www.youtube.com/watch?v=yasajLJUYvg

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
				Total CIE Marks	60
Semester End Examination (Practice)			180	100	40
				Total Marks	**100**

5. Format for CIE (1, 2, 3) Written Test

Course Name	Electronics Measurement and Testing Techniques	Test	I/II/III	Sem	III/IV
Course Code	20EC34P	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					
Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks
I	1				
	2				
II	3				
	4				
III	5				
	6				
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional Questions in each section carry the same weightage of marks, Cognitive level and course outcomes.					

5. (a) Format for CIE-4 Skill Test - Practice

SL. No.	COs	Particulars/Dimension	Marks
1	1	Conduct an experiment on characteristics/ Calibration/ Bridge Writing circuit -20 Marks Conduction -20 Marks Result -10 Marks	50
2	3	Conduct an experiment on Sensor/Transducer	40
3	1,3	Portfolio evaluation of Practice sessions through Rubrics	10
		Total Marks	**100**

5. (b) Format for CIE-5 Skill Test - Practice

SL. No.	COs	Particulars/Dimension	Marks
1	2	Conduct experiment on CRO/ Measurement of L C R	40
2	4	Conduct an experiment on Troubleshooting RPS/ Repair of Decade Boxes	50
3	2,4	Portfolio evaluation of Practice sessions through Rubrics	10
		Total Marks	**100**

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
	Average Marks= (8+6+2+2)/4=4.5						**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Electronic Measurements and Instrumentation -2nd Revised Edition, R. K. Rajput, ISBN: 81- 219-2917-2 234.
2	Electronic Measurements and Instrumentation-3rd Edition, Sanjay Talbar & Akhilesh Upadhayaya, ISBN :81-874-3335-3
3	Electronic Instrumentation -3rdEdition, Kalsi H. S., ISBN: 00-707-0206-3
4	Modern Electronic Instrumentation and Measurement Techniques-2nd Edition, Albert Helfrick & William Cooper, ISBN:81-203-0752-6

8. SEE Scheme of Evaluation

SL. No.	COs	Particulars/Dimension	Marks
1	1,2	Identify errors, calibrate and perform measurement using analog multimeter/Wheatstone bridge/LCR meter/CRO	30
2	3	Identify the Sensor/Transducer used in different applications.	10
3	4	Conduct an experiment on Troubleshooting and repair of DTK/ RPS/ Decade Boxes	40
4	1,2,3,4	Viva-Voce	20
		Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers	Intel Core i5 11th gen/8GB RAM/1 TB HDD/256GB SSD/ Graphics 2 GB	20
2	MATLAB/Multisim/PSPICE/Electronic Workbench Simulation Software		
3	Dual trace oscilloscope	20-30MHz	20
4	LCR meter		10
5	Multi function meter		5
6	Resistors, Capacitors, Inductors ,Thermistor		Consumables as required
7	Digital multimeter		10
8	Analog multimeter		10
9	Function generator		5
10	Position, and Proximity sensors		10 each
11	Transducer		5
12	Load cell		5
13	Tool kit		2 sets
14	Soldering set		10 sets

ಮೂರನೇ ಸೆಮಿಸ್ಟರ್

ಕನ್ನಡ ಬಲ್ಲ ಡಿಪ್ಲೋಮಾ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ

(ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ಪರಂಪರೆ ಕುರಿತು)

Course Code	20KA31T	Semester : III	Course Group - AU
Course Title	**ಸಾಹಿತ್ಯ ಸಿಂಚನ – 2**	Category : Audit	Lecture Course
No. of Credits	2	Type of Course	CIE Marks : 50
Total Contact Hours	02 Hrs Per Week 26 Hrs Per Semester	Prerequisites Teaching Scheme (L:T:P)= 2:0:0	SEE Marks : Nil

ಸಾಹಿತ್ಯ ಸಿಂಚನ – 2 ಪಠ್ಯಕ್ರಮ - 20KA31T

26 ಗಂಟೆಗಳು

ಪಠ್ಯಕ್ರಮದ ಪರಿವಿಡಿ	**ಬೋಧನಾ ಅವಧಿ**
1. ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಪ್ರಭಾವಗಳು ಮತ್ತು ಪ್ರೇರಣೆಗಳು	**01 ಗಂಟೆ**
2. ಹೊಸಗನ್ನಡ ಕಾವ್ಯದ ಪ್ರಕಾರಗಳು -	**02 ಗಂಟೆ**
• ನವೋದಯ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು. • ನವ್ಯ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು. • ಬಂಡಾಯ ಮತ್ತು ಪ್ರಗತಿಪರ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು. • ದಲಿತ ಸಾಹಿತ್ಯ, ಮಹಿಳಾ ಸಾಹಿತ್ಯ, ವಿಜ್ಞಾನ ಸಾಹಿತ್ಯ ಮತ್ತು ಇತ್ತೀಚಿನ ಪ್ರಚಲಿತ ಕನ್ನಡ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು.	**03 ಗಂಟೆ** **03 ಗಂಟೆ** **03 ಗಂಟೆ** **03 ಗಂಟೆ**
3. ವೈಚಾರಿಕತೆ ಕುರಿತಾದ ಲೇಖನ - **ಜಿ ಎಸ್. ಶಿವರುದ್ರಪ್ಪ**	**01 ಗಂಟೆ**
4. ಕಥೆ - **ನೇಮಿಚಂದ್ರ**	**01 ಗಂಟೆ**
5. ಪ್ರವಾಸ ಕಥನ - **ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ**ರವರ (ಕುಪ್ಪಳ್ಳಿ ಡೈರಿ ಪುಸ್ತಕದಿಂದ)	**01 ಗಂಟೆ**
6. ಪರಿಸರ, ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ಕುರಿತಾದ ಲೇಖನಗಳು	**01 ಗಂಟೆ**
7. ಪ್ರಬಂಧ - **ಗೊರೂರು ರಾಮಸ್ವಾಮಿ ಅಯ್ಯಂಗಾರ**	**01 ಗಂಟೆ**
8. ಪ್ರಚಲಿತ ವಿದ್ಯಮಾನಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಲೇಖನ - "ಪೇರು ಮಾರುಕಟ್ಟೆ ಮತ್ತು ಹಣಕಾಸು ನಿರ್ವಹಣೆ" ಕುರಿತಂತೆ	**01 ಗಂಟೆ**
9. ಕರ್ನಾಟಕ ಏಕೀಕರಣ ಚಳುವಳಿ - **ಪ್ರೊ. ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ**	**01 ಗಂಟೆ**
10. ಕನ್ನಡ ಸಿನಿಮಾರಂಗ ಬೆಳೆದು ಬಂದ ದಾರಿ ಮತ್ತು ನಾಡು-ನುಡಿ ಹಾಗೂ ನಾಡಿನ ಸಂಸ್ಕೃತಿಯ ಮೇಲೆ ಬೀರಿದ ಪ್ರಭಾವಗಳು	**01 ಗಂಟೆ**
11. ಕನ್ನಡದ ಸಾಮಾಜಿಕ ಉಪಭಾಷೆಗಳು (ಭಾಷಾ ಪ್ರಭೇದಗಳು)	**01 ಗಂಟೆ**
12. ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಒಂದು ಅವಲೋಕನ	**02 ಗಂಟೆ**
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ 26 ಗಂಟೆಗಳು	**26 ಗಂಟೆ**

ಕನ್ನಡ ಬಾರದ / ಕನ್ನಡೇತರ ಡಿಪ್ಲೋಮಾ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಕನ್ನಡ ಕಲಿಸಲು ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ

Course Code	20KA31T	Semester : III	Course Group - AU
Course Title	**ಬಳಕೆ ಕನ್ನಡ – 2**	Category : Audit	Lecture Course
No. of Credits	2	Type of Course	CIE Marks : 50
Total Contact Hours	2 Hrs Per Week 26Hrs Per Semester	Prerequisites Teaching Scheme (L:T:P)= 2:0:0	SEE Marks : Nil

ಬಳಕೆ ಕನ್ನಡ – 2 ಪಠ್ಯಕ್ರಮ - 20KA31T

Table of Contents (ಪರಿವಿಡಿ) **26 ಗಂಟೆಗಳು**

ಸಾಹಿತ್ಯ ಸಿಂಚನ ಭಾಗ - II ಮತ್ತು **ಬಳಕೆ ಕನ್ನಡ ಭಾಗ - II** ಈ ಎರಡು ಪಠ್ಯಕ್ರಮಗಳಿಗೆ
CIE - ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಮಾರ್ಗಸೂಚಿಗಳು :

(Course Assessment and Evaluation Chart - CIE only)

Sl. No	Assessment	Type	Time frame in semester	Duration In minutes	Max marks	Conversion
1.	**CIE- Assessment - 1**	Written Test - 1	At the end of 3rd week	80	30	**Average of three written tests : 1, 2 & 3 for 30 Marks**
2.	**CIE- Assessment - 2**	Written Test - 2	At the end of 7th week	80	30	
3	**CIE- Assessment - 3**	Written Test - 3	At the end of 13th week	80	30	
4.	**CIE- Assessment - 4**	MCQ/Quiz	At the end of 5th week	60	20	**Average of three Assessment tests : 4, 5 & 6 for 20 Marks**
5	**CIE- Assessment - 5**	Open Book Test	At the end of 9th week	60	20	
6	**CIE- Assessment - 6**	Work book Consolidation & Activities	At the end of 11th week	60 (Work book Submission)	20	
Total CIE – Continuous Internal Evaluation Assessment Marks						50
Total Marks						50

ಸೂಚನೆ : 1.CIE - ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ 1, 2 ಮತ್ತು 3 ರ ಕಿರು ಪರೀಕ್ಷೆಗಳನ್ನು ಮತ್ತು ಮೌಲ್ಯಮಾಪನದ 4, 5 ಮತ್ತು 6 ರ ಪರೀಕ್ಷೆಗಳನ್ನು ಪ್ರತ್ಯೇಕ ಬ್ಲೂಬುಕ್ ಪುಸ್ತಕದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳು ಬರೆಯಬೇಕು.

2.ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳು, ತರಗತಿ ಕನ್ನಡ ಭಾಷಾ ಶಿಕ್ಷಕರಿಂದ ಮತ್ತು ವಿಭಾಗಾಧಿಕಾರಿಗಳಿಂದ ದೃಢೀಕರಣಗೊಂಡ ಕಾರ್ಯಪಠ್ಯಪುಸ್ತಕವನ್ನು (Work Book) ಮೌಲ್ಯಮಾಪನ ಭಾಗ- **CIE- Assessment – 6** ರ ಪರೀಕ್ಷೆಯ ನಂತರ ಆಯಾ ವಿಭಾಗಕ್ಕೆ ಸಲ್ಲಿಸಬೇಕು.

4TH SEMESTER

Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Electronics & Communication	**Semester**	IV
Course Code	20EC41P	**Type of Course**	Programme Core
Course Name	PCB Design & Fabrication	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

1. Rationale

Printed Circuit Boards (PCBs) are the core component in almost all the electronic gadgets used either for domestic or industrial purposes. PCBs hold almost all electronic components necessary for a device to function. Using a PCB has many advantages such as compact design, ease of testing and repair, low noise and interference, and improved reliability. Apart from electrically connecting, it also gives mechanical support to the electrical components. Using PCBs, a highly complicated circuit can be designed in a very small package which helps in reducing the size of electronic devices.

PCB design can be done either manually or using software. Electronic design automation tools are software tools used for designing the schematic and layout of PCB. Large number of PCBs can be fabricated at the same time after the layout is designed once. With consumers pushing for slimmer and faster devices, and with industries seeking improved functionality, the PCB will continue to develop in the future.

2. Course Outcomes: On successful completion of the course, the students will be able to:

CO-1	Identify different types of Printed Circuit Board (PCB), list the differences between them and its adequacy for specific application.
CO -2	Draw the schematic and PCB layout for an analog circuit to be used for a given application.
CO-3	Select the right components for a designed circuit, build the circuit and fabricate it using the appropriate tools following all necessary safety protocols.
CO-4	Test the fabricated circuit, identify the problem and troubleshoot to ensure the circuit provides the desired output.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	1	1. Introduction to PCB, need and evolution of PCBs. 2. Classes of PCB – First Class (RF, microwave, and analog PCB) & Second Class (digital based PCB) – characteristics. 3. Types of PCB - Single sided, double sided and multilayer PCBs, rigid and flexible PCBs.	Refer Table 1	1. Familiarization of any Electronic design automation (EDA) software -Open source EDA Tool KiCad. 2. Practice the PCB design steps for a simple analog circuit: Schematic design-Familiarization of schematic editor, schematic creation, annotation, electrical rule check, mapping of components, netlist generation.
2	1,2	1	1. Comparison between single layer, double layer and multilayer PCBs. 2. Importance of grounding in PCBs, impedance matching, reflection, ground bounce, SSN. 3. Materials used for multilayer PCBs, PCB thickness, aspect ratio.	Refer Table 1	1. Practice placement of components. 2. Practice the routing (normal tracks -10 mils and power tracks-50 mils).
3	1,2	1,2	1. Component package types - Through-Hole, Surface-Mount, Fine Pitch, FPGA, QFT, TFP, BGA, Press Fit. 2. Calculation of track width required for different types of packages. 3. Types of Planes in PCB.	Refer Table 1	1. Learn how to create symbols for diodes, transistors, connectors, ICs. 2. Create the footprint for diodes, transistors, connectors,ICs.
4	2	2,3,4	1. Design for manufacturability (DFM). 2. Electromagnetic Interference (EMI), Electromagnetic Compatibility (EMC). 3. Thermal issues in PCB	Refer Table 1	1. Design Schematic for Regulated Power supply. 2. Design PCB layout for Regulated Power supply.

5	2	2,3,4	1. Conduction, convection, radiation in thermal issues. 2. Heat Dissipation in PCB, Heat sinks. 3. RF PCB-introduction.	Refer Table 1	1. Design Schematic for inverting /summing amplifier using op-amp. 2. Design PCB layout for inverting /summing amplifier using op-amp.
6	2	2,3,4	1. High-speed digital basics. 2. General design factor for digital and analog PCBs. 3. Voltage and current considerations in PCBs.	Refer Table 1	1. Design Schematic for astable multivibrator using IC 555. 2. Design PCB layout for astable multivibrator using IC 555.
7	2	2,3,4	1. Transmission lines, significance of transmission line and its effects. 2. Types of Transmission lines. 3. Different types of termination techniques, simple problems.	Refer Table 1	1. Design Schematic for RC coupled amplifier. 2. Design PCB layout for RC coupled amplifier.
8	2	2,3,4	1. Crosstalk in transmission lines, minimization of crosstalk. 2.ENIG and ENEPIG. 3. Noise budget.	Refer Table 1	1. Design Schematic for a given circuit (Ex: proximity sensor/ LED blinking/+ or -12v power supply using 7812 IC and 7912 IC) 2. Design PCB layout for a given ckt (Ex:proximity sensor/LED blinking circuit/+or - 12v power supply using 7812 and 7912 IC)
9	2,3	3,4,,5	1. Preparation of Manufacturing Drawing (MD). 2. Importance of Solder mask, assembly drawing, silkscreen, Gerber file. 3. Board origin, component origin, importance of origin.	Refer Table 1	1.Familiarisation of copper clad sheet, drilling machine, drill bits, required chemicals .(links) 2. Generate the Gerber file of works done in weeks 4 - 8 and take printouts on glossy paper.

10	2,3,4	4,5	1. Importance of CNC machines. CNC machines for component pick and place, drill file. 2. Design for Testing(DFT) 3. Design specification standards.	Refer Table 1	Fabrication process.
11	2,3,4	7	1. Steps involved in fabrication of single side PCB. 2. Steps involved in fabrication of double sided PCB. 3. Steps involved in fabrication of multilayer PCB.	Refer Table 1	Fabrication process.
12	2,3,4	7	1. Steps involved in fabrication of multilayer PCB- continued. 2. Soldering techniques. 3. Testing of PCB.	Refer Table 1	Fabrication process.
13	2,3,4	7	1. Importance of RoHS (Restriction of use of Hazardous Substances). 2. Waste management of hazardous materials in PCB. 3. Environment Management Standards (EMS).	Refer Table 1	Fabrication process.
Total in hours			**39**	**13**	**52**

TABLE 1: Suggested activities for tutorials.

The list is shared as an example and not inclusive of all possible activities of the course.

The list of activities for one week can be shared among teams in a batch of students.

Week no.	**Suggested activities for tutorials**
01	1. Prepare a report on reference designators for components used in PCB. 2. Give a presentation on general guidelines for designing the PCB. 3. Prepare a report on comparison of different types of PCBs.

02	1. Collect information on different electronic design automation (EDA) tools and their comparison (Cadstar, Orcad, Pads). 2. Collect the information on materials used for multilayer PCB, drill holes, vias, aspect ratio and present it.
03	1. Collect the datasheets of electronic components such as diode, regulator IC, DIP IC and study their mechanical dimension and their projection (first angle/ third angle projection, top view, front view). 2. Give a presentation on through-hole and surface-mount technology.
04	1. Collect a case study on DFM issues and present it. 2. Give a presentation on Electromagnetic Interference in real life and provide solution to solve the problem.
05	1. Collect details of different types of heat sinks used in PCBs. 2. Collect any frequency synthesizer circuit and explain it.
06	1. Prepare a report on comparison of analog and digital PCBs and present it. 2. Give a presentation on the importance of spacing and thickness of the tracks in PCB's.
07	1. Give a presentation on the importance of transmission lines. 2. Discuss selection of transmission lines for optimum design.
08	1. Write a report on how to analyse the presence of crosstalk in signals. 2. Give a presentation on advantages and disadvantages of ENIG and ENEPIG.
09	1. Collect information on different types of solder paste. 2. Collect any completed PCB file and explain it.
10	1. Prepare a report on comparison of manual soldering and machine soldering and present it. 2.Collect information on design standards used in India for designing PCBs.
11	1. Collect different types of manufacturing techniques and explain them. 2. What are the different parameters to be considered to decide the cost of manufactured PCB?
12	1. Give a presentation on the failures of PCB due to improper soldering. 2. Write a report on testing of PCB.

13	1. Study the latest technological changes in this course and present the impact of these changes on industry. 2. Give a presentation on the role of students for protecting environment from hazardous materials. 3. Find different methods for disposing of PCB lab wastes and dispose it.

4. CIE and SEE Assessment Methodologies

Sl. No	**Assessment**	**Test Week**	**Duration** In minutes	**Max marks**	**Conversion**
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
				Total CIE Marks	60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. Format for CIE (1, 2, 3) Written Test

Course Name	**PCB Design & Fabrication**	Test	I/II/III	Sem	III/IV
Course Code	**20EC41P**	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					
Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks
I	1				
	2				
II	3				
	4				
III	5				
	6				
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.					

5. (a) Format for CIE-4 Skill Test - Practice.

SL. No.	**COs**	**Particulars/Dimension**	**Marks**
1	1	Identification of different types of PCB.	10
2	2	Schematic Design of the given Analog Circuit using EDA tool(KiCad)	40
3	2	Layout Design of the given Analog Circuit using EDA tool (KiCad)	40
4	1,2	Portfolio evaluation of Practice sessions through Rubrics	10
		Total Marks	**100**

5. (b) Format for CIE-5 Skill Test - Practice.

SL. No.	COs	Particulars/Dimension	Marks
1	2	Design of the given Analog Circuit Schematic Design -5 Marks Layout Design -5 Marks	10
2	3	Fabrication of the given Analog Circuit Fabrication -30 Marks Component mounting & soldering -20 Marks	50
3	4	Testing & Troubleshooting of a given PCB. Testing - 10 Marks Troubleshooting - 20 Marks	30
4	2,3,4	Portfolio evaluation of Practice sessions through Rubrics	10
		Total Marks	**100**

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
					Average Marks= (8+6+2+2)/4=4.5		**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Printed Circuits Handbook - 6th edition Clyde F. Coombs,Jr.
2	PCB Design & Technology - Walter C. Bosshart
3	Printed Circuit Board by RS Khandpur, Tata McGraw Hill Education Pvt Ltd., New Delhi
4	Electronic Product Design Volume-I by S D Mehta, S Chand Publications
5.	Open source EDA Tool KiCad Tutorial: http://kicad-pcb.org/help/tutorials/
6	PCB Fabrication user guide page: http://www.wikihow.com/Create-Printed-Circuit-Boards http://www.siongboon.com/projects/2005-09-07_home_pcb_fabrication http://reprap.org/wiki/MakePCBInstructions#Making_PCBs_yourself

8. SEE Scheme of Evaluation

SL. No.	COs	Particulars/Dimension	Marks
1	1	Identification of Types of PCB.	10
2	2	Design of the given Analog Circuit Schematic Design -15 Marks Layout Design -15 Marks Routing -10 Marks	40
3	3	Fabrication of the given Analog Circuit Fabrication -10 Marks Component mounting & soldering -10 Marks	20
4	4	Testing & Troubleshooting of PCB.	10
5	1,2,3, 4	Viva Voce	20
		Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers	Intel Core i5 11th gen/8GB RAM/1 TB HDD/256GB SSD/ Graphics 2 GB	20
2	Open source EDA Tool KiCad.		20
3	Single-sided copper clad sheet.		100
4	Diluted Acidic solution for copper etching purpose with plastic tray.		5
5	Tapes and pads for layout design of different dimensions.		
6	Glossy paper		60
7	Hand drilling/Power drilling machine.		10
8	Tool kit (Tray, Brush, PCB Laminate, tong, hand gloves etc.)		20

Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Electronics & Communication	**Semester**	IV
Course Code	20EC42P	**Type of Course**	Programme Core
Course Name	Wireless Communication	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

1. Rationale

The purpose of wireless communication is to communicate messages over distances without the use of wires. It includes an exposure to microwave engineering, radar systems, cellular and satellite communication. In the microwave industry, job opportunities are available in assembly, production, installation, repair and maintenance of microwave transmitters and receivers. The knowledge of radar systems allows opportunities with civil and defence organizations dealing with aircraft and shipping. Satellite communication is used to relay signals around the curvature of Earth allowing communication between widely separated points. Mobile communication is a fast changing technology which offers voice and data connectivity between individuals.

2. Course Outcomes: On successful completion of the course, the students will be able to:

CO-1	Identify the types of wireless communications, list differences and its applications.
CO-2	Identify the components of a given wireless communication system, explain the role of those components in the system and list their characteristics.
CO-3	Build a working model of a wireless communication system to be used for a specific application.
CO-4	Test a given set top Box / mobile phone, identify the problem and troubleshoot to ensure the device is fully functional.

3. Course Content

Week	**CO**	**PO**	**Lecture (Knowledge Criteria)**	**Tutorial (Activity Criteria)**	**Practice (Performance Criteria)**
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1,2, 3	1	1. Wireless communication – Concept, block diagram, types, frequency spectrum used in different wireless communication systems. 2. Wireless metropolitan area network(WMANs), Wireless local area networks(WLANs), Wireless personal area network – (WPANs) 3. Wi-Fi- Features and applications, significance of hotspot.	Refer Table 1	1. Implement WLAN in your computer lab.

2	1,2, 3	1,3	1. RFID- concept & applications. 2 Bluetooth – components, connections, networking & applications. 3. Waveguides- Need, types, applications.	Refer Table 1	1. Conduct an experiment to connect PC to internet through bluetooth access point of mobile and transfer a text file/image file/video file. 2. Interface RFID reader for any application using Arduino controller.
3	1,2, 3	1,5	1. Microwave signals, microwave devices –Two cavity klystron, Reflex klystron. 2. Magnetron and Travelling Wave Tube (TWT) and their applications. 3. RADAR- principle of operation and applications.	Refer Table 1	1. Video demonstration & documentation on working of a. Two cavity klystron. b. Reflex klystron. 2. Video demonstration & documentation on working of a.Magnetron. b.TWT.
4	1,2, 3	1,2	1. Radar range equation (no derivation) and factors influencing the radar range. 2. Pulsed radar system- principle and block diagram, Duplexer. 3. Antenna scanning and tracking.	Refer Table 1	1. Study and measure the characteristics of pulse from signal generator using a CRO. 2. Conduct an experiment to use a smart phone as CCTV camera (or a CCTV camera) and connect it to another mobile to view the camera feed.
5	1,2, 3	1,5	1. Special purpose Radars- doppler radar, MTI radar-block diagram and their applications. 2. Secondary surveillance radar & ILS. 3. ZigBee –architecture, network topologies, applications.	Refer Table 1	1a.Video demonstration and documentation to understand radar scanning and tracking systems. b. Video demonstration and documentation to understand the working of secondary surveillance radar. 2. Interface Zigbee module for any application using Arduino controller.
6	1	1,5	Satellite Communication 1. Satellite - Types, orbits. apogee and perigee, azimuth and elevation angles, sub satellite point, sub satellite paths, ascending and descending nodes. 2. Posigrade and Retrograde orbits, Uplink and downlink, orbital period and radius of geosynchronous satellite, satellite eclipse. Polar and Geostationary satellites - advantages and disadvantages. 3. LEO, MEO & GEO satellites, Station keeping, Attitude control and thermal control	Refer Table 1	1. Study the features and working of different sections in a satellite communication trainer kit. 2. Conduct an experiment to Transmit & Receive three separate Signals (Audio, Video, and Tone/ Voice) simultaneously through satellite link and perform Link Fail Operations using satellite communication trainer kit.

7	1,2	1,5	1. Satellite communication system-block diagram. Transponder-single conversion, double conversion and regenerative transponder. 2. Increasing channel capacity-frequency reuse and spatial isolation. Communication satellite-satellite subsystems. 3. Earth station- block diagram, Applications payload.	Refer Table 1	1. Find the delay between Uplink transmitter and Downlink receiver during data transmission using satellite communication trainer kit. 2. Demonstrate working of satellite transponders using satellite communication trainer kit.
8	1,2, 3	1,5	1. Global Positioning System (GPS) –features, working. 2. Satellite for TV applications - Direct-To-Home (DTH) and cable TV. 3. Satellite for military applications, VSAT – features & applications.	Refer Table 1	1. Video demonstration and documentation on a.Working of GPS System b.Working of Satellite TV. 2. Conduct an experiment to tabulate latitude, longitude, Plus codes of different locations using a GPS receiver in mobile phone and learn sharing of live locations.
9	1,2, 4	1,5,7	1. Satellite for voice and data communication, Earth observation. 2. Set top box -concept, block diagram. 3. Set top box - working.	Refer Table 1	1. Video demonstration and documentation of TV Set top box repair. 2. Test and troubleshoot Set top box.
10	1,2	1,5	1. Cellular networks, cellular concept, frequency reuse. 2. Terminologies used in mobile communication. capacity expansion techniques-cell splitting and cell sectoring. 3. Handoff strategies. working of a typical cellular system.	Refer Table 1	1. Conduct an experiment to understand the working of different sections in a mobile phone using a mobile phone trainer kit. 2. Conduct an experiment to analyze MIC & Speaker section, Buzzer section using a mobile phone trainer kit.
11	3	7	1. GSM services and features. 2. GSM architecture, working. 3. LTE architecture and working.	Refer Table 1	1. Conduct an experiment to analyse vibrator section, LED control section using a mobile phone trainer kit. 2. Conduct an experiment to analyse the active mode/sleep mode/Partially ON mode while charging of a mobile phone using a mobile phone trainer kit.
12	1,2, 4	7	Mobile servicing 1. Mobile displays – working principle.		Video demonstration and documentation of

			2. Mobile camera – working principle. 3. Charging ports & battery - concept	Refer Table 1	1. Troubleshooting, testing and replacement of display, front camera. 2. Troubleshooting, testing and replacement of charging port, battery.
13	1,2, 3	7	1. IoT – introduction, characteristics of IoT, internet of things. 2. IoT protocols-MQTT, IoT-functional blocks. 3. IoT communication models, IoT enabling technologies.	Refer Table 1	1. Build an IoT based simple real time application using Arduino controller and prepare a report.
Total in hours			**39**	**13**	**52**

Note: 1) In Practice sessions Video demonstration should be followed by MCQs/Quiz/Subjective questions and the evaluation has to be documented.

2) In Practice sessions, all circuits should be simulated using suitable software before its construction and verification.

TABLE 1: Suggested activities for tutorials

The list is shared as an example and not inclusive of all possible activities of the course.

The list of activities for one week can be shared among teams in a batch of students.

Week no.	**Suggested activities for tutorials**
01	1. Give a presentation on differences between wired and wireless communication. 2. Demonstrate the implementation of Wi-Fi hotspot. 3, Video demonstration & documentation of working of industrial wireless communication.
02	1. Give a presentation on Bluetooth specification Standards (IEEE 802.15.1). 2. Build a simple application using RFID. 3. Analyse the CCTV setup in your department/college and troubleshoot the CCTV application if required and submit the report.
03	1. Prepare a report on microwave devices- IMPATT & TRAPATT. 2. Give a presentation on the working of any one type of waveguide.

04	1. Give a presentation on any one application of a Radar system in daily life. 2. Give a presentation about the usage of the Radar technology in case of searching a crashed aircraft in the ocean. 3. Solve problems on radar range equation.
05	1. Prepare and present a report on radar displays. 2. Give a presentation on aircraft landing systems (ILS). 3. Give a presentation on the design & performance analysis of the doppler radar system.
06	1. Give a presentation on applications of LEO & MEO satellites. 2. Prepare a report on satellites launched by ISRO. 3. Give a presentation on differences between geostationary and geosynchronous satellite. List some examples of geostationary satellites.
07	1. Present a report on satellite frequency allocation and satellite bandwidth. 2. Give a presentation on station keeping. 3. Give a presentation on the different types of antennas used in earth station.
08	1. Prepare & present a report on GPS applications. 2. Prepare a report on DRONE, its working and various uses. 3. Prepare a report on different types of launch vehicles used for launching a satellite in India and its significance.
09	1. Differences between cable box & set top box. 2. Compare the different set up boxes available in the market. 3. Prepare a report on the various experimentation and findings being conducted on the surface of MARS by NASA's Perseverance Rover (include actual pictures released from NASA website).
10	1. Prepare a report on different generations of cellular networks. 2. Give a presentation on different mobile operating systems.
11	1. Study of SIM card and its detection, SIM reset, SIM clock, SIM data, and SIM supply. 2. Give a presentation on CDMA system-services and features. 3. Give a presentation on LTE system services and features.
12	1. Prepare a report on compatibility of mobile phone battery size and its heat dissipation. 2. Discuss the types and characteristics of antennas used in mobile phones.

13	1. Study the latest technological changes in this course and present the impact of these changes on industry. 2. Demonstrate the importance of IoT based health monitoring system.

LINKS

1. https://youtu.be/Q97bVxd2r10
2. https://youtu.be/Fvud81pYGOg
3. https://youtu.be/bUsS5KUMLvw
4. https://youtu.be/4-wp_M1z4ls
5. https://youtu.be/qzBPSG1b5uo
6. https://youtu.be/H00_PVX2bRw
7. https://youtu.be/wCcARVbL_Dk
8. https://youtu.be/OpkatIqkLO8
9. https://youtu.be/AiT36qdoSCc.
10. https://youtu.be/oEa0Pfxl4C8
11. ttps://youtu.be/1JZG9x_VOwA
12. https://youtu.be/iS8jmhVAfoQ.
13. https://youtu.be/2UujN_pOcYI
14. https://youtu.be/iQeaK0NGMnA
15. www.ifixit.com-> Repair guides->select the particular model for ref.

4. CIE and SEE Assessment Methodologies

Sl. No	**Assessment**	**Test Week**	**Duration** In minutes	**Max marks**	**Conversion**
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
				Total CIE Marks	60
			180	100	40
				Total Marks	**100**

5. Format for CIE (1, 2, 3) Written Test

Course Name	Wireless Communication		Test	I/II/III	Sem	III/IV
Course Code	**20EC42P**		Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.						
Section	Assessment Questions			Cognitive Levels	Course Outcome	Marks
I	1					
	2					
II	3					

	4			
III	5			
	6			
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.				

5.(a) Format for CIE-4 Skill Test – Practice

SL. No.	COs	Particulars/Dimension	Marks
1	1	Identification of types of wireless communications & its applications.	10
2	2	Identify the various components of a given wireless communication system & their role in the system.	10
3	3	Build and demonstrate a WLAN/ RFID/ZIGBEE communication for a specific application. Construction / Setting up - 40 Marks. Result /Output - 30 Marks.	70
4	1,2,3	Portfolio evaluation of Practice sessions through Rubrics.	10
		Total Marks	**100**

5.(b) Format for CIE-5 Skill Test - Practice

SL. No.	COs	Particulars/Dimension	Marks
1	1	Identification of types of wireless communications & its applications.	10
2	2	Identify the various components of a given wireless communication system & their role in the system.	10
3	3	Demonstrate a wireless communication system for a specific application Construction - 10 Marks Output - 10 Marks	20
4	4	Test a given Set Top Box/Mobile Phone. Testing Steps -25 Marks Troubleshooting Steps -25 Marks	50
5	1,2,3, 4	Portfolio evaluation of Practice sessions through Rubrics	10
		Total Marks	**100**

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
					Average Marks= (8+6+2+2)/4=4.5		**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Microwave Devices and Components by Sylio, Prentice Hall of India, New Delhi
2	Wireless Communications (Principles and Practice), by Thedore Rappaport
3	Wireless Communications and Networking, by William Stallings
4	Mobile Communication by John Schiller, Prentice Hall of India, New Delhi

8. SEE Scheme of Evaluation

SL. No.	COs	Particulars/Dimension	Marks
1	1	Identify the types of wireless communications and its uses/applications	10
2	2	Identify the various components of a given wireless communication system & their role in the system.	10
3	3	Demonstrate a wireless communication system for a specific application Construction - 15 Marks Output - 15 Marks	30
4	4	Test a given Set Top Box/Mobile Phone Testing Steps -15 Marks Troubleshooting Steps -15 Marks	30
5	1,2,3, 4	Viva- Voce	20
		Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl No	Particulars	Specification	Quantity
1	Computers	Intel Core i5 11th gen/8GB RAM/1 TB HDD/256GB SSD/ Graphics 2 GB	20
2	MATLAB Software		
3	Dual trace oscilloscope	Up to 20-30MHz	10
4	CAT5 cable		100m
5	RJ 45 connectors		100
6	Arduino microcontroller board		10
7	RFID Reader , Tag		5, 20
8	ZigBee Module		10
9	Satellite Communication trainer kit	Uplink Transmitter, Inbuilt tone generator Satellite Link, Downlink receiver.	5
10	TV Set up box		10
11	Mobile phone trainer kit	Onboard Section: Keypad, Dual SIM, Charging Circuit, User interface: Buzzer, Vibrator, Mic, Speaker, Hands free port and display LEDs	5
12	Not- working mobile phones		5

Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Electronics and Communication	Semester	IV
Course Code	20EC43P	Type of Course	Programme Core
Course Name	Embedded C Programming	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1. Rationale

C is a general purpose programming language which is robust and highly portable used for scripting system applications which form a major part of all operating systems**.** C language is available on a very wide range of platforms, from embedded microcontrollers to supercomputers. Microcontroller is a compressed microcomputer manufactured to control the functions of embedded systems in various fields such as automobile, aeronautics, robotics, mobile communication, electronic appliances, industrial processing, defense, space, medical applications etc. The future of the micro controller depends on machine learning in embedded systems.

2. Course Outcomes: On successful completion of the course, the students will be able to:

CO1	Write the code using C constructs for a given requirement, execute the program, debug and to demonstrate that the program produces the required result/output.
CO2	List the various components and the characteristics of each component in a 8051 Microcontroller.
CO3	Write an embedded program for a given requirement, test and troubleshoot to obtain the desired output.
CO4	Identify the right microcontroller/peripheral device using data sheets / specification sheets for a given application.

3. Course Content

Week	**C O**	**PO**	**Lecture (Knowledge Criteria)**	**Tutorial (Activity Criteria)**	**Practice (Performance Criteria)**
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	1,2, 3	1. Introduction to C - features, compilation process. 2. C tokens, variables and identifiers, constants. 3. Data types - classification, memory requirement, range of values, usage.	Refer Table 1	1. Familiarisation of TURBO C. 2. Programs to illustrate the use of different data types and verify their memory size.

2	1	1,2, 3	1. Operators and Operands- Arithmetic, logical, relational operators. 2. Unary, conditional, assignment and special operators, precedence and associativity. 3. Basic input and output functions, format specifiers, preprocessor directive & library functions	Refer Table 1	1a.Compute simple interest given the principal, interest rate and duration. b. Compute compound interest given P,t,r,n. 2a. Compute the area of a circle, square, rectangle and triangle. b. Swap contents of two variables without using intermediate variables.
3	1	1,2, 3	1. Flowchart and Algorithm, Structure of a C program, simple C programs. 2. Branching- conditional -if, if-else, example programs. 3. Nested if-else, switch, example programs.	Refer Table 1	1a.Compute the largest of three numbers using if-else and ternary operators. b.Compute the result of a student using nested if. 2. Given the resistance and tolerance, generate the color bands of the resistor using a switch statement.
4	1	1,2, 3	1. Looping- for, while, do-while loops. 2. Example programs on looping. 3. Arrays- definition, declaration, initializing single dimensional arrays. Examples.	Refer Table 1	1a.Compute factorial of a single digit number. b. Compute the sum of digits of a given 3 digit number reducing it to a single digit. 2. Sort an array of numbers in ascending order and descending order.
5	1	1,2, 3	1. Strings- declaration, initialization with an example. Two dimensional arrays- declaration, initialization with an example. 2. Functions- elements of user defined functions, example. 3. Pointers- introduction with example. Structures- introduction with example.	Refer Table 1	1a. Compute the length of a string and reverse the string using string functions. 1b. Compute the sum of two matrices. 2a. Compute cube of a number using a function. 2b. Store the details of an employee using a structure and print the details
6	2	1	1. Introduction to the concepts of embedded systems, microprocessors, microcontrollers. 2. Selection of 8 bit, 16 bit, 32 bit, 64 bit microcontrollers. Introduction to 8051 microcontroller. 3. Architecture of 8051 microcontroller, PSW and special function registers.	Refer Table 1	1. Identification of program development tools. 2. Familiarization of program development using Keil.
7	2	1,2, 3	1. Memory organization, general purpose RAM, bit addressable RAM. 2. Register banks, Pin details of 8051.	Refer Table 1	1. Familiarize with the structure of the 8051 assembly program and executing it.

			3. Interfacing external data and code memory.		2. Write and execute simple ALP to understand different addressing modes.
8	3	1,2, 3	1.8051 Addressing modes. 2. Instruction set- classification, syntax and function of data transfer instructions, 3. Arithmetic instructions, Logical instructions.	Refer Table 1	1.Write and execute an ALP to (a) Move a block of data within internal RAM (b) Exchange a block of data between internal RAM and external memory. 2. Write an ALP to (a) evaluate simple arithmetic expression such as y= (((5*2)-(4+1))/3) %2. (b)Perform addition of three 8-bit BCD numbers to result in BCD form.
9	3	1,2, 3	1. Bit level instructions, jump instructions. 2. Introduction to Embedded C and its applicability to 8051. 3. General structure of embedded C program, data types.	Refer Table 1	1.Write an ALP to (a) Rotate or shift 16-bit data. (b)Evaluate simple logical expression such as Y= a&&b||c^!d where a, b, c and d are 8-bit data. 2.Write and execute an assembly and embedded C program to convert (a)Packed BCD to unpacked BCD (b) Unpacked BCD to packed BCD.
10	3	1,2, 3	1. Memory types and models, pointers, pointer's memory type. 2. Time-delay generation using loops, example program. 3. Arithmetic and logical operators, example programs.	Refer Table 1	1. Write and execute a program to search a given 8-bit number in an array of N numbers using embedded C. 2. Write and execute a program to toggle a particular bit in the internal RAM with the use of delay subroutine.
11	3,4	7	1. Features of I/O ports. Interface I/O devices such as LED, buzzer with programs. 2. Polling & interrupt methods, executing an interrupt, IE and IP registers. 3. Enabling, disabling and priority setting, example programs.	Refer Table 1	1. Write and execute an embedded C program to toggle the LED/buzzer with tone using push-button switch. 2. Write ALPs to enable, disable and priority setting of interrupts and

					verify it in IE and IP registers.
12	3,4	7	1. Bit structure and function of TMOD and TCON registers, mode 1 operation of timers. 2. Time delay generation & example programs. 3. Bit structure of SCON register, SBUF register, TI and RI flags, working of serial port for data transmission and reception.	Refer Table 1	1. Write and execute an embedded C program to generate a square wave on P1.2 using timer 0 in mode 1 to generate delay. 2. Observe the square wave of the above program on CRO by downloading the program to the microcontroller kit.
13	3,4	5,7	1. Interfacing 8051 to Multiplexed seven-segment display with assembly/C program. 2. Interfacing 8051 to ADC 0804, waveform generation using DAC 0808 with assembly/C program. 3. Interfacing 8051 to DC motor, Stepper motor with assembly /C program.	Refer Table 1	Interfacing experiments 1. Program to control direction and speed of a stepper motor/ dc motor. Study the data sheets of stepper motor/dc motor. 2. Program to control traffic lights **OR** Program to generate sine/ rectangular / triangular wave-forms.
Total in hours			**39**	**13**	**52**

TABLE 1: Suggested activities for tutorials

The list is shared as an example and not inclusive of all possible activities of the course.

The list of activities for one week can be shared among teams in a batch of students.

Week No.	**Suggested Activities for Tutorials**
01	1. Give a presentation on comparison of different high level languages. 2. Prepare a report on advantages and applications of C.
02	1. Write a program to print a pyramid number pattern and explain it. 2. Explain operator precedence and associativity with examples. 3. Demonstrate implicit and explicit type conversions.
03	1. Write and explain algorithms and flowcharts for simple programs.

	2. Give a presentation on comparison of switch and if-else statements. 3. Demonstrate the use of break, continue and goto statements in C.
04	1. Demonstrate the comparison of while, do-while and for loop with an example. 2. Write and explain a program to print multiplication tables from 1 to 5.
05	1. Write and explain a program to check whether a given string is palindrome or not. 2. Write and explain a program to multiply two matrices. 3. Give a presentation on advantages of user defined functions. 4. Give a presentation on usage of pointers in C.
06	1. Give a presentation to differentiate RISC & CISC. 2. Discuss variants of MCS-51 family and their features.
07	1. Give a presentation on applications of microcontrollers. 2. Prepare and explain the memory organization diagram. 3. Explain bit structure of PSW and PCON registers.
08	1. Write and explain examples for different addressing modes. 2. Find the addressing mode, no. of bytes and no. of machine cycles for different instructions.
09	1. Compare different types of JUMP instructions. 2. Explain the pros and cons of embedded C.
10	1. Write embedded C programs for time delay generation using loops. 2. Write and explain instructions for arithmetic and logical operations.
11	1. Give a presentation on the importance of I/O ports in microcontrollers and write programs using I/O ports. 2. Give a presentation on the need of interrupts in microcontrollers.
12	1. Write and explain bit structures of TCON, TMOD and SCON registers. 2. Give a presentation on comparison of mode 1 and mode 2 operations of timers.
13	1. Study the latest technological changes in this course and present the impact of these changes on industry. 2. List any 5 other microcontrollers used in real world applications and interpret their datasheets.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
				Total CIE Marks	60
Semester End Examination (Practice)			180	100	40
				Total Marks	**100**

5. Format for CIE (1, 2, 3) Written Test

Course Name	**Embedded C Programming**	Test	I/II/III	Sem	III/IV
Course Code	**20EC43P**	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					
Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks
I	1				
	2				
II	3				
	4				
III	5				
	6				
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional Questions in each section carry the same weightage of marks, Cognitive level and course outcomes.					

5.(a) Format for CIE-4 Skill Test - Practice.

SL. No.	COs	Particulars/Dimension	Marks
1	1	C Programming Writing two C programs - 30 Marks Entry & Execution - 30 Marks Output -10 Marks	70
2	2	List the various components and the characteristics of each component in a 8051 Microcontroller.	20
3	1,2	Portfolio evaluation of Practice sessions through Rubrics	10
		Total Marks	**100**

5. (b) Format for CIE-5 Skill Test - Practice.

SL. No.	COs	Particulars/Dimension	Marks
1	2	List the various components and the characteristics of each component in a 8051 Microcontroller.	10
2	3	8051 ALP /8051 C programs for a desired output Writing program - 20 Marks Output - 20 Marks	40
3	4	Interfacing program for an application Writing program - 20 Marks Downloading to kit and Output - 20 Marks	40
4	2,3,4	Portfolio evaluation of Practice sessions through Rubrics	10
		Total Marks	**100**

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
	Average Marks= (8+6+2+2)/4=4.5						**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	C Programming By Kernighan and Dennis Ritchie 04.
2	C Programming By Balaguruswamy, TMH Publishers, ISBN-10: 8131716813, 2009.I
3	Scott MacKenzie and Raphael C.W. Phan. The 8051 Microcontroller. (4/e), Pearson education, 2008.
4	Kenneth J Ayala, The 8051 Microcontroller, (3/e), Thomson Delmar Learning.

8. SEE Scheme of Evaluation

SL No.	COs	Particulars/Dimension	Marks
1	1	C Programming Writing Program - 10 Marks Entry & Execution -10 Marks Output - 5 Marks	25
2	2	Identify & Explain the functionality of various components in a 8051 Microcontroller	10
3	3	8051 ALP /8051 C programs for a desired output Writing program - 15 Marks Output - 5 Marks	20
4	4	Interfacing program for an application Writing program - 10 Marks Downloading to kit and Output- 15 Marks	25
5	1,2,3,4	Viva-Voce	20
		Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers	Intel Core i5 11th gen/8GB RAM/1 TB HDD/256GB SSD/ Graphics 2 GB	20
2	TURBO C		
3	8051 Microcontroller kits		20
4	Interfacing kits		5 each

Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Electronics and Communication	**Semester**	IV
Course Code	20EC44P	**Type of Course**	Programme Core
Course Name	Industrial Automation	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

1. Rationale

Automation in the industrial workplace provides the advantages of improving productivity and quality while reducing errors and waste, increasing safety, and adding flexibility to the manufacturing process. Industrial automation results in increased productivity, more efficient use of materials, increased safety, reliability, better product quality, shorter workweeks for labour, profitability and reduced factory lead times. Worker safety is an important reason for automating an industrial operation**.** A wide range of industrial controls and automation depends on power electronics. PLC is an industrial computer control system used to control the state of output devices based upon a custom program. SCADA is a centralized system that monitors and controls field devices at remote sites.

2. Course Outcomes: On successful completion of the course, the students will be able to

CO-01	Explain the role and importance of power electronics in today's industrial automation and for a given application list the commonly used components in power electronics.
CO-02	Build a power electronic circuit and demonstrate the working of that circuit for a specific application either in a real or simulated environment.
CO-03	Design, test and troubleshoot a given PLC automation system to meet defined operational specifications in a simulated environment.
CO-04	Explain the concept of SCADA, DCS and HMI and list their various applications in industry.

3. Course Content

Week	**CO**	**PO**	**Lecture (Knowledge Criteria)**	**Tutorial (Activity Criteria)**	**Practice (Performance Criteria)**
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	1	1. Introduction to industrial automation, need for power devices, features of power diode, power BJT. 2. Features of SCR, IGBT and Power MOSFET. 3. DIAC and TRIAC - working, applications.	Refer Table 1	1. Conduct an experiment to find the holding current and latching current of SCR. 2.Conduct an experiment to determine break-over voltage of an SCR.
2	1,2	1	1. Triggering-Need, Triggering circuits- R-triggering, RC–triggering.	Refer Table 1	1. Construct a R triggering circuit and verify its working.

			2. Pulse triggering using UJT relaxation oscillators. 3. Commutation-Need, natural and forced commutation of SCR. resonant commutation.		2. Construct a R-C triggering circuit and verify its working.
3	1,2	1,3	1. Auxiliary commutation and Complementary commutation. 2. Protection of SCR-Snubber circuit- turn ON, turn OFF and over- voltage. 3. Controlled rectifiers- Single phase half-wave controlled rectifier, single phase full-wave bridge controlled rectifier (only resistive load), importance of freewheeling diode.	Refer Table 1	1. Verify SCR triggering by UJT relaxation oscillator using a kit. 2. Construct a full-wave controlled rectifier circuit using R-C triggering and verify its working.
4	1,2	1,3	1. Chopper- working principle, duty cycle, chopper control schemes. 2. Chopper classifications, Step-up and Step-down choppers. 3. Working of first quadrant, second quadrant choppers.	Refer Table 1	1. Verify the working of a constant frequency voltage commutated chopper using a kit. 2. Verify the working of a variable frequency voltage commutated chopper using a kit.
5	1,2	1,3	1. Working of two quadrant and four quadrant choppers, Buck and Boost converters. 2. Inverters- working principle and types, Half-bridge inverter. 3. Full-bridge inverter, Series inverter,	Refer Table 1	1. Verify working of series inverter using a kit. 2. Verify working of full bridge inverter using a kit.
6	1,2	1,3	1. Variable dc link inverter, voltage source and current source inverters. 2. PWM techniques used in inverters. 3. Cycloconverter- classification, working of single phase to single phase midpoint cycloconverter.	Refer Table 1	1. Verify PWM techniques in inverters using a simulator. 2. Verify single phase to single phase cycloconverter using a kit.
7	1,2	1,3	1. Photo-electric control of SCR, Light dimmer circuit using DIAC and TRIAC. 2. Burglar alarm circuit. Need for electronic control of motors. 3. Armature voltage control method and Field control method for speed control of DC shunt motor.	Refer Table 1	1. Verify light dimmer circuit using DIAC and TRIAC. 2. Simulate and verify the working of Burglar alarm circuit/Photo electric control of SCR/Speed control of DC shunt motor.

8	2,3	1,3, 5	1. Speed control of DC motors using dual converters, speed control of Induction motor. 2. PLC-introduction, compare Relay logic control and PLC logic control, block diagram of PLC system, PLC scanning. 3. Internal architecture of PLC, memory organization.	Refer Table 1	1. Verify the speed control of universal motor using a kit. 2. Verify the speed control of stepper motor using inverter in clockwise and anti-clockwise direction using a kit.
9	3	1,3, 5	1. PLC input devices – switches, proximity sensors, photoelectric sensors, temperature sensors, liquid level sensors. 2. PLC output devices – solenoids, relay, directional control valve, motors & stepper motors. 3. Programming standards, PLC Ladder diagram, ladder diagram for logic gates.	Refer Table 1	1. Familiarization of software for PLC simulation (Keyence/Picosoft). 2. Write ladder diagrams and verify the truth table of all logic gates.
10	3	3,5, 7	1.PLC input instructions and outputs- coils, indicators, Conversion of Boolean functions from word description to ladder diagram and vice-versa. 2.Write the ladder diagrams for different applications Ex i. A system where there has to be no output when any one of four sensors gives an output, otherwise there is to be an output. ii. Staircase light application. iii.Conveyor control application. 3. PLC register basics- Input, Holding, Output, PLC arithmetic functions- addition, subtraction, multiplication & division.	Refer Table 1	1. Write a ladder diagram for DOL starter and test the output using PLC trainer kit module. 2.Simulate and test the following task using PLC, A signal lamp is required to be switched ON if a pump is running and the pressure is satisfactory, or if the lamp test switch is closed, otherwise the signal lamp should remain OFF.
11	3	3,5, 7	1. PLC Basic comparison functions and its applications. 2. PLC Timer functions- on delay timer, off-delay timer, pulsed timer , one shot, applications of timing functions in process control. 3. PLC Counter functions- up/down counter, applications of	Refer Table 1	1. Write a ladder diagram, timing diagram and simulate a circuit for the following process control application. There are 3 mixing devices on a processing line A, B and C. After the process begins mixer-A is to start after 7 seconds elapse, next mixer-B is to start 3.6 seconds after A. Mixer-C is to start 5 seconds after B. All of them remain ON until a master enable switch is turned OFF.

			PLC counter functions in process control.		2. Write a ladder diagram and simulate a circuit for a process control application in which a paint spray has to run for 40 seconds when the count reaches the value of 25.
12	3,4	3,5, 7	1. PLC and the internet, selection of PLC and its maintenance, PID module. 2. Distributed Control System- Introduction, features, hierarchical architecture, advantages. 3. DCS application in chemical plants/ cement plants/ paper and pulp industries, Introduction to HMI/MMI.	Refer Table 1	1. Write the ladder diagram and execute the Water level controller/Staircase light controller application using PLC trainer kit module. 2. Video demonstration and documentation of DCS application in any plant.
13	4	3,5, 7	1. SCADA-Introduction, background, definition, features, typical SCADA system. 2. SCADA architecture, SCADA hardware & software. 3. SCADA protocols, interfacing PLC with SCADA. applications of SCADA.	Refer Table 1	1. Write the ladder diagram and execute the Lift control/Conveyor control application using PLC trainer kit module. 2. Video demonstration and documentation of the SCADA systems.
Total in hours			**39**	**13**	**52**

Note: 1) In Practice sessions Video demonstration should be followed by MCQs/Quiz/Subjective questions and the evaluation has to be documented.

2) In Practice sessions, all discrete circuits should be simulated using suitable software before its construction and verification.

TABLE 1: Suggested activities for tutorials

The list is shared as an example and not inclusive of all possible activities of the course.

The list of activities for one week can be shared among teams in a batch of students.

Week no.	**Suggested activities for tutorials**
01	1. Give a presentation on constructional features of SCR, its specifications and ratings. 2. Prepare a report on specifications and ratings of Diac and Triac. 3. Discuss feasibility of Germanium Controlled Rectifier.
02	1. Discuss the importance of triggering an SCR. 2. Explain the comparison of natural and forced commutation of SCR.

03	1. List the applications of controlled rectifiers in industries. 2. Explain any one real time application of a controlled rectifier.
04	1. Explain any one real time application of choppers.
05	1. Explain the differences between Buck and Boost converters. 2. Collect the information on the type and working of inverter used in your lab UPS.
06	1. Differentiate between step up and step down cyclo converter with their applications. 2. Explain the role of a cycloconverter in the working of a washing machine.
07	1. Construct and demonstrate any one real time application of SCR/TRIAC(ex:Automatic street lighting/Smoke detector).
08	1. List the leading PLC manufacturers around the world and collect information on applications of PLC systems. 2. Prepare a report on advantages of using PLC in automation.
09	1. Collect information on the specifications/parameters / datasheets of input devices used with PLC. 2. Collect information on the specifications/parameters / datasheets of output devices used with PLC.
10	1. Develop a fire alarm system which has Fire sensors providing inputs to a SET-RESET function block so that if one of the sensors is activated, the alarm is set and remains set until it is cleared by being reset. 2. Two Conveyors feed a main conveyor, find the main conveyor count from the count of parts entering the two conveyors.
11	1. Give a presentation on real time PLC Counter applications. 2. Prepare a report on all types of PLC timer functions. 3. Give a presentation on PLC advanced comparison functions.
12	1. Give a presentation on applications of HMI/MMI. 2. Give a presentation on the different levels of industrial control with respect to networking of PLCs. 3. Prepare a report on DCS system integration and DCS flow sheet symbols.
13	1. Study the latest technological changes in this course and present the impact of these changes on industry.

	2. Prepare a report on different ways of deploying SCADA systems along with advantages and disadvantages. 3. Prepare a report on the security threat and vulnerability of SCADA Systems.

4. CIE and SEE Assessment Methodologies

Sl. No	**Assessment**	**Test Week**	**Duration** In minutes	**Max marks**	**Conversion**
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
				Total CIE Marks	60
		Semester End Examination (Practice)	180	100	40
				Total Marks	**100**

5. Format for CIE (1, 2, 3) Written Test

Course Name	Industrial Automation	Test	I/II/III	Sem	III/IV
Course Code	20EC44P	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					
Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks
I	1				
	2				
II	3				
	4				
III	5				
	6				
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.					

5. (a) Format for CIE-4 Skill Test - Practice.

SL. No.	COs	Particulars/Dimension	Marks
1	1	Identify the various components used in Power Electronics and demonstrate its use for a given application.	20
2	2	Build a power electronic circuit and demonstrate the working of that circuit for a specific application either in a Real or Simulated environment. Construction of circuit diagram -20 Marks Conduction -20 Marks Output -30 Marks.	70
3	1,2	Portfolio evaluation of Practice sessions through Rubrics	10
		Total Marks	**100**

5. (b) Format for CIE-5 Skill Test - Practice.

SL. No.	COs	Particulars/Dimension	Marks
1	3	Design, Test and Troubleshoot a specific PLC Automation System to meet defined operational specifications in a simulated environment. Writing Ladder diagram (2 applications) - 40 Marks Interfacing to kit - 20 Marks Result - 10 Marks	70
2	4	Concept of SCADA/DCS/HMI and list their various applications	20
3	3,4	Portfolio evaluation of Practice sessions through Rubrics	10
		Total Marks	**100**

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
						Average Marks= (8+6+2+2)/4=4.5	5

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	"Programmable Logic Controllers Principles and Applications" by John W. Webb – Ronald A. Reis. 5th Edition, Published by PHI Publication.
2	"Introduction to PLC's" by Gary Dunning, 3rd Edition, Thomson India Edition
3	"PLC's" by W. Bolton, 4th edition.
4	Programmable Logic Controllers by Frank D Petruzella, 4th Edition, McGraw Hill Publications.

8. SEE Scheme of Evaluation

SL. No.	COs	Particulars/Dimension	Marks
1	1	Identify the various components used in Power Electronics and demonstrate its use for a given application.	10
2	2	Build a power electronic circuit and demonstrate the working of that circuit for a specific application either in a Real or Simulated environment. Construction of circuit diagram - 10 Marks Conduction -10 Marks Output -10 Marks	30
3	3	Design, Test and Troubleshoot a specific PLC Automation System to meet defined operational specifications in a simulated environment. Writing Ladder diagram - 10 Marks Interfacing to kit - 10 Marks Result - 10 Marks	30
4	4	Concept of SCADA/DCS/HMI and their applications.	10
5	1,2,3, 4	Viva-Voce	20
		Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers	Intel Core i5 11th gen/8GB RAM/1 TB HDD/256GB SSD/ Graphics 2 GB	20
2	POWERSIM simulation software		
3	Kit for SCR triggering by UJT relaxation oscillator		10
4	Kit for Voltage commutated chopper both constant frequency & variable frequency.		10
5	Series Inverter kit		10
6	Full bridge inverter kit		10
7	PWM inverter kit		10
8	Single phase to Single phase cyclo converter kit		10
9	Light Dimmer kit		10

10	Speed control of universal motor kit		10
11	Speed control of stepper motor kit		10
12	PLC kits		10
13	PLC interfacing kits for Lift control, water level control		3 each

Government of Karnataka
Department of Collegiate and Technical Education

Programme	Audit Course	**Semester**	IV
Course Code	20EC45T	**Type of Course**	Audit
Course Name	**Indian Constitution**	**Contact Hours**	2 hours/week 26 hours/semester
Teaching Scheme	L:T:P :: 2:0:0	**Credits**	2
CIE Marks	50	**SEE Marks**	Nil

1. Course Outcomes: At the end of the Course, the student will be able to:

CO-01	**CO1**	Understand Preamble, salient features and importance of Indian Constitution.
CO-02	**CO2**	Understand Fundamental rights, duties and Directive principles of state policy.
CO-03	**CO3**	Understand Parliamentary system of governance, Structure, Functions, Power of Central, state governments (Legislative, Executive) and Judiciary.
CO-04	**CO4**	Understand Panchayat Raj Institutions and Local self-governments, UPSC, KPSC, NHRC, Status of women, RTE etc.

2. Course Content

Week	CO	Detailed Course Content	Contact Hours
1	1	Introduction to constitution of India-Formation and Composition of the Constituent Assembly-Salient features of the Constitution-Preamble to the Indian Constitution	2
2	1,2	Fundamental Rights- Definition, The right to equality, The right to freedom, The right against exploitation, The right to freedom of religion.	2
3	1,2	Cultural and educational rights and The right to constitutional remedies. Fundamental Duties, Directive principles of state policy.	2
4	1,3	Parliamentary system of governance- Structure of Parliament- Lok Sabha and Rajya Sabha. Functions of parliament- Legislative, Executive, Financial Function Powers of Lok Sabha and Rajya Sabha.	2
5	1,3	Procedure followed in parliament in making law, Annual financial statement (Budget) – procedure in parliament with respect to estimates, Appropriation bill, Supplementary, additional grants, Vote on account, votes on credit and exception grant, special provisions, rules of procedure.	2
6	1,3	Structure of union executive, Power and position of President. Vice President, Prime minister and council of ministers.	2
7	1,3	Structure of the judiciary: Jurisdiction and functions of Supreme Court, high court, and subordinate courts.	2
8	1,3	Federalism in the Indian constitution- Division of Powers: Union list, State list and concurrent list. Structure of state legislation, Legislative assembly and Legislative council.	2
9	1,3	Functions of state legislature, Structure of state executive-Powers and positions of Governor, Speaker, Deputy Speaker, Chief Minister and council of minister.	2

10	4	Local self-government- meaning-Three tier system, Village Panchayat-Taluk panchayat Zilla panchayat, Local bodies-Municipalities and Corporations, Bruhath Mahanagara Palike, Functions of Election commission, UPSC, KPSC.	2
11	4	Amendment of the constitution, Human Rights-Definition-constitutional provisions-right to life and liberty-Human Rights of Women-Discrimination against women steps that are to be taken to eliminate discrimination against women in Education, employment, health care, Economic and social life,	2
12	4	Status of Women in India - Women in rural areas, Constitutional Safeguards - Dowry Prohibition act 1961- Domestic violence act 2005- Sexual harassment at work place bill 2006. Human Rights of Children- Who is a child- list the Rights of the Child- Right to education, Protection of Children from Sexual Offences Act (POCSO)-2012-	2
13	1,4	National Human Rights Commission Constitution- Powers and function of the Commission-Employee rights- Provisions made, Contractual-Non contractual employee rights-Whistle blowing-definition-Aspects-Intellectual Property Rights (IPR)–Meaning-Need for protection- Briefly description of concept of patents, Copy right, Trademark	2
Total in Hours			**26 Hrs**

REFERENCES

1. Introduction to the Constitution of India- Dr. Durga Das Basu
2. Empowerment of rural women in India-Hemalatha H.M and Rameshwari Varma, Hema Prakashana.

4. CIE and SEE Assessment Methodologies

Sl. No	**Assessment**	**Test Week**	**Duration** In minutes	**Max marks**	**Conversion**
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 MCQ	6	60	20	Average of two CIE = 20
5	CIE-5 Open Book Test	12	60	20	
Total CIE Marks					50
Semester End Examination (Practice)			-	-	-
Total Marks					**50**