3rd SEMESTER

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

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

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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. **Analog 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 - "ಷೇರು 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.