BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

Programme Name/s	**: Automobile Engineering./ Agricultural Engineering/ Chemical Engineering/ Mechanical Engineering/ Production Engineering/ Polymer Technology**
Programme Code	**: AE/ AL/ CH/ ME/ PG/ PO**
Semester	**: Second**
Course Title	**: BASIC ELECTRICAL AND ELECTRONICS**
Course Code	**: 312020**

I. RATIONALE

Modern engineering systems, irrespective of the field, are increasingly incorporating smart technologies that rely on electrical and electronics components. Many engineering projects involve the integration of mechanical, electrical and electronic components. A well-rounded education in electrical and electronics principles enables engineers to work seamlessly across disciplines. In Chemical Engineering, Agricultural Engineering and Polymer Technology, precise measurement and control of variables are crucial. The fourth industrial revolution emphasizes the integration of digital technologies into manufacturing and engineering processes. Electrical and electronics knowledge is fundamental for implementing Industry 4.0 concepts in Engineering fields .This course will develop skills in handling tools and equipment related electrical and electronics engineering and provide the necessary foundation for understanding, maintaining and implementing advanced systems.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcomes through various teaching learning experiences: Use Electrical and Electronics equipment safely in mechanical engineering applications

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Use Principles of electrical and magnetic circuits to solve mechanical engineering broadly defined problems.
- CO2 - Use of Transformer and Electric motors for given applications.
- CO3 - Suggest suitable electronic component for given mechanical engineering application.
- CO4 - Use of diodes and transistors as a relevant component in given electric circuits of . mechanical engineering application

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312020	BASIC ELECTRICAL AND ELECTRONICS	BEE	AEC	2	-	4	-	6	3	-	-	-	-	-	50	20	50@	20	-	-	100

BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the given technical terms related to Electric and Magnetic circuits . TLO 1.2 Identify analogy between Electric and Magnetic Circuits. TLO 1.3 Apply Fleming's right hand rule and Lenz's law for determination of direction of induced emf in the given situation. TLO 1.4 Explain attributes of the given AC quantities. TLO 1.5 Find currents and voltages in the given series and parallel AC circuits.	**Unit - I Electric and Magnetic Circuit** 1.1 1 Electric circuits E.M.F, Potential difference, power, Magnetic circuits M.M.F, magnetic force, permeability. 1.2 Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law, dynamically induced emf. 1.3 Statically induced emf. (a) Self induced emf (b) Mutually induced emf; Equations of self and mutual inductance. 1.4 A .C. Signal terms: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor, Peak Factor, impedance, phase angle, and power factor. 1.5 Voltage and Current relationship in Star and Delta connections. Working of Batteries, wiring specifications and IS electrical standards for safety and appliances.	Chalk-Board Presentations Videos on Flemings Right hand rule and Lenz Law
2	TLO 2.1 Explain with sketches the construction and working principle of the given type of single phase transformer. TLO 2.2 Explain with sketches the working principle of the given autotransformer. TLO 2.3 Describe with sketches the construction of the given single phase motor. TLO 2.4 Explain with the sketches the working principle of the given single phase induction motors.	**Unit - II Transformer and single phase induction motor** 2.1 General construction and principle of different type of transformers, EMF equation and transformation ratio of transformers. 2.2 Auto transformers. Working Principle and applications 2.3 Construction and Working principle of single phase AC. motor. Types of single phase motors, applications of single phase motors. 2.4 Applications of Induction motors	Chalk-Board Demonstration Hands-on

BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Differentiate between the given active and passive components. TLO 3.2 Determine the value of given resistor and capacitor using color code and printed information on components . TLO 3.3 Explain the given signal parameters with sketches. TLO 3.4 Identify the given type of ICs based on the IC number	**Unit - III Electronic Components and Signals** 3.1 Electronic Components : Passive and Active components: Resistor, Capacitor, Inductor, symbols color codes, specifications. 3.2 Voltage and current sources, signals: Waveform (Sinusoidal, triangular and square). 3.3 Time and frequency domain representation of signals.Amplitude, frequency, phase, wavelength. 3.4 Integrated circuits - Analog and Digital.	Chalk-Board Demonstration of components Hands-on
4	TLO 4.1 Explain with the sketches the working of given type of diode using its V-I characteristics. TLO 4.2 .Explain with the sketches the working of given type of rectifier using circuit diagram. TLO 4.3 Justify the given selection of power supply and LEDs for the given circuit. TLO 4.4 Explain with the sketches the application of the given type of transistor as a switch. TLO 4.5 Compare the performances of the given transistor configurations.	**Unit - IV Diodes and Bipolar Junction Transistor** 4.1 Diodes and its Applications: P-N junction diode: symbol, construction working and applications ,Zener diode: working, symbol, voltage regulator. 4.2 Rectifiers: Half wave, Full wave, Bridge rectifier Performance parameters: PIV, ripple factor, efficiency. 4.3 Light Emitting Diodes: symbol, construction, working principle and applications. 4.4 BJT Symbol, construction, working principle Transistor as switch and amplifier. 4.5 Input and Output characteristics: CE configurations, Operating regions: Cut-off, saturation Active Region.	Chalk-Board Demonstration Hands-on

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Measure voltage and current in single phase circuits with resistive load using appriopriate meters	1	* Voltage and Current measurement	2	CO1
LLO 2.1 Measure power required by single phase circuit with resistive load.	2	* Power measurement of single phase circuit	2	CO1
LLO 3.1 Measure Energy consumed by given equipment using energy meter.	3	Energy measurement	2	CO1
LLO 4.1 Measure average value, peak value and RMS value of AC waveform using CRO./ DSO LLO 4.2 Measure time and frequency of AC waveform using CRO./ DSO	4	AC signal parameters	2	CO1
LLO 5.1 Make a star and delta connection to measure line and phase voltage	5	* Line and Phase voltage measurement of star - delta connection circuit	2	CO1
LLO 6.1 Test given battery using digital multimeter.	6	* Battery Testing	2	CO1
LLO 7.1 Connect Single phase transformer for measuring input and output quantities LLO 7.2 Determine its turns ratio	7	* Input and output quantities of Single phase transformer	2	CO2
LLO 8.1 Test primary and secondary winding to measure continuity of transformer.	8	Continuity test of transformer-primary and secondary windings	2	CO2

BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 9.1 Measure output voltage of auto transformer	9	Auto transformer	2	CO2
LLO 10.1 Identify parts of single phase induction motor.	10	* Single phase induction motor	2	CO2
LLO 11.1 Select the suitable gauge of wire for given electrical application.	11	* Electrical wire specifications	2	CO2
LLO 12.1 Build the switch board for given requirement by connecting suitable coloured wire to respective terminals .	12	* Electrical Swichboard assembly	2	CO2
LLO 13.1 Identify Passive electronic components on given electronics circuit	13	* Passive electronic components	2	CO3
LLO 14.1 Connect the capacitors in series combination on bread board to measure its value using multimeter. LLO 14.2 Connect the capacitors in parallel combination on bread board to measure its value using multimeter.	14	* Resistors in series and parallel connections	2	CO3
LLO 15.1 Connect the capacitors in series combination on bread board to measure its value using multimeter. LLO 15.2 Connect the capacitors in parallel combination on bread board to measure its value using multimeter.	15	Capacitors in series and Parallel connections	2	CO3
LLO 16.1 Use LCR-Q meter for measuring the value of given Inductor and Capacitors.	16	* LCR-Q meter	2	CO3
LLO 17.1 Identify various active electronic components in given circuit.	17	* Active electronic components	2	CO3
LLO 18.1 Test the given P N junction diode using multi meter	18	* P N Junction diode	2	CO4
LLO 19.1 Multi colour LEDs.	19	Multi colour LEDs	2	CO4
LLO 20.1 Identify type of seven segment display (Common anode / Common cathode)) LLO 20.2 Testing of seven- segment display.	20	* Seven- segment display	2	CO4
LLO 21.1 Built/ Test Half Wave Rectifier.	21	Half Wave Rectifier	2	CO4
LLO 22.1 Test Full Wave Rectifier using virtual Lab.	22	Full Wave Rectifier	2	CO4
LLO 23.1 Build/Test Bridge Rectifier constructed using four diodes LLO 23.2 Test bridge rectifier package	23	Bridge Rectifier	2	CO4
LLO 24.1 Identify three terminals of transistors using multimeter.	24	Three terminals of transistors	2	CO4
LLO 25.1 Test the performance of NPN transistor.	25	Testing of NPN transistor	2	CO4
LLO 26.1 Soldering and de- soldering given passive active components on PCB	26	* Soldering and De soldering	2	CO4
LLO 27.1 Test the performance of zener diode	27	Zener diode	2	CO4
LLO 28.1 Identify components of flasher circuits	28	Electronic flasher circuit	2	CO4
LLO 29.1 Identify terminals of three terminal positive and negative voltage regulator	29	* Three terminal voltage regulators	2	CO4
LLO 30.1 Build and test + 5 V regulated D C power supply using three terminal voltage regulator .	30	Regulated Power Supply	2	CO4

BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) : NOT APPLICABLE

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Single Phase Autotransformer: Single phase, Input 0-230,10 A, Output:0-270 Volts	1,2
2	Clamp on Meter: 750 V, 2000 Counts	1,2
3	Single Phase Induction Motor - 230 V 50 Hz AC supply	11
4	LCR Q Meter: Parameter L-Q, C-D, R-Q and Z-Q Frequency 00 Hz, 120 Hz and 1 KHz Accuracy Basic Accuracy : 0.3% Display 5 digits display for both primary and secondary parameters L 100 Hz, 120 Hz 1 mH - 9999 H 1 KHz 0.1 mH - 999.9 H Measurement C 100 Hz, 120Hz 1 pF – 9999 mF Range 1 KHz 0.1 pF - 999.9 mF R, |Z| 0.0001V- 999.9 MV D, Q 0.0001 – 9999 D% 0.0001% - 9999% Test Level 120 Hz 0.3 Vrms (1 ±15%) (Range Auto 1 KHz and Open 100 Hz 0.42 Vrms (1±15%) Circuit) Ranging Mod Auto and Hold Equ	15
5	Function Generator: Frequency range 0.1Hz to 30 MHz sine, square, triangular, ramp and pulse generator, Output amplitude 20V open circuited, Output impedance 50 ohms. Facility to indicate output frequency and amplitude on display	22,23,24,29
6	Simulation software: Multisim, Proteus	23
7	CRO: Dual Channel, 4 Trace CRT / TFT based Bandwidth 20 MHz/30 MHz X10 magnification 20 nS max sweep rate, Alternate triggering Component tester and with optional features such as Digital Readout , USB interface or CRO with higher specifications	26,27,28,30
8	Digital Storage Oscilloscope: 25MHz/60MHz/70MHz/100MHz Dual Channel, 4 Trace TFT based X10 magnification 20 nS max sweep rate, Alternate triggering Component tester and with optional features such as Digital Read out, USB interface. Any other Oscilloscope with additional features is also suitable with magnifying probe at least two probes, if possible isolated probe	27,28,30
9	Single Phase Direct Measuring Energy Meter :100A 176 to 276V AC	3
10	Measurement Digital Multimeter: Minimum 3 ½ digit 4 ½ digit display, multimeter measures Vac, Vdc (1000V max), Adc, Aac (10-amp max), Resistance (0-100 Mohm), diode and transistor testing mode	4,6,12,14,17,18,19,20,21,25,13,9
11	Lamp Bank - 230 V 0-20 A	5
12	Single phase auto transformer-Single Phase Input 0-230,10A,output: 0-270Volts	7,8

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Electric and Magnetic Circuit	CO1	7	0	0	0	0

BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
2	II	Transformer and single phase induction motor	CO2	8	0	0	0	0
3	III	Electronic Components and Signals	CO3	7	0	0	0	0
4	IV	Diodes and Bipolar Junction Transistor	CO4	8	0	0	0	0
Grand Total				**30**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- For FA PR ,Formative (Continuous) assessment shall be based on process and product related performance indicators. Course teacher may assign 60%, weightage for process and 40% weightage for product related LL work .

Summative Assessment (Assessment of Learning)

- For SA PR At the end of semester PR examination will be conducted by course teacher and based on PR exam performance marks out of 50 will be allocated

XI. SUGGESTED COS - POS MATRIX FORM

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

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Mittle and Mittal	Basic Electrical Engineering	McGraw Education, New Delhi, edition 2017, ISBN-13 978-0070593572
2	Jegathesan, V	Basic Electrical and Electronics Engineering	Wiley India, New Delhi, edition-2015 ISBN 978-8126529513
3	Sedha, R.S.	A Text book of Applied Electronics	S.Chand New Delhi, edition-2008 ISBN-13: 978-8121927833
4	Mehta, V.K. Mehta, Rohit	Principles of Electronics	S. Chand and Company, New Delhi, edition-2014, ISBN-13-9788121924504
5	Bell Devid	Fundamental of Electronic Devices and Circuits	Oxford University Press, New Delhi edition-2015 ISBN 978-0195425239
6	Susan S Mathew Saji T Chacko	Fundamental of Electrical and Electronics Engineering	Khanna Book Publishing Co (P) Ltd. New Delhi 978-93-91505-59-2

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://fossee.in/ (Open Source Electronics Simulation software) https://cloud.scilab.in/ (Open Source Scilab Cloud for Electronics Simulation)	Smulation
2	https://www.electrical4u.com/fleming-left-hand-rule-and-flem ing-right-hand-rule/	Flemings Right hand and left hand rule
3	https://www.electrical4u.com/lenz-law-of-electromagnetic-ind uction/	Lenz's Law
4	https://www.animations.physics.unsw.edu.au/jw/	Electronic components, A.C. circuits, transformer, Electric motors.
5	https://en.wikipedia.org/wiki/Transformer	Transformer
6	http://www.alpharubicon.com/altenergy/understandingAC.htm	A.C. Current
7	https://www.learningaboutelectronics.com/Articles/	Electronic components
8	https://learn.sparkfun.com/tutorials/transistors	Transistors
9	https://www.technologystudent.com/elec1/transis1.htm	Transistors
10	https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/get_i s_list_by_category_id/5	IS standards for electrical safety and appliances

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

ESSENCE OF INDIAN CONSTITUTION **Course Code : 313002**

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Hotel Management & Catering Technology/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ FC/ HA/ HM/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ TC/ TE/ TR/ TX**
Semester	**: Third**
Course Title	**: ESSENCE OF INDIAN CONSTITUTION**
Course Code	**: 313002**

I. RATIONALE

This course will focus on the basic structure and operative dimensions of Indian Constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian Constitution. The Constitution of India is the supreme law of India. The document lays down the framework demarcating the fundamental political code, structure, procedures, powers, and sets out fundamental rights, directive principles, and the duties of citizens. The course on constitution of India highlights key features of Indian Constitution that makes the students a responsible citizen. In this online course, we shall make an effort to understand the history of our constitution, the Constituent Assembly, the drafting of the constitution, the preamble of the constitution that defines the destination that we want to reach through our constitution, the fundamental right constitution guarantees through the great rights revolution, the relationship between fundamental rights and fundamental duties, the futurist goals of the constitution as incorporated in directive principles and the relationship between fundamental rights and directive principles.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry /employer expected outcome – Abide by the Constitution in their personal and professional life.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - List salient features and characteristics of the constitution of India.
- CO2 - Follow fundamental rights and duties as responsible citizen of the country.
- CO3 - Analyze major constitutional amendments in the constitution.
- CO4 - Follow procedure to cast vote using voter-id.

ESSENCE OF INDIAN CONSTITUTION **Course Code : 313002**

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313002	ESSENCE OF INDIAN CONSTITUTION	EIC	VEC	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	50	20	50

Total IKS Hrs for Sem. : 0 Hrs

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

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

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the meaning of preamble of the constitution. TLO 1.2 Explain the doctrine of basic structure of the constitution. TLO 1.3 List the salient features of constitution. TLO 1.4 List the characteristics of constitution.	**Unit - I Constitution and Preamble** 1.1 Meaning of the constitution of India. 1.2 Historical perspectives of the Constitution of India. 1.3 Salient features and characteristics of the Constitution of India. 1.4 Preamble of the Constitution of India.	Presentations Blogs Hand-outs Modules Flipped classrooms Case studies
2	TLO 2.1 Enlist the fundamental rights. TLO 2.2 . Identify fundamental duties in general and in particular with engineering field. TLO 2.3 Identify situations where directive principles prevail over fundamental rights.	**Unit - II Fundamental Rights and Directive Principles** 2.1 Fundamental Rights under Part-III. 2.2 Fundamental duties and their significance under part-IV-A. 2.3 Relevance of Directive Principles of State Policy under part-IV A.	Presentations Blogs Hand-outs Modules Case Study Flipped Classroom

ESSENCE OF INDIAN CONSTITUTION **Course Code : 313002**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Enlist the constitutional amendments. TLO 3.2 Elaborate the elements of Centre-State Relationship TLO 3.3 Analyze the purposes of various amendments.	**Unit - III Governance and Amendments** 3.1 3.1 Amendment procedure of the Constitution and their types - simple and special procedures. 3.2 The Principle of Federalism and its contemporary significance along with special committees that were setup. 3.3 Major Constitutional Amendment procedure - 1st, 7th, 42nd, 44th, 73rd & 74th, 76th, 86th, 52nd & 91st, 102nd	Cases of Federal disputes with relevant Supreme court powers and Judgements Presentations Blogs Hand-outs Problem based learning
4	TLO 4.1 Explain the importance of electoral rights. TLO 4.2 Write the step by step procedure for process of registration TLO 4.3 Explain the significance of Ethical electoral participation TLO 4.4 Explain the steps to motivation and facilitation for electoral participation TLO 4.5 Enlist the features of the voter's guide TLO 4.6 Explain the role of empowered voter TLO 4.7 Write the steps of voting procedure TLO 4.8 Write steps to create voter awareness TLO 4.9 Fill the online voter registration form TLO TLO 4.10 Follow procedure to cast vote using voter-id.	**Unit - IV Electoral Literacy and Voter's Education** 4.1 Electoral rights , Electoral process of registration 4.2 Ethical electoral participation 4.3 Motivation and facilitation for electoral participation 4.4 Voter's guide 4.5 Prospective empowered voter 4.6 Voting procedure 4.7 Voter awareness 4.8 Voter online registration https:/ /www.ceodelhi.gov.in/ELCdetails.aspx	Presentations Hand-outs Modules Blogs Problem based Learning

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Outline the procedure to submit application for Voter-id
- Assignments are to be provided by the course teacher in line with the targeted COs.

A1. Prepare an essay on Constitution of India .
A2 Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA

- Assignments are to be provided by the course teacher in line with the targeted COs. A1. Prepare an essay on Constitution of India . A2 Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA A3. Self-learning topics: Parts of the constitution and a brief discussion of each part Right to education and girl enrollment in schools. GER of Girls and Boys. Right to equality. Social Democracy. Women Representation in Parliament and State Assemblies. LGBTQIA+

Micro project

- 1. Organize a workshop-cum discussions for spreading awareness regarding Fundamental Rights of the citizen of the country

2. Prepare elaborations where directive principle of State policy has prevailed over Fundamental rights with relevant Supreme Court Judgements.
3. Organize a debate on 42nd, 97th and 103rd Constitutional Amendment Acts of Constitution of India.

Seminar

- 1 Differences in the ideals of Social democracy and Political democracy.

2 Democracy and Women's Political Participation in India.
3 Khap Panchayat - an unconstitutional institution infringing upon Constitutional ethos.
4 Situations where directive principles prevail over fundamental rights.

Group discussions on current print articles.

-

- Art 356 and its working in Post-Independent India.
- Women's Resrvation in Panchayat leading to Pati Panchayats - Problems and Solutions.
- Adoption of Article 365 in India.
- Need of Amendments in the constitution.
- Is India moving towards a Unitary State Model ?

Activity

- Arrange Mock Parliament debates.

Prepare collage/posters on current constitutional issues.
i. National (Art 352) & State Emergencies (Art 356) declared in India.
ii. Seven fundamental rights.
iii. Land Reforms and its effectiveness - Case study of West-Bengal and Kerala.

Cases: Suggestive cases for usage in teaching:

- A.K. Gopalan Case (1950) :SC contented that there was no violation of Fundamental Rights enshrined in Articles 13, 19, 21 and 22 under the provisions of the Preventive Detention Act, if the detention was as per the procedure established by law. Here, the SC took a narrow view of Article 21.

Shankari Prasad Case (1951) : This case dealt with the amendability of Fundamental Rights (the First Amendment's validity was challenged). The SC contended that the Parliament's power to amend under Article 368 also includes the power to amend the Fundamental Rights guaranteed in Part III of the Constitution.
Minerva Mills case (1980) :This case again strengthens the Basic Structure doctrine. The judgement struck down 2 changes made to the Constitution by the 42nd Amendment Act 1976, declaring them to violate the basic structure. The judgement makes it clear that the Constitution, and not the Parliament is supreme.
Maneka Gandhi case (1978) :A main issue in this case was whether the right to go abroad is a part of the Right to Personal Liberty under Article 21. The SC held that it is included in the Right to Personal Liberty. The SC also ruled that the mere existence of an enabling law was not enough to restrain personal liberty. Such a law must also be "just, fair and reasonable."
Other cases:
1. Kesavananda Bharati Case (1973) : In this case the Hon. SC laid down a new doctrine of the 'basic structure' (or 'basic features') of the Constitution. It ruled that the constituent power of Parliament under Article 368 does not enable it to alter the 'basic structure' of the Constitution. This means that the Parliament cannot abridge or take away a Fundamental Right that forms a part of the 'basic structure' of the Constitution.
2. Mathura Rape Case(1979) : A tribal woman Mathura (aged 14 to 16 years) was raped in Police Custody. The case raised the questions on the idea of 'Modesty of Woman' and here it was was a tribal woman who succumbs to multiple pattiarchies. Custodial rape was made an offence and was culpable with the detainment of 7 years or more under Section 376 of Indian Penal Code. The weight of proofing the allegations moved from the victim to the offender, once sexual intercourse is established. The publication of the victim's identity was banned and it was also held that rape trials should be conducted under the cameras.
3. Puttswamy vs Union of India (2017) : In this landmark case which was finally pronounced by a 9-judge bench of the Supreme Court on 24th August 2017, upholding the fundamental right to privacy emanating from Article 21. The court stated that Right to Privacy is an inherent and integral part of Part III of the Constitution that guarantees

fundamental rights. The conflict in this area mainly arises between an individual's right to privacy and the legitimate aim of the government to implement its policies and a balance needs to be maintained while doing the same.
4. Navtej Singh Johar & Ors. v. Union of India (2018) : Hon. SC Decriminalised all consensual sex among adults, including homosexual sex by scrapping down section 377 of the Indian penal code (IPC). The court ruled that LGBTQ community are equal citizens and underlined that there cannot be discrimination in law based on sexual orientation and gender.
5. Anuradha Bhasin Judgement (2020) : The Supreme Court of India ruled that an indefinite suspension of internet services would be illegal under Indian law and that orders for internet shutdown must satisfy the tests of necessity and proportionality. The Court reiterated that freedom of expression online enjoyed Constitutional protection, but could be restricted in the name of national security. The Court held that though the Government was empowered to impose a complete internet shutdown, any order(s) imposing such restrictions had to be made public and was subject to judicial review.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED : NOT APPLICABLE

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Constitution and Preamble	CO1	4	0	0	0	0
2	II	Fundamental Rights and Directive Principles	CO2	4	0	0	0	0
3	III	Governance and Amendments	CO3	4	0	0	0	0
4	IV	Electoral Literacy and Voter's Education	CO4	3	0	0	0	0
Grand Total				**15**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Assignment, Self-learning and Terms work Seminar/Presentation

Summative Assessment (Assessment of Learning)

XI. SUGGESTED COS - POS MATRIX FORM

ESSENCE OF INDIAN CONSTITUTION **Course Code : 313002**

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

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	P.M.Bakshi	The Constitution of India	Universal Law Publishing, New Delhi 15th edition, 2018, ISBN: 9386515105 (Check the new edition)
2	D.D.Basu	Introduction to Indian Constitution	Lexis Nexis Publisher, New Delhi, 2015, ISBN:935143446X
3	B. K. Sharma	Introduction to Constitution of India	PHI, New Delhi, 6thedition, 2011, ISBN:8120344197
4	MORE READS :	Oxford Short Introductions - The Indian Constitution by Madhav Khosla. The Indian Constitution: Cornerstone of a Nation by Granville Austin. Working a Democratic Constitution: A History by Garnville Austin Founding Mothers of the Indian Republic: Gender Politics of the Framing of the Constitution by Achyut Chetan. Our Parliament by Subhash C. Kashyap. Our Political System by Subhash C. Kashyap. Our Constitution by Subhash C. Kashyap. Indian Constitutional Law by Rumi Pal.	Extra Read
5	B.L. Fadia	The Constitution of India	Sahitya Bhawan,Agra, 2017, ISBN:8193413768

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://www.legislative.gov.in/constitution-of-india	Constitution overview
2	https://en.wikipedia.org/wiki/Constitution_of_India	Parts of constitution
3	https://www.india.gov.in/my-government/constitution-india	Constitution overview
4	https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/	Fundamental rights and duties
5	https://main.sci.gov.in/constitution	Directive principles
6	https://legalaffairs.gov.in/sites/default/files/chapter%203.pdf	Parts of constitution

ESSENCE OF INDIAN CONSTITUTION **Course Code : 313002**

Sr.No	Link / Portal	Description
7	https://www.concourt.am/armenian/legal_resources/world_constitutions/constit/india/india-e.htm	Parts of constitution
8	https://constitutionnet.org/vl/item/basic-structure-indian-constitution	Parts of constitution

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 02/07/2024 **Semester - 3, K Scheme**

EDA TOOLS **Course Code : 313013**

Programme Name/s : **Electronics & Computer Engg.**
Programme Code : **TE**
Semester : **Third**
Course Title : **EDA TOOLS**
Course Code : **313013**

I. RATIONALE

Electronic Design Automation (EDA) tools are software tools used to create, modify, analyze and optimize electronic system. EDA tools enable designers to simulate and validate their designs before physical implementation or manufacturing. Students can learn a variety of skills through EDA tools, including troubleshooting and how various devices and system work together. Working on EDA tools prepare student for present industrial need.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend following industry/employer excepted outcome through various teaching learning experiences:
Use basic concepts of Electronic Design Automation (EDA) tools for various applications.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Use EDA tools to simulate the simple circuits.
- CO2 - Develop Analog circuits and test the output using EDA tool.
- CO3 - Analyze Digital circuits for the given input using EDA tool.
- CO4 - Develop various miscellaneous circuits using EDA tool.
- CO5 - Use EDA tool to develop PCB Layout for the given electronic circuit.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313013	EDA TOOLS	EDT	SEC	-	-	4	-	4	2	-	-	-	-	-	25	10	25@	10	-	-	50

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

EDA TOOLS **Course Code : 313013**

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 State main features of given EDA tool. TLO 1.2 Explain use of different windows to perform various operations of given EDA tool. TLO 1.3 Describe the procedure to create new file in the given EDA tool software. TLO 1.4 Explain the procedure to make changes in the given file.	**Unit - I Introduction to EDA Tools** 1.1 Need of EDA tools 1.2 Applications of EDA tools 1.3 Introduction to different EDA tools: eSim, EasyEDA, Kicad, Multisim, Proteus, SCILAB, MATLAB or any other EDA tool 1.4 Steps for Installation of EDA tools 1.5 Features of EDA tools: open file, create new file, run simulation, virtual instrument. 1.6 Editing windows, functions, controls 1.7 File format, report generation in the given EDA tool	Demonstrations Presentations Hands-on Chalk-Board
2	TLO 2.1 List steps to develop rectifier circuits using EDA tool. TLO 2.2 Select desired components to obtain ripple free output. TLO 2.3 Interpret the transient behavior of single and two stage amplifier using given transistor. TLO 2.4 Interpret the transient behavior of single and two stage amplifier using FET/MOSFET.	**Unit - II Analog Circuits** 2.1 Rectifiers: Design of Half wave, Full wave (bridge rectifier and center tapped) with input and output waveform 2.2 Rectifier with shunt capacitor, series inductor, LC and CLC filter 2.3 Single and multi stage amplifier by using BJT 2.4 Single and multi stage amplifier by using JFET/MOSFET	Demonstration Presentations Chalk-Board Hands-on
3	TLO 3.1 List different logic gates available in the library of EDA tool. TLO 3.2 List different types of MUX and DEMUX ICs available with EDA tool. TLO 3.3 List different types of flip-flops available with EDA tool. TLO 3.4 Use the given flip-flop to construct specific type of counters and shift register.	**Unit - III Digital Circuits** 3.1 Combinational circuit: Logic Gates, Boolean Expression 3.2 Adder, Subtractor 3.3 Multiplexer, De-multiplexer, Encoder, Decoder 3.4 Sequential Circuits: One bit memory cell, SR flip-flop, JK flip-flop, D flip-flop, T flip-flop, 3.5 Counters: Synchronous and Asynchronous Counter 3.6 4 bit universal Shift register	Chalk-Board Presentations Hands-on
4	TLO 4.1 Calculate modulation index of AM and FM wave. TLO 4.2 Observe radiation pattern for various antenna.	**Unit - IV Miscellaneous Circuits** 4.1 Need for Modulation 4.2 Amplitude Modulation: Modulation index, Representation of AM wave in time and frequency domain 4.3 Frequency Modulation: Modulation index, Representation of FM wave in time and frequency domain 4.4 Antenna: Radiation pattern, frequency and length of different antennas	Demonstration Chalk-Board Hands-on
5	TLO 5.1 List different types of PCB. TLO 5.2 Test the performance of voltage regulator.	**Unit - V PCB Layout Design** 5.1 DC regulated power supply 5.2 Voltage regulator: Zener diode as voltage regulator 5.3 Switch mode power supply	Demonstration Educational Videos Hands-on

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

EDA TOOLS **Course Code : 313013**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Choose different components available in the library of EDA tool.	1	*Identification of components and virtual instruments available in EDA tool.	2	CO1
LLO 2.1 Choose appropriate tab to create new project using EDA tool.	2	*Create new file using given EDA tool.	2	CO1
LLO 3.1 Choose suitable diode and resistor to develop Half wave rectifier circuit. LLO 3.2 Observe change in input and output waveforms.	3	*Simulate Half wave rectifier and observe input output waveforms.	2	CO2
LLO 4.1 Select required components to develop Half wave rectifier with shunt capacitor filter. LLO 4.2 Observe change in input and output waveforms.	4	Simulate Half wave rectifier with shunt capacitor filter and observe input output waveforms.	2	CO2
LLO 5.1 Select different components available in the library to develop Full wave rectifier circuit. LLO 5.2 Observe change in input and output waveforms.	5	*Simulate Full wave rectifier and observe input output waveforms.	2	CO2
LLO 6.1 Select desired components to build Full wave rectifier circuit. LLO 6.2 Select appropriate filter for getting pure DC output.	6	Simulate Full wave rectifier with LC,Pi filter observe input and output waveforms.	2	CO2
LLO 7.1 Select appropriate transistor to develop single stage amplifier. LLO 7.2 Observe frequency response of given amplifier.	7	*Simulate single stage amplifier using BJT to observe frequency response.	2	CO2
LLO 8.1 Select appropriate FET/MOSFET for given amplifier. LLO 8.2 Observe frequency response of given amplifier.	8	Simulate single stage amplifier using FET/MOSFET to observe frequency response.	2	CO2
LLO 9.1 Develop circuit for multistage amplifier by selecting different components available in EDA tool. LLO 9.2 Observe frequency response of given amplifier. LLO 9.3 Calculate cutoff frequency for given amplifier.	9	*Interpret DC and Transient analysis of two stage RC coupled amplifier using BJT. Observe frequency response using virtual spectrum analyzer.	2	CO2
LLO 10.1 Select required component to build two stage RC coupled amplifier using FET/MOSFET. LLO 10.2 Observe frequency response of given amplifier. LLO 10.3 Calculate cutoff frequency of the given amplifier.	10	Interpret DC and Transient analysis of two stage RC coupled amplifier using FET/MOSFET Observe frequency response using virtual spectrum analyzer.	2	CO2

EDA TOOLS **Course Code : 313013**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 11.1 Identify symbols of various Logic gates available in EDA tool library. LLO 11.2 Verify truth table for various Logic gate.	11	*Test functionality of Logic gates.	2	CO3
LLO 12.1 Select required gates to develop circuit for Half and Full adder circuit.	12	*Simulate Half and Full adder using EDA tool.	2	CO3
LLO 13.1 Select desired IC from library to develop 8:1 MUX. LLO 13.2 Choose required select lines to develop 8:1 MUX.	13	*Simulate 8:1 multiplexer using EDA tool.	2	CO3
LLO 14.1 Select desired IC to develop 1:8 DEMUX. LLO 14.2 Verify data flow of DEMUX for different select lines.	14	Simulate 1:8 De-multiplexer using EDA tool.	2	CO3
LLO 15.1 Make necessary connection to develop RS,JK flip-flop. LLO 15.2 Verify truth table of RS,JK flip-flop.	15	*Simulate RS,JK flip-flops and observe output on virtual logic analyzer.	2	CO3
LLO 16.1 Select required IC to design D,T flip-flops.	16	Simulate D,T flip-flops and observe output on virtual logic analyzer.	2	CO3
LLO 17.1 Select required number of flip-flops to develop Synchronous counter. LLO 17.2 Choose appropriate clock signal for Synchronous counter.	17	*Simulate modulo-N Synchronous counter using flip-flop and verify output using virtual logic analyzer.	2	CO3
LLO 18.1 Choose desired flip flop to develop universal shift register.	18	Simulate 4 bit universal shift register verify output using virtual logic analyzer.	2	CO3
LLO 19.1 Analyze the behavior of generated AM wave.	19	*Generate AM wave for various carrier frequencies using EDA tool.	2	CO4
LLO 20.1 Analyze the behavior of generated FM wave.	20	*Generate FM wave using EDA tool.	2	CO4
LLO 21.1 Observe radiation pattern of different types of antenna.	21	Plot radiation pattern of different types of antenna using EDA tools.	2	CO4
LLO 22.1 Prepare PCB layout for given circuit. LLO 22.2 Use EDA tool to develop 3D view of circuit.	22	Develop PCB Layout of Half wave rectifier circuit using EDA Tool.	2	CO5
LLO 23.1 Use EDA tool to develop 3D view of circuit. LLO 23.2 Generate footprint for given circuit.	23	Develop PCB layout of Full wave rectifier circuit with LC filter using EDA tool.	2	CO5
LLO 24.1 Develop PCB layout for given circuit. LLO 24.2 Use EDA tool to develop 3D view of circuit.	24	*Develop PCB Layout of Full wave rectifier with Pi filter using EDA Tool.	2	CO5
LLO 25.1 Observe voltage and waveform at different stages. LLO 25.2 Select appropriate components to develop circuit.	25	Simulate regulated power supply circuit.	2	CO5

EDA TOOLS **Course Code : 313013**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 26.1 Use EDA tool to develop 3D view of circuit. LLO 26.2 Generate footprint for given circuit.	26	*Develop single sided PCB layout of Regulated Power supply.	2	CO5
LLO 27.1 Select appropriate zener diode for given output voltage.	27	*Simulate zener regulator circuit.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- NOT Applicable

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	EDA tools like: EasyEDA /eSim/MultiSim/Scilab/Protues/KiCAD/MATLAB or any other open source EDA software	All
2	Personal Computer: 8 GB RAM,500 GB HDD/SSD,i3 or higher processor	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- For formative assessment of laboratory learning 25 marks.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.

Summative Assessment (Assessment of Learning)

- End semester summative assessment is of 25 marks for laboratory learning.

XI. SUGGESTED COS - POS MATRIX FORM

EDA TOOLS **Course Code : 313013**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	2	2	2	1	1	1			
CO2	1	2	3	2	1	1	1			
CO3	1	2	3	2	1	1	1			
CO4	1	2	3	2	1	1	1			
CO5	1	3	3	2	2	1	1			
Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level										

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Mark D. Birnbaum	Essential Electronic Design Automation (EDA)	Publisher(s): Pearson, October 2003, ISBN: 0131828290
2	Peter Kattan	MATLAB for Beginners: A Gentle Approach	Peter I Kattan, September 2009, ISBN:978-0578036427

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://easyeda.com/	EDA tool for analog circuit, digital circuit and PCB design
2	https://esim.fossee.in/home	EDA tool for analog circuit, digital circuit and PCB design
3	https://www.multisim.com/	EDA tool for analog circuit, digital circuit and PCB design
4	http://www.kicad-pcb.org	EDA tool for analog circuit, digital circuit and PCB design
5	https://spoken-tutorial.org/tutorial-search/?search_foss=KiCad&search_language=English	Spoken Tutorials for KiCad
6	https://spoken-tutorial.org/tutorial-search/?search_foss=eSim&search_language=English	Spoken Tutorials for eSim
7	https://spoken-tutorial.org/tutorial-search/?search_foss=Scilab&search_language=English	Spoken Tutorials for Scilab
8	https://www.youtube.com/watch?v=7h33KDtKXEg&list=PLWiMVu6LCYtCtiyv7qNSjcuem9y__UwFk	Video demonstration for EasyEDA
9	https://image.easyeda.com/files/EasyEDA-Tutorial_v6.4.32.pdf	EasyEDA Tutorial
10	https://www.scilab.org/sites/default/files/Scilab_beginners.pdf	Scilab Tutorial
11	https://download.ni.com/support/manuals/374485a.pdf	Multisim component reference guide
12	https://www.youtube.com/watch?v=dEG_hv5E8VQ	Video demonstration for AM wave generation
13	https://www.youtube.com/watch?v=AlZm0wTTQCs	Video demonstration for FM wave generation

EDA TOOLS **Course Code : 313013**

Sr.No	Link / Portal	Description

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 02/07/2024 **Semester - 3, K Scheme**

DATABASE MANAGEMENT SYSTEM **Course Code : 313302**

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Data Sciences/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Electronics & Computer Engg.**
Programme Code	**: AI/ AN/ BD/ CM/ CO/ CW/ DS/ HA/ IF/ IH/ TE**
Semester	**: Third**
Course Title	**: DATABASE MANAGEMENT SYSTEM**
Course Code	**: 313302**

I. RATIONALE

This course focuses on fundamentals of relational database management system and enables students to design and manage database for various software applications. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in Information Technology applications.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

To design database and use any RDBMS package as a backend for developing database applications.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Explain concept of database management system.
- CO2 - Design the database for given problem.
- CO3 - Manage database using SQL.
- CO4 - Implement PL/SQL codes for given application.
- CO5 - Apply security and backup methods on database.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313302	DATABASE MANAGEMENT SYSTEM	DMS	DSC	3	1	4	2	10	5	3	30	70	100	40	50	20	25#	10	25	10	200

DATABASE MANAGEMENT SYSTEM **Course Code : 313302**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain given database concept. TLO 1.2 Explain Overall structure of DBMS TLO 1.3 Describe architecture of database.	**Unit - I Introduction To Database System** 1.1 Database concepts:-Data, Database, Database management system, File system Vs DBMS, Applications of DBMS, Data Abstraction, Data Independence, Database Schema, The Codd's rules, Overall structure of DBMS 1.2 Architecture:- Two tier and Three tier architecture of database. 1.3 Data Models:- Hierarchical, Networking, Relational Data Models.	Presentations, Hands-on, Chalk-Board.
2	TLO 2.1 Explain relational structure of database. TLO 2.2 State types of keys with example. TLO 2.3 Draw ER diagrams for given problem. TLO 2.4 Explain different normalization forms.	**Unit - II Relational Data Model** 2.1 Relational Structure :- Tables (Relations), Rows (Tuples), Domains, Attributes, Entities 2.2 Keys :- Super Keys, Candidate Key, Primary Key, Foreign Key. 2.3 Data Constraints :- Domain Constraints ,Referential Integrity Constraints 2.4 Entity Relationship Model : - Strong Entity set, Weak Entity set, Types of Attributes, Symbols for ER diagram, ER Diagrams 2.5 Normalization:- Functional dependencies, Normal forms: 1NF, 2NF, 3NF	Presentations, Hands-on, Chalk-Board.

DATABASE MANAGEMENT SYSTEM **Course Code : 313302**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Write SQL queries using DDL, DML, DCL and TCL. TLO 3.2 Write SQL queries to join relations. TLO 3.3 Write SQL queries for ordering and grouping data. TLO 3.4 Use various class of operators in SQL. . TLO 3.5 Create schema objects for performance tunning.	**Unit - III Interactive SQL and Performance Tuning** 3.1 SQL: -Data-types, Data Definition Language (DDL), Data Manipulation language (DML), Data Control Language (DCL), Transaction Control Language (TCL). 3.2 Clauses & Join:- Different types of clauses - Where, Group by ,Order by, Having. Joins: Types of Joins, Nested queries. 3.3 Operators:- Relational, Arithmetic, Logical, Set operators. 3.4 Functions:- Numeric , Date and time, String functions, Aggregate Functions. 3.5 Views, Sequences, Indexes: -Views : Concept ,Create ,Update, Drop Views. Sequences :- Concept ,Create, Alter , Drop, Use of Sequence in table, Index: Concept ,Types of Index , Create ,Drop Indexes	Presentations, Hands-on, Chalk-Board.
4	TLO 4.1 Use control Structures in PL-SQL. TLO 4.2 Handle different types of exceptions. TLO 4.3 Explain various types of cursors. TLO 4.4 Create Procedure, Function on given problem. TLO 4.5 Explain types of triggers with examples	**Unit - IV PL/SQL Programming** 4.1 Introduction of PL/SQL: -Advantages of PL/SQL,The PL/SQL Block Structure, PL/SQL Data Types, Variable , Constant 4.2 Control Structure:- Conditional Control, Iterative Control, Sequential Control. 4.3 Exception handling: -Predefined Exception, User defined Exception. 4.4 Cursors:- Implicit and Explicit Cursors, Declaring, opening and closing cursor, fetching a record from cursor ,cursor for loops, parameterized cursors 4.5 Procedures:- Advantages, Create, Execute and Delete a Stored Procedure 4.6 Functions:- Advantages, Create, Execute and Delete a Function 4.7 Database Triggers :- Use of Database Triggers, Types of Triggers, Create Trigger, Delete Trigger	Presentations, Hands-on, Chalk-Board.
5	TLO 5.1 Implement SQL queries for database administration. TLO 5.2 Explain concept of various types database backup processes. TLO 5.3 Describe various terms related to advanced database concepts.	**Unit - V Database Administration** 5.1 Introduction to database administration:- Types of database users, Create and delete users, Assign privileges to users 5.2 Transaction: Concept, Properties & States of Transaction 5.3 Database Backup: Types of Failures, Causes of Failure, Database backup introduction, types of database backups: Physical & Logical 5.4 Data Recovery – Recovery concepts , recovery techniques- roll forward ,Rollback 5.5 Overview of Advanced database concepts:- Data Warehouse ,Data lakes , Data mining, Big data ,Mongo DB , DynamoDB,	Presentations, Hands-on, Chalk-Board.

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Install database software	1	* Install the provided database software	2	CO1

DATABASE MANAGEMENT SYSTEM **Course Code : 313302**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 2.1 Create Database schema for given application	2	*Note :- Ensure to Carry out following activities before creating database: - Draw ER diagram for given problem - Normalize the relation up to 3NF 1) Create Database for given application 2) Create tables for the given application 3)Assign Primary key for created table 4) Modify the table as per the application needs	4	CO1
LLO 3.1 Execute DDL Commands to manage database using SQL	3	* Write queries using DDL Statements for following operations – 1)Create, alter, truncate, drop ,rename table 2) Apply Key Constraints for suitable relation.	2	CO3
LLO 4.1 Execute DML Commands to manipulate data using SQL	4	* Write queries using DML Statements for following operations – 1) Select, Insert, delete, update, table 2) Apply Key Constraints for suitable relation.	2	CO3
LLO 5.1 Execute DCL Commands to control the access to data using SQL .	5	* Write queries using DCL Statements for following operations – 1)Grant, Revoke	2	CO3
LLO 6.1 Execute TCL Commands to control transactions on data using SQL .	6	* Write queries using TCL Statements for following operations – 1) Commit, Rollback, Savepoint	2	CO3
LLO 7.1 Implement Queries using Arithmetic operators	7	Write Queries using built-in Arithmetic operators.	2	CO3
LLO 8.1 Implement Logical operators to apply various conditions in query.	8	Apply built-in Logical operators on given data	2	CO3
LLO 9.1 Implement Relational operators to apply various conditions in query.	9	Apply built-in relational operators on given data	2	CO3
LLO 10.1 Write Queries to implement SET operations using SQL .	10	* Use following Set operators to perform different operations.	2	CO3
LLO 11.1 Execute queries using String functions	11	Write SQL Queries using built-in String functions	2	CO3
LLO 12.1 Execute queries using Arithmetic functions	12	Write SQL Queries using built-in Arithmetic functions	2	CO3
LLO 13.1 Implement queries using Date and Time functions	13	Write Queries using built-in Date and Time functions	4	CO3
LLO 14.1 Implement queries using Aggregate functions	14	Write Queries using SQL built-in Aggregate functions	2	CO3
LLO 15.1 Execute Queries for ordering and grouping data.	15	* Implement Queries Using different Where, Having, Group by, & Order by clauses .	2	CO3

DATABASE MANAGEMENT SYSTEM **Course Code : 313302**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 16.1 Execute the queries based on Inner & outer join	16	* Implement SQL queries for Inner and Outer Join	2	CO3
LLO 17.1 Create and manage Views for faster access on relations.	17	* Create and Execute Views ,Seqeuence and Index in SQL.	4	CO3
LLO 18.1 Implement PL/SQL program using Conditional Statements	18	* Write a PL/SQL program using Conditional Statements- if, if then else ,nested if, if elseif else	2	CO4
LLO 19.1 Implement PL/SQL program using Iterative Statements	19	* Write a PL/SQL program using Iterative Statements- loop,for, do-while, while	2	CO4
LLO 20.1 Implement PL/SQL program using Sequential Control	20	Write a PL/SQL program using Sequential Control-switch, continue,goto	2	CO4
LLO 21.1 Create implicit & explicit cursors	21	* Write a PL/SQL code to implement implicit & explicit cursors	2	CO4
LLO 22.1 Implement PL/SQL program based on Exception Handling (Pre-defined exceptions)	22	* Write a PL/SQL program based on Exception Handling (Pre-defined exceptions)	2	CO4
LLO 23.1 Implement PL/SQL program based on Exception Handling (user defined exceptions)	23	* Write a PL/SQL program based on Exception Handling (user defined exceptions)	2	CO4
LLO 24.1 Create Procedures and stored procedures for modularity.	24	* Write a PL/SQL code to create Procedures and stored procedures	2	CO4
LLO 25.1 Create function for given database	25	* Write a PL/SQL code to create functions.	2	CO4
LLO 26.1 Implement triggers for given database.	26	* Write a PL/SQL code to create triggers for given database.	2	CO4
LLO 27.1 Implement SQL queries for database administration.	27	Execute DCL commands using SQL 1) Create Users 2) Grant Privileges to users 3)Revoke Privileges to users	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Self Learning

- Implement PL/SQL code for relevant topics suggested by the teacher.
- Complete any one course related to Database Management System on Infosys Springboard platform.

Assignment

- Solve an assignment on any relevant topic given by the teacher.

Micro project

- Develop a database for restaurant management system. The restaurant maintain catalogue for the list of food items and generate bill for the ordered food.
- Prepare Invoice management system for electricity bill generation. Accept meter reading as inputs and generate respective bill amount for the same.
- Design a database for registration and admission of patient for Hospital management system, draw ER diagram and normalize the database up to 3NF.

- Any topic suggested by teacher.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer system - (Any computer system with basic configuration)	All
2	Any RDBMS software (MySQL/Oracle/SQL server/ or any other)	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction To Database System	CO1	6	4	6	2	12
2	II	Relational Data Model	CO2	8	2	4	6	12
3	III	Interactive SQL and Performance Tuning	CO3	12	2	6	10	18
4	IV	PL/SQL Programming	CO4	12	4	4	10	18
5	V	Database Administration	CO5	7	2	4	4	10
Grand Total				**45**	**14**	**24**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
- A continuous assessment based term work.

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

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

DATABASE MANAGEMENT SYSTEM **Course Code : 313302**

CO1	3	-	-	-	1	-	1			
CO2	2	2	3	2	1	2	1			
CO3	1	2	2	2	-	2	1			
CO4	1	3	3	2	1	3	2			
CO5	1	1	2	2	2	2	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Henry F. Korth	Database System Concepts	McGraw Hill Education ISBN : 9780078022159
2	Ivan Bayross	SQL, PL/SQL – The Programming Language of Oracle	BPB Publication ISBN 10: 8170298997 BPB Publication ISBN 13: 9788170298991
3	ISRD Group	Introduction to Database Management Systems	McGraw Hill Education ISBN 10: 0070591199 McGraw Hill Education ISBN-13 : 978-0070591196

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://nptel.ac.in/courses/106105175	Data Base Management System
2	https://www.w3schools.com/sql/	SQL Tutorial
3	https://www.tutorialspoint.com/sql/index.htm	SQL Programming Language

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

DIGITAL TECHNIQUES **Course Code : 313303**

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electronics & Tele-communication Engg./ Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Instrumentation/ Medical Electronics/ Electronics & Computer Engg.**
Programme Code	**: AI/ AN/ AO/ CM/ CO/ CW/ DE/ DS/ EJ/ ET/ EX/ HA/ IC/ IE/ IS/ MU/ TE**
Semester	**: Third**
Course Title	**: DIGITAL TECHNIQUES**
Course Code	**: 313303**

I. RATIONALE

Digitization implies use of digital circuits in most of automation and industrial systems. The knowledge of logic gates, combinational and sequential circuits using discrete gates and digital ICs will enable students to interpret working of digital equipment and test their functionality.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help students to attain the following industry/employer expected outcome through various teaching learning experiences:
Student will able to test the functionality of the digital circuits/system.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Apply number system and codes concept to interprete working of digital systems.
- CO2 - Apply Boolean laws to minimize complex Boolean function.
- CO3 - Develop combinational logic circuits for given applications.
- CO4 - Develop sequential logic circuits using Flip-flops.
- CO5 - Interpret the functions of data converters and memories in digital electronic systems.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313303	DIGITAL TECHNIQUES	DTE	DSC	3	-	2	1	6	3	3	30	70	100	40	25	10	25#	10	25	10	175

DIGITAL TECHNIQUES **Course Code : 313303**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Convert the given number from one number system to another number system. TLO 1.2 Perform arithmetic operations on binary numbers. TLO 1.3 Subtract given binary numbers using 1’s and 2’s compliment method. TLO 1.4 Convert the given coded number into the other specified code. TLO 1.5 Write the application of the given code. TLO 1.6 Perform BCD addition and subtraction for the given Decimal numbers .	**Unit - I Number Systems** 1.1 Number Systems: Types of Number Systems (Binary, Octal, Decimal, Hexadecimal), conversion of number systems 1.2 Binary Arithemetic: Addition, Subtraction, Multiplication and Division 1.3 Subtraction using 1's and 2's complement method 1.4 Codes: BCD, Gray code, Excess-3 and ASCII code,Code conversions, Applications of codes. 1.5 BCD Arithemetic: BCD Addition, Subtraction using 9's and 10's complement	Lecture Using Chalk-Board

DIGITAL TECHNIQUES **Course Code : 313303**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Define the given characteristics parameters of the digital logic families. TLO 2.2 Draw symbol and truth table of given logic gates. TLO 2.3 Explain the concept of Buffer and Tristate logic . TLO 2.4 Implement basic gates and other gates with the help of universal gate. TLO 2.5 Simplify the given expression using Boolean laws and develop logic circuits .	**Unit - II Logic Gates and Boolean Algebra** 2.1 Logic Families: Characteristics Parameters of logic Families- Noise margin, Power dissipation, Figure of merit ,Fan in, Fan out, Speed of operation, maximum clock frequency supply voltage requirement ,power per gate , Comparison of TTL, CMOS and ECL logic family 2.2 Introduction to positive and negative logic systems, Logic Gates: Symbol ,Truth table of Basic logic gates(AND,OR,NOT),Universal gates(NAND,NOR) and Special purpose gates(EX-OR,EX-NOR) 2.3 Buffer: Tristate logic, Unidirectional and Bidirectional 2.4 Boolean algebra : Laws of Boolean algebra, Duality Theorem ,De-Morgan's theorem	Flipped Classroom Lecture Using Chalk-Board
3	TLO 3.1 Develop logic circuits for standard SOP/POS form of the given logic expression. TLO 3.2 Minimize the given logic expression using K-map (up to 4 variables). TLO 3.3 Design Adder and subtractor using K-map. TLO 3.4 Describe working of specified Encoder and Decoder with help of block diagram and truth table. TLO 3.5 Describe the working of Multiplexer and Demultiplexer.	**Unit - III Combinational Logic Circuits** 3.1 Standard Boolean expression: Sum of products [SOP] and Products of Sum [POS], Min-term and Max-term, SOP-POS form conversion, realisation using NAND/NOR gates 3.2 Boolean Expression reduction using K-map: Minimization of Boolean expressions (upto 4 variables) using SOP and POS form 3.3 Arithemetic circuits : design Half and Full Adder using K-maps, design Half and Full Subtractor using K-maps , n bit adder and n bit subtractor . 3.4 Encoder and Decoder: Functions of Encoder and Decoder, Block Diagram and Truth table, Priority Encoder (4:2, 8:3), BCD to 7 segment Decoder/Driver, Keyboard Encoder / decoder 3.5 Multiplexer and Demultiplexer: Working, Truth table and applications of MUX and DEMUX. MUX tree, DEMUX tree, DEMUX as Decoder	Flipped Classroom Presentations Lecture Using Chalk-Board

DIGITAL TECHNIQUES **Course Code : 313303**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Differentiate between Latch and Flip Flop. TLO 4.2 Explain basic memory cell and use relevant triggering technique for the given digital circuit. TLO 4.3 Describe the truth tables for the given Flip flops, applications of Flip flops. TLO 4.4 Use the given type of flip flop and its excitation table to design specific type of counter. TLO 4.5 Describe the working of specified shift register with the help of timing diagram. TLO 4.6 Design specified modulo-N counter using Flip flops . TLO 4.7 Design Ring /Twisted ring counter using given Flip-Flop.	**Unit - IV Sequential Logic Circuits** 4.1 Difference between Combinational and Sequential Logic circuits, Time independent (un-clocked)and Time dependent (Clocked) logic system , Flips- Flops and Latch, Basic memory cell ,RS-Latch using NAND and NOR, Triggering methods- Edge trigger and Level Trigger 4.2 Flip-Flops: S-R, J-K, T and D, Truth table and logic circuits of each flip-flop, Excitation table, applications 4.3 Race around condition in JK flip-flop, Master- Slave JK Flip Flop 4.4 Shift registers- Serial In Serial Out, Serial In Parallel Out, Parallel In Serial Out ,Parallel In Parallel Out,Bi-directional Shift register, 4-bit Universal Shift register 4.5 Counters- Synchronous and Asynchronous counters, Modulus of counter, Ripple counter, Ring Counter, Twisted Ring Counter, Up – down counter, Decade Counter, MOD-N counter, Timing Diagram	Video Demonstrations Lecture Using Chalk-Board Simulation
5	TLO 5.1 Describe the working of the given type of DAC. TLO 5.2 Calculate the output voltage for the given digital input for specified DAC. TLO 5.3 Describe the working of the given type of ADC. TLO 5.4 Compare working of ROM,EPROM, EEPROM and Flash Memory .	**Unit - V Data Converters and Memories** 5.1 Digital to Analog Data Converter (DAC)- circuit diagram and working of Weighted resistor DAC and R-2R Ladder DAC, DAC Specification/Selection factors 5.2 Analog to Digital Data Converter (ADC) : Block Diagram, Types and Working of Dual Slope ADC, Successive Approximation, Flash Type ADC, ADC selection factors/ specifications 5.3 Memories: Types- Primary memory , Secondary Memory, Organization, Dimension, Memory Bank, Features , Applications: RAM (SRAM, DRAM), Volatile and Non-Volatile, ROM (PROM, EPROM, EEPROM), Flash Memory, Comparison of RAM and ROM,EPROM and Flash Memory, SIMM: Features, SSD memory: Features,	Video Demonstrations Lecture Using Chalk-Board

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Test the functionality of basic gates. LLO 1.2 Test the functionality of special purpose gates.	1	* Test the functionality of AND, OR, NOT, Ex-OR and EX-NOR logic Gates using equivalent 74 series or CMOS Devices [CD] series.	2	CO1 CO2

DIGITAL TECHNIQUES **Course Code : 313303**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 2.1 Test the functionality of NAND and NOR gate using breadboard.	2	* Test the functionality of the given Universal Gates using equivalent 74 series /CD series.	2	CO2
LLO 3.1 Test the functionality of the constructed Basic gates using universal gates.	3	* Construct Basic Gates using Universal Gates.	2	CO2
LLO 4.1 Construct Ex-OR, EX-NOR gates using universal gates.	4	Construct Exclusive Gates using Universal Gates.	2	CO2
LLO 5.1 Build the logic circuit on breadboard to verify the De - Morgan's theorems.	5	* Verify De-Morgan's Theorem (1 and 2).	2	CO2
LLO 6.1 Verify the truth table of Half and Full adder circuits for the given input.	6	* Implement 2 input, 3 input Adder Circuit.	2	CO3
LLO 7.1 Verify the truth table of Half and Full subtractor using Boolean expressions.	7	Implement 2 input, 3 input Subtractor Circuit.	2	CO3
LLO 8.1 Construct and test BCD to 7 segment decoder using Digital IC.	8	Test the output of BCD to 7 Segment Decoder using Digital IC for the given inputs.	2	CO3
LLO 9.1 Build/Test 2 or 4 bit Magnitude comparator using Digital IC.	9	Check the output of comparator circuit consisting of Digital IC.	2	CO3
LLO 10.1 Build / test function of MUX Digital IC.	10	* Build and test the functionality of 4:1/8:1 Multiplexer.	2	CO3
LLO 11.1 Build / test function of DEMUX Digital IC.	11	Build and test the functionality of 1:4/1:8 De-Multiplexer.	2	CO3
LLO 12.1 Test functionality of RS flip flop using NAND Gate .	12	Implement and verify the truth table of RS Flip flop.	2	CO4
LLO 13.1 Test functionality of Master Slave (MS) JK flip-flop using Digital IC.	13	Implement and test the functionality of master slave- JK Flip Flop using Digital IC.	2	CO4
LLO 14.1 Test functionality and truth table for D and T Flip flop.	14	Use Digital IC to construct and test the functionality of D and T flip flop.	2	CO4
LLO 15.1 Interpret timing diagram of 4 bit Universal Shift Register.	15	Build 4- bit Universal Shift register and observe the timing diagram.	2	CO4
LLO 16.1 Interpret timing diagram of 4-bit ripple counter using Digital IC.	16	Implement Ripple Counter using Digital IC.	2	CO4
LLO 17.1 Interpret timing diagram of Decade counter (Mod-10).	17	* Implement Decade Counter Using Digital IC.	2	CO4
LLO 18.1 Build R-2R resistive network on breadboard to convert given digital data into analog.	18	* Test the output of given R-2R type Digital to Analog Converter for the given input.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Implement 1:8 DEMUX using 1:4 /1:2 DE-MUX.
- Build a circuit to implement 4 Bit adder.
- Build a 4bit parity generator and parity tester.
- Implement 16:1 MUX using 8:1/4:1 MUX.
- Build a circuit to test 7 bit segment display.
- Build a LED display bar.
- Develop a project on Burglar alarm.
- Light Detector circuit using NAND gate.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Digital Storage Oscilloscope 25MHz/60MHz/70MHz/100MHz Dual Channel, 4 Trace CRT / TFT based X10 magnification 20 nS max sweep rate, Alternate triggering Component tester and with optional features such as Digital Read out, USB interface. Any other Oscilloscope with additional features is also suitable with magnifying probe at least two probes, if possible isolated probe	15,16,17
2	Trainer kit for 4 bit Counter using Flip Flops 4 bit ripple counter synchronous counter IC 7476 based circuit, Input given by switches and output indicated on LED, Facility to select MOD 8 or MOD 16 mode, Built in DC power supply and manual pulser with indicator	16,17
3	Trainer kit IC DAC IC 0800 Trainer based on IC 0800, 8 bit digital input selected by switches and provision for measurement of analog output. Facility to study effect of change in reference voltage, Built in buffer amplifier, Built in DC power supply	18
4	Digital multimeter 3.5 digit with R , V, I measurements, diode and BJT testing	All
5	Digital IC Tester Tests a wide range of Analog and Digital ICs such as 74 series /CD series	All
6	Bread Board Development System Bread Board system with DC power output 5V,+/-12V and 0-5V variable , digital voltmeter ,ammeter , LED indicators 8 no , logic input switches 8 no, 7 segment display 2 no, clockgenerator	All
7	Trainer kits for digital ICs Trainer kit should consists of digital ICs for logic gates, flop flop, shift registers, counter alongwith toggle switches for inputs and bi-colourLED at outputs, built in power supply	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Number Systems	CO1	5	2	4	2	8

DIGITAL TECHNIQUES **Course Code : 313303**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
2	II	Logic Gates and Boolean Algebra	CO2	8	2	4	6	12
3	III	Combinational Logic Circuits	CO3	12	4	6	8	18
4	IV	Sequential Logic Circuits	CO4	12	4	6	8	18
5	V	Data Converters and Memories	CO5	8	4	6	4	14
Grand Total				**45**	**16**	**26**	**28**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two offline unit tests of 30 marks and average of two unit test marks will be consider for out of 30 marks.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
- For formative assessment of laboratory learning 25 marks

Summative Assessment (Assessment of Learning)

- End semester assessment is of 70 marks.
- End semester summative assessment of 25 marks for laboratory learning

XI. SUGGESTED COS - POS MATRIX FORM

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

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Jain R.P	Modern Digital Electronics	McGraw-Hill Publishing, New Delhi,2009 ISBN:9780070669116
2	Anand Kumar	Fundamentals of Digital Circuits	PHI learning Private limited, ISBN:978-81-203-5268-1
3	Salivahanan S, Arivazhagan S.	Digital Circuits and Design	Vikas Publishing House, New Delhi,2013 ISBN: 9789325960411
4	Puri.V.K	Digital Electronics	McGraw-Hill Publishing, New Delhi,2016 ISBN:97800746331751
5	Malvino A.P Donald .P. Leach	Digital Principles	McGraw-Hill Education, New Delhi ISBN:9789339203405

DIGITAL TECHNIQUES **Course Code : 313303**

Sr.No	Author	Title	Publisher with ISBN Number
6	Anil.K.Maini	Digital Electronics: Principles, Devices and Applications	Wiley India, Delhi, 2007, ISBN:9780470032145
7	Floyd, Thomas	Digital Fundamentals	Pearson Education India, Delhi 2014,ISBN:9780132737968
8	G.K.Kharate	Digital Electronics	Publisher: Oxford University Press, ISBN: 9780198061830

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://studytronics.weebly.com/digital-electronics.html	Basics of Digital Electronics
2	https://www.udemy.com/course/basics-of-digital-techniques/	Introduction To Digital Number System & Logic Gates
3	https://www.geeksforgeeks.org/synchronous-sequential-circuits-in-digital-logic/	Boolean Algebra and Logic Gates, Combinational and Sequential Logic Circuits
4	https://onlinecourses.nptel.ac.in/noc19_ee51/preview	Digital Circuits
5	https://de-iitr.vlabs.ac.in/	Virtual Labs for Digital Systems
6	https://www.tutorialspoint.com/digital_circuits/digital_circuits_sequential_circuits.htm	Sequential Circuits

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

OBJECT ORIENTED PROGRAMMING USING C++ **Course Code : 313304**

Programme Name/s	**: Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Electronics & Computer Engg./**
Programme Code	**: BD/ CM/ CO/ CW/ HA/ IF/ IH/ TE**
Semester	**: Third**
Course Title	**: OBJECT ORIENTED PROGRAMMING USING C++**
Course Code	**: 313304**

I. RATIONALE

In the modern world of Information Technology, Object Oriented Programming provides the most preferred approach for software development. It offers a powerful way to cope up with real world problems. C++ helps to develop fundamental understanding of object oriented concepts. This course enables to implement object oriented approach to solve a given programming problem.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop applications using concepts of OOP in C++.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Write C++ programs using classes and objects.
- CO2 - Develop C++ programs using constructors.
- CO3 - Implement Inheritance in C++.
- CO4 - Implement Polymorphism in C++.
- CO5 - Develop C++ programs to perform file operations.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313304	OBJECT ORIENTED PROGRAMMING USING C++	OOP	SEC	3	2	4	1	10	5	3	30	70	100	40	50	20	25@	10	25	10	200

OBJECT ORIENTED PROGRAMMING USING C++ **Course Code : 313304**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Compare POP vs OOP approach of programming. TLO 1.2 Describe the different features of Object Oriented Programming. TLO 1.3 Write programs to solve arithmetic expressions. TLO 1.4 Write programs to demonstrate use of special operators in C++. TLO 1.5 Develop C++ program to show the use of Classes and Objects.	**Unit - I Principles of Object Oriented Programming** 1.1 Procedure Oriented Programming (POP) verses Object Oriented Programming (OOP) 1.2 Features of Object Oriented Programming, Examples of Object Oriented languages, Applications of OOP 1.3 Data types, Type compatibility, Declaration of variable, Dynamic initialization of variable, Reference variable, Type casting 1.4 Special Operators in C++: Scope resolution operator, Memory management operators, Manipulators 1.5 Structure of C++ program, Basic Input /Output operators and functions in C++, Simple C++ Program 1.6 Class & Object: Introduction, Specifying a class, Access specifiers, Defining member functions: Inside class and Outside class, Creating objects, Memory allocations for objects	Lecture Using Chalk-Board, Demonstration, Presentations, Hands-on, Flipped Classroom.
2	TLO 2.1 Develop a program using inline function. TLO 2.2 Develop friend function to solve given problem. TLO 2.3 Write C++ programs using array of objects. TLO 2.4 Write C++ program to initialize the object using constructor. TLO 2.5 Write C++ program to delete object using destructor.	**Unit - II Functions and Constructors** 2.1 Inline function, Static data members, Static member function, Friend function: Using two different classes , Using non-member function 2.2 Array of Objects, Object as function arguments 2.3 Concepts of Constructors, Types of constructors 2.4 Constructor overloading and Constructors with default arguments 2.5 Destructors	Lecture Using Chalk-Board, Demonstration, Presentations, Hands-on, Flipped Classroom.

OBJECT ORIENTED PROGRAMMING USING C++ **Course Code : 313304**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain the given type of inheritance based on its characteristics. TLO 3.2 Implement given type of inheritance in C++ program. TLO 3.3 Write C++ program using virtual base class. TLO 3.4 Use constructor in given derived class.	**Unit - III Extending classes using Inheritance** 3.1 Introduction to Inheritance, Defining a derived class, Visibility modes and effects 3.2 Types of Inheritance : Single, Multilevel, Multiple, Hierarchical, Hybrid 3.3 Virtual base class, Abstract class, Constructor in derived class	Lecture Using Chalk-Board, Demonstration, Presentations, Hands-on, Flipped Classroom.
4	TLO 4.1 Create C++ program to perform given arithmetic operations using pointers. TLO 4.2 Use 'pointer to object' to solve the given problem. TLO 4.3 Use compile time polymorphism to solve the given problem. TLO 4.4 Use run time polymorphism to solve the given problem.	**Unit - IV Pointers and Polymorphism in C++** 4.1 Concept of Pointer: Pointer declaration, Pointer operator, Address operator, Pointer arithmetic 4.2 Pointer to Object: Pointer to object, 'this' pointer, Pointer to derived class 4.3 Introduction of Polymorphism, Types of polymorphism 4.4 Compile time Polymorphism: Function overloading, Revision of constructor overloading, Operator overloading: Rules for operator overloading, Overloading of unary and binary operators 4.5 Run time polymorphism: Virtual function, Rules for virtual function, Pure virtual function	Lecture Using Chalk-Board, Presentations, Demonstration, Hands-on, Flipped Classroom.
5	TLO 5.1 Identify relevant class to perform the given file operations. TLO 5.2 Describe different file modes. TLO 5.3 Develop C++ program to perform read/write operations from/to the given file.	**Unit - V File operations** 5.1 C++ stream classes, Classes for file stream operations 5.2 Detection of end of file, File modes 5.3 Opening files: Using constructors and open(), Closing files, Reading from and writing to files, Formatted Input/output functions in file 5.4 Types of file: Random access, Sequential access	Lecture Using Chalk-Board, Presentations, Demonstration, Hands-on, Flipped Classroom.

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Develop program to evaluate expressions using various operators and Input/output functions.	1	*Write programs to evaluate any expression using Input / Output functions	2	CO1
LLO 2.1 Develop C++ program using special type of operators.	2	*Write programs using- • Scope resolution operator • Memory management operator • Manipulators	4	CO1
LLO 3.1 Develop programs to implement type casting.	3	Write programs to demonstrate use of- • Implicit type casting • Explicit type casting	2	CO1
LLO 4.1 Implement classes and objects to define the function inside class.	4	Write programs to show use of classes and objects to define the function inside the class	2	CO1
LLO 5.1 Implement classes and objects to define the function outside class.	5	*Write programs to define the function outside the class	2	CO1

OBJECT ORIENTED PROGRAMMING USING C++ **Course Code : 313304**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Implement programs using inline function.	6	*Write programs to implement inline function	2	CO2
LLO 7.1 Implement friend function using different classes. LLO 7.2 Implement friend function using external function.	7	*Write programs to implement friend function using- • Two different classes • External function	2	CO2
LLO 8.1 Develop program using static data member. LLO 8.2 Develop program using static member function.	8	*Write programs to implement- • Static data member • Static member function	2	CO2
LLO 9.1 Implement programs to show the use of array of objects.	9	*Write programs to create array of objects	2	CO2
LLO 10.1 Implement the concept of constructor and destructor.	10	*Write programs for- • Default constructor • Parameterized constructor • Copy constructor • Multiple constructor in one class	4	CO2
LLO 11.1 Implement Single level inheritance. LLO 11.2 Implement multilevel inheritance.	11	Write programs using- • Single level inheritance • Multilevel inheritance	2	CO3
LLO 12.1 Develop program using multiple inheritance.	12	*Write programs to implement multiple inheritance	2	CO3
LLO 13.1 Develop program using hierarchical inheritance.	13	Write programs to implement hierarchical inheritance	2	CO3
LLO 14.1 Implement virtual base class in a program.	14	*Write programs to implement virtual base class.	2	CO3
LLO 15.1 Implement constructors in derived class in a program.	15	Write programs which show the use of constructors in derived class	2	CO3
LLO 16.1 Implement pointer arithmetic in a program. LLO 16.2 Implement pointer to object in a program. LLO 16.3 Implement 'this' pointer in a program.	16	*Write programs to implement- • Pointer to object • 'this' pointer	2	CO4
LLO 17.1 Implement program to use pointer to derived class.	17	*Write programs for- • Pointer to derived class in single inheritance • Pointer to derived class in multilevel inheritance	4	CO4
LLO 18.1 Implement function overloading in a program.	18	Write programs which show the use of function overloading	2	CO4

OBJECT ORIENTED PROGRAMMING USING C++ **Course Code : 313304**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 19.1 Implement unary operator overloading using member function. LLO 19.2 Implement unary operator overloading using friend function.	19	*Write programs to overload unary operator using- • Member function • Friend function	4	CO4
LLO 20.1 Implement binary operator overloading using member function. LLO 20.2 Implement binary operator overloading using friend function.	20	Write programs to overload binary operator using- • Member function • Friend function	2	CO4
LLO 21.1 Develop program using virtual function.	21	*Write programs to implement virtual function	2	CO4
LLO 22.1 Develop program using pure virtual function.	22	Write programs to implement pure virtual function	2	CO4
LLO 23.1 Implement read and write operations from/to file using constructor. LLO 23.2 Implement read and write operations from/to file using open().	23	*Write programs to read and write from/to file using- • Constructor • open()	2	CO5
LLO 24.1 Use formatted Input / Output functions to format the contents.	24	*Write programs to copy the content of one file into another file using formatted input/output functions	2	CO5
LLO 25.1 Implement get() and put() functions on file.	25	Write file programs to implement sequential input and output operations on file	2	CO5
LLO 26.1 Implement input/ output operations on binary file.	26	Write programs to perform input / output operations on binary files	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Develop Student Grading System. Accept student data and marks for 5 subjects for 5 students. Calculate the percentage and finalize grade awarded to the student. Write the records in to file.
- Develop Quiz Management System. Quiz should accept student credentials and contain 10 MCQ type questions. Determine the final result. Save the result in file along with student credentials.
- Develop advanced calculator for the following function: Binary to Decimal, Decimal to Binary etc..
- Develop Hotel Management Application. It should accept room reservation for 10 rooms. Find number of empty rooms. Display relevant information and write maximum 5 records into file.
- Develop Employee Management System using Inheritance. Collect following information from user: Employee_ID ,Employee_Name, Basic_Salary, Leave taken in the month Calculate Net Salary assuming applicable deductions and display. Write maximum 5 records into file.
- Any other micro project as suggested by subject faculty.

Assignment

- Solve assignment covering all COs given by teacher

Other

- Complete the course object oriented concepts using C++ on Infosys Springboard

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer System (Any computer system with basic configuration)	All
2	“C++” Compiler (Any)	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Principles of Object Oriented Programming	CO1	8	2	4	6	12
2	II	Functions and Constructors	CO2	12	2	4	10	16
3	III	Extending classes using Inheritance	CO3	9	2	4	10	16
4	IV	Pointers and Polymorphism in C++	CO4	10	2	4	10	16
5	V	File operations	CO5	6	0	4	6	10
Grand Total				**45**	**8**	**20**	**42**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators
- Each practical will be assessed considering 60% weightage to process and 40% weightage to product
- A continuous assessment-based term work

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

OBJECT ORIENTED PROGRAMMING USING C++ **Course Code : 313304**

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

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	E Balaguruswamy	Object Oriented Programming with C++	McGraw-Hill Education ISBN-10:0070669074, ISBN-13:9780070669079
2	D Ravichandran	Programming with C++	McGraw-Hill Education ISBN-10: 0070681899, ISBN-13: 978-0070681897
3	Stroustrup B.	The C++ Programming Language	Pearson Education New Delhi ISBN-10: 0275967301, ISBN-13: 978-0275967307
4	Robert Lafore	Object Oriented Programming in C++	Pearson Education India ISBN-10: 8131722821, ISBN-13: 978-8131722824

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.w3schools.com/cpp/	C++ Tutorial for all topics
2	https://www.javatpoint.com/cpp-tutorial	C++ Tutorial for all topics
3	https://www.javatpoint.com/cpp-files-and-streams	C++ File Streams
4	https://www.programiz.com/cpp-programming	Inheritance in C++
5	https://www.programiz.com/cpp-programming/online-compiler/	Online Compiler for C++
6	https://www.onlinegdb.com/online_c++_compiler	Online compiler for C++

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

ANALOG ELECTRONICS **Course Code : 313324**

Programme Name/s	**: Digital Electronics/ Electronics & Tele-communication Engg./ Electronics & Communication Engg./ Electronics Engineering/ Instrumentation & Control/ Industrial Electronics/ Instrumentation/ Medical Electronics/ Electronics & Computer Engg.**
Programme Code	**: DE/ EJ/ ET/ EX/ IC/ IE/ IS/ MU/ TE**
Semester	**: Third**
Course Title	**: ANALOG ELECTRONICS**
Course Code	**: 313324**

I. RATIONALE

Analog electronic circuits are the basic building blocks of many complex electronic system. Therefore it is necessary for students to understand the working principle and testing of basic analog circuits consist of discrete components and integrated circuits. After learning this course students will be able to apply the concept of working of basic electronic circuit and Op-Amp circuits to maintain the electronic system.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attain the following industry/ employer expected outcome through various teaching learning experiences:
Maintain analog electronic circuits.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Use transistor as a Power Amplifier.
- CO2 - Construct various configurations of Op-Amp for different applications.
- CO3 - Maintain different waveform generator circuits.
- CO4 - Analyze active filters used in various electronic circuits.
- CO5 - Use specific analog IC to develop various applications.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313324	ANALOG ELECTRONICS	ATE	DSC	3	-	4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175

ANALOG ELECTRONICS **Course Code : 313324**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the performance of the given power amplifier parameters. TLO 1.2 Explain with sketches the working of given type of power amplifier. TLO 1.3 Compare the given type of power amplifiers on the basis of performance parameter. TLO 1.4 Select relevant type of power amplifier for the given applications.	**Unit - I Power Amplifiers** 1.1 Power Amplifier: Concept, Performance parameters like: Gain, Bandwidth, frequency band, efficiency and distortion 1.2 Classification: Class A, Class B, Class AB and Class C power amplifier and their applications 1.3 Circuit diagram, working, input output waveforms and efficiency of single stage Class A, Class B, Class AB and Class C power amplifier, Push Pull amplifier, Complementary symmetry push–pull amplifier. Transformer less push-pull amplifier. Distortions in Power amplifier 1.4 Generalised features of audio power amplifier IC's, Heat Sink	Lecture Using Chalk-Board Video Demonstrations Assignments
2	TLO 2.1 Describe with sketches the function of the given block(s) of Op-Amp. TLO 2.2 List ideal characteristics of Op-Amp. TLO 2.3 Define the given parameters of Op-Amp. TLO 2.4 Interpret the output waveform of given mode of operation of Op-Amp. TLO 2.5 Calculate the output voltage of given arithmetic circuit consist of Op-Amp. TLO 2.6 Describe the working of the given application circuit consist of Op-Amp.	**Unit - II Op-Amp and its applications** 2.1 Op-Amp: block diagram, symbol, characteristics, open loop and closed loop amplifier, virtual ground concept, IC-741 and it's pin configuration 2.2 Op-Amp parameters: input offset voltage, output offset voltage, input offset current, input bias current, Common Mode Rejection Ratio, Power supply rejection ratio ,slew rate, input and output Impedance, bandwidth and gain bandwidth product, Drift parameters 2.3 Closed loop configurations: inverting and non-inverting 2.4 Basic mathematical applications such as adder, subtractor, integrator and differentiator 2.5 Sample and Hold circuit, I-V converter, V-I converter 2.6 Comparator: Zero Crossing Detector (Inverting and Non Inverting type), Schmitt Trigger, Window Detector and Peak Detector	Lecture Using Chalk-Board Video Demonstrations Assignments

ANALOG ELECTRONICS **Course Code : 313324**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain the principle of positive and negative feedback for amplifier circuit. TLO 3.2 State Barkhausen's criteria for oscillation. TLO 3.3 Describe the working principle of given type of oscillator. TLO 3.4 Calculate the frequency of oscillation for given oscillator. TLO 3.5 Select the circuit components of the given type of oscillator for given operating frequency.	**Unit - III Waveform Generators** 3.1 Principle of feedback amplifier. Types of feedback: Negative and Positive feedback, advantages and disadvantages of negative feedback, Types of feedback connections (Block Diagrams and features only) 3.2 Oscillator: need of oscillator, compare oscillator and amplifier 3.3 Condition for oscillations: Barkhausen's criteria, classification of oscillator 3.4 Oscillators Circuits : Phase shift oscillator using IC 741 , Hartley oscillator using IC 741 and crystal oscillator using BJT & FET	Lecture Using Chalk-Board Video Demonstrations Assignments Blended Classroom
4	TLO 4.1 Describe with circuit diagram working of the given type of filter. TLO 4.2 Identify the type of filter based on given frequency response. TLO 4.3 Calculate the cut off frequency of given type of filter. TLO 4.4 Develop given type and order of active filter for the given cut off frequency.	**Unit - IV Active Filters** 4.1 Definition, type of filters and difference between active and passive filter 4.2 Merits and demerits of active filter over passive filter 4.3 Terms related to filters: Order of filter, cut off frequency, Pass band, Stop band, Center frequency, Roll off rate, Bandwidth and Q factor 4.4 Order and frequency response: First and second order of low pass and high pass filter	Lecture Using Chalk-Board Assignments Video Demonstrations Blended Learning Tools
5	TLO 5.1 Develop a circuit for the given application using IC-555. TLO 5.2 Calculate the duty cycle of the given type of multivibrator. TLO 5.3 Describe the working of given block of PLL. TLO 5.4 Develop a circuit for the given application using IC-565.	**Unit - V Specialized IC Applications** 5.1 Timer IC: IC 555 block diagram, pin diagram and functions, Astable and Monostable multivibrators, Voltage Controlled Oscillator 5.2 Phase Lock Loop (PLL) : IC 565 pin diagram, block diagram and it's working, Lock range and Capture range 5.3 Applications of PLL: PLL as a frequency multiplier, FM Demodulator	Lecture Using Chalk-Board Assignments Video Demonstrations Blended Learning Tools

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Interpret the operation of single stage Class A power amplifier.	1	* Test the performance of single stage Class A power amplifier.	2	CO1
LLO 2.1 Interpret the operation of Class B push pull power amplifier.	2	* Test the performance of Class B push pull power amplifier.	2	CO1
LLO 3.1 Interpret the operation of Class AB power amplifier.	3	Test the performance of Class AB power amplifier.	2	CO1
LLO 4.1 Measure output voltage swing of Op-Amp (IC 741).	4	* Determine the range of output voltage swing of Op-Amp (IC 741).	2	CO2

ANALOG ELECTRONICS **Course Code : 313324**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 5.1 Measure input offset voltage and output offset voltage of IC 741.	5	* Build the circuit to measure input offset voltage and output offset voltage of IC 741.	2	CO2
LLO 6.1 Connect IC 741 in inverting and non-inverting mode. LLO 6.2 Measure the voltage gain of inverting and non-inverting amplifier circuit using IC 741.	6	* Determine the gain of inverting and non-inverting amplifier using IC 741.	2	CO2
LLO 7.1 Select the proper range of multimeter to measure the voltage. LLO 7.2 Measure output voltage of adder circuit consist of IC 741.	7	* Build /Test adder circuit consist of IC 741.	2	CO2
LLO 8.1 Select the proper range of multimeter to measure the voltage. LLO 8.2 Measure output voltage of subtractor circuit consist of IC 741.	8	Build /Test subtractor circuit consist of IC 741.	2	CO2
LLO 9.1 Use function generator. LLO 9.2 Interpret input and output waveforms of Integrator circuit consist of IC 741.	9	* Build /Test Integrator circuit consist of IC 741.	2	CO2
LLO 10.1 Use function generator. LLO 10.2 Interpret input and output waveforms of Differentiator circuit consist of IC 741.	10	* Build /Test Differentiator circuit consist of IC 741.	2	CO2
LLO 11.1 Measure output current of V to I converter circuit using IC 741.	11	* Build/ Test V to I converter circuit using IC 741.	2	CO2
LLO 12.1 Interpret output voltage waveform of zero crossing detector.	12	* Build the circuit of zero crossing detector and test the output.	2	CO2
LLO 13.1 Check the performance of feedback on the output voltage of amplifier.	13	Use transistor to build/test voltage series feedback amplifier with feedback.	2	CO3
LLO 14.1 Check the performance of feedback on the output voltage of amplifier.	14	Use transistor to build/test voltage shunt feedback amplifier with feedback.	2	CO3
LLO 15.1 Check the performance of amplifier for positive and negative feedback.	15	* Test the effect of positive and negative feedback on the output voltage of given amplifier.	2	CO3
LLO 16.1 Measure the output frequency of RC phase shift oscillator based on IC 741.	16	* Test the circuit to measure the frequency of oscillation of the given RC phase shift oscillator consist of IC 741.	2	CO3
LLO 17.1 Measure the output frequency of Crystal Oscillator	17	Test the circuit of transistorised Crystal Oscillator	2	CO3
LLO 18.1 Measure the output frequency of Hartley Oscillator consist of IC 741.	18	Test the Hartley Oscillator based on IC 741.	2	CO3
LLO 19.1 Observe the output waveform of Hartley Oscillator.	19	Simulate the working of Hartley Oscillator using multisim or relevant software.	2	CO3
LLO 20.1 Measure bandwidth and cut off frequency of low pass filter. LLO 20.2 Plot the frequency response of low pass filter.	20	* Build and test the circuit of first order low pass filter.	2	CO4
LLO 21.1 Measure bandwidth and cut off frequency of high pass filter. LLO 21.2 Plot the frequency response of high pass filter.	21	* Build and test the circuit of first order high pass filter.	2	CO4

ANALOG ELECTRONICS **Course Code : 313324**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 22.1 Observe the output waveform of high pass filter.	22	Simulate the working of high pass filter consist of IC 741 using multisim or relevant software.	2	CO4
LLO 23.1 Select the proper value of R and C for generating waveform of specific duty cycle.	23	* Build / test astable multivibrator using IC 555 for the specific duty cycle.	2	CO5
LLO 24.1 Measure the time period of monostable multivibrator using IC 555.	24	Build / test monostable multivibrator using IC 555 for the specific duty cycle.	2	CO5
LLO 25.1 Observe the output waveform of monostable multivibrator.	25	Simulate the working of monostable multivibrator using IC 555 using multisim or relevant software.	2	CO5
LLO 26.1 Check the performance of Voltage Controlled Oscillator using IC 555.	26	* Build/ Test Voltage Controlled Oscillator using IC 555.	2	CO5
LLO 27.1 Measure the output frequency of multiplier circuit consist of IC565.	27	Build/ test the circuit of frequency multiplier using PLL IC 565.	2	CO5
LLO 28.1 Interpret input and output waveform of FM demodulator circuit contains PLL (IC 565).	28	Check the performance of PLL as FM demodulator (IC 565).	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- 1) Construct audio amplifier using IC LM386N or equivalent IC.
- 2) Develop clap switch using IC 741.
- 3) Build automatic light operated switch using LDR and IC 741.
- 4) Build automatic evening lamp using IC 555 or equivalent IC.
- 5) Construct square wave generator using IC 741 or equivalent.
- 6) Develop low pass filter/high pass filter with cut off frequency of 2KHz using universal IC UAF42 or equivalent IC.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number

ANALOG ELECTRONICS **Course Code : 313324**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Cathode Ray Oscilloscope Dual Trace 20Mhz/30Mhz, 1Mega ohm Input Impedance.	1,2,3,9,10,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26
2	Digital Storage Oscilloscope 20MHz and above, 1Mega ohm Input Impedance.	1,2,3,9,10,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26
3	Function Generator 0-2 MHz with sine, square and triangular output with variable amplitude and frequency.	1,2,3,9,10,12,13,14,15,19,20,21,22,23,24,25,26
4	Simulation software like: TINA-TI/Multisim etc. or any other open-source simulation software can be used.	19,22,25
5	Dual Tracking Power Supply 0-30V,2 A, short circuit and over voltage protection.	3,4,5,6,7,8,9,10,11,16,17,18,19,20,21
6	Analog IC tester with tests Op-amp,555, IC testing 741 , 555 ,556 ,565 it has Auto search facility of IC's Test by: Truth table/sequence table comparison ZIF: 40 pin DIP ZIF sockets.	4,5,6,7,8,9,10,11,12,16,17,18,19,20,21,22,23,24,25,26
7	Variable DC power supply 0-30V, 2A with short circuit and over voltage protection.	All
8	Digital Multimeter: Minimum 3 ½ digit 4 ½ digit display,9999 counts digital multimeter measures Vac, Vdc(1000V max) , Adc, Aac (10 amp max), Resistance(0-100 M ohm), diode and transistor testing mode.	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Power Amplifiers	CO1	8	4	4	4	12
2	II	Op-Amp and its applications	CO2	11	4	6	8	18
3	III	Waveform Generators	CO3	8	4	4	6	14
4	IV	Active Filters	CO4	8	4	4	6	14
5	V	Specialized IC Applications	CO5	10	4	4	4	12
Grand Total				**45**	**20**	**22**	**28**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two offline unit tests of 30 marks and average of two unit test marks will be consider for out of 30 marks.
- For formative assessment of laboratory learning 25 marks.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.

Summative Assessment (Assessment of Learning)

- End semester assessment is of 70 marks.
- End semester summative assessment is of 25 marks for laboratory learning.

XI. SUGGESTED COS - POS MATRIX FORM

ANALOG ELECTRONICS **Course Code : 313324**

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

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Sedha R.S.	Applied Electronics	S.Chand, New Delhi,2015 ISBN:9788121927833
2	Gayakwad Ramakant A.	Op-Amps and Linear Integrated Circuits	PHI Learning, New Delhi 2011, ISBN:9788120320581
3	Salivahanan S., Bhaaskaran Kanchana V. S.	Linear Integrated Circuits	Tata McGraw-Hill Education,New Delhi, 2018, ISBN: 9789353160487
4	Chaudhary D. Roy	Linear Integrated Circuits	New Age International Publishers ISBN: 9788122420906
5	S. Salivahanan, N. Suresh Kumar	Electronic Devices and Circuits	McGraw Hill Education, Edition-Fourth, ISBN-9789339219505

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=mgoCeOCjiBI	Basic of Op-Amp.
2	https://youtu.be/dKTbrZMscpM?si=6lQ3xdhGvLDZL-VL	Class A Power Amplifier
3	https://www.youtube.com/watch?v=BfjdB09V1NQ&list=PLuv3GM6-gs E3npYPJJDnEF3pdiHZT6Kj3&index=22	Op-Amp as Integrator
4	https://www.youtube.com/watch?v=M3yI0byaqKc&list=PLuv3GM6-gs E3npYPJJDnEF3pdiHZT6Kj3&index=27	Introduction to Oscillator.
5	https://www.youtube.com/watch?v=aeQoEnH74C8&list=PLuv3GM6-gs E3npYPJJDnEF3pdiHZT6Kj3&index=31	Working of Crystal Oscillator.
6	https://www.elprocus.com/op-amp-applications-in-electronics/	Applications of Op-Amp.
7	https://testbook.com/electrical-engineering/power-amplifier-definition-types-and-uses	Power Amplifiers
8	http://vlabs.iitkgp.ac.in/be/exp17/inverting_opamp.html	Virtual Lab for Inverting Amplifier
9	https://ae-iitr.vlabs.ac.in/exp/astable-monostable-multivibrator/simulation/astable/exp.html?	Virtual Lab for Multivibrators using Op-Amp.

ANALOG ELECTRONICS **Course Code : 313324**

Sr.No	Link / Portal	Description

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 02/07/2024 **Semester - 3, K Scheme**