APPLIED MATHEMATICS	**Course Code : 312301**

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 Software Technology/ Computer Science & Engineering/** **Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./** **Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/** **Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Information Technology/** **Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/** **Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Manufacturing Technology/** **Medical Electronics/ Production Engineering/ Computer Science/ Electronics & Computer Engg./**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CST/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ MR/ MU/ PG/ SE/ TE**
Semester	**: Second**
Course Title	**: APPLIED MATHEMATICS**
Course Code	**: 312301**

I. RATIONALE

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

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

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

III.   COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Solve the broad-based engineering problems of integration using suitable methods.
- CO2 - Use definite integration to solve given engineering related problems.
- CO3 - Apply the concept of differential equation to find the solutions of given engineering problems.
- CO4 - Employ numerical methods to solve programme specific problems.
- CO5 - Use probability distributions to solve elementary engineering problems.

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	

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312301	APPLIED MATHEMATICS	AMS	AEC	3	1	-	-	4	2	3	30	70	100	40	-	-	-	-	-	-	100

Total IKS Hrs for Sem. : 2 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 Solve the given simple problem(s) based on rules of integration. TLO 1.2 Evaluate the given simple integral(s) using substitution method. TLO 1.3 Integrate given simple functions using the integration by parts. TLO 1.4 Solve the given simple integral by partial fractions.	**Unit - I Indefinite Integration** 1.1 Simple Integration: Rules of integration and integration of standard functions 1.2 Integration by substitution. 1.3 Integration by parts. 1.4 Integration by partial fractions (only linear non repeated factors at denominator of proper fraction).	Improved Lecture Demonstration Chalk-Board Presentations Video Demonstrations
2	TLO 2.1 Solve given examples based on Definite Integration. TLO 2.2 Use properties of definite integration to solve given problems.	**Unit - II Definite Integration** 2.1 Definite Integration: Definition, rules of definite integration with simple examples. 2.2 Properties of definite integral (without proof) and simple examples.	Video Simulation Chalk-Board Improved Lecture Presentations
3	TLO 3.1 Find the order and degree of given differential equations. TLO 3.2 Form simple differential equation for given elementary engineering problems. TLO 3.3 Solve given differential equations using the methods of Variable separable and Exact Differential Equation(Introduce the concept of partial differential equation). TLO 3.4 Solve given Linear Differential Equation.	**Unit - III Differential Equation** 3.1 Concept of Differential Equation. 3.2 Order, degree and formation of Differential equations 3.3 Methods of solving differential equations: Variable separable form, Exact Differential Equation, Linear Differential Equation.	Video Demonstrations Presentations Chalk-Board Improved Lecture Flipped Classroom

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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 Find roots of algebraic equations by using appropriate methods. TLO 4.2 Solve the system of equations in three unknowns by iterative methods. TLO 4.3 Solve problems using Bakhshali iterative method for finding approximate square root. (IKS)	**Unit - IV Numerical Methods** 4.1 Solution of algebraic equations: Bisection method, Regula falsi method and Newton –Raphson method. 4.2 Solution of simultaneous equations containing three Unknowns by iterative methods: Gauss Seidal and Jacobi's method. 4.3 Bakhshali iterative method for finding approximate square root. (IKS)	Video SCILAB Spreadsheet Chalk-Board Flipped Classroom Presentations
5	TLO 5.1 Solve given problems based on repeated trials using Binomial distribution. TLO 5.2 Solve given problems when number of trials are large and probability is very small. TLO 5.3 Utilize the concept of normal distribution to solve related engineering problems.	**Unit - V Probability Distribution** 5.1 Binomial distribution. 5.2 Poisson's distribution. 5.3 Normal distribution.	Video ORANGE Chalk-Board Improved Lecture Presentations

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 Solve simple problems of Integration by substitution	1	*Integration by substitution	1	CO1
LLO 2.1 Solve integration using by parts	2	*Integration by parts	1	CO1
LLO 3.1 Solve integration by partial fractions(only linear non repeated factors at denominator of proper fraction).	3	Integration by partial fractions.	1	CO1
LLO 4.1 Solve examples on Definite Integral based on given methods.	4	Definite Integral based on given methods.	1	CO2
LLO 5.1 Solve problems on properties of definite integral.	5	*Properties of definite integral	1	CO2
LLO 6.1 Solve given problems for finding the area under the curve and volume of revolution.	6	* #Area under the curve and volume of revolution.(Only for Civil and Mechanical Engineering Group)	1	CO2
LLO 7.1 Solve examples on mean value and root mean square value.	7	* #Mean value and root mean square value. (Only for Computer, Electrical and Electronics Engineering Group)	1	CO2
LLO 8.1 Solve examples on order, degree and formation of differential equation.	8	Order, degree and formation of differential equation.	1	CO3
LLO 9.1 Solve first order first degree differential equation using variable separable method.	9	Variable separable method.	1	CO3
LLO 10.1 Solve first order first degree differential equation using exact differential equation and linear differential equation.	10	*Exact differential equation and linear differential equation.	1	CO3

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 11.1 Solve engineering application problems using differential equation.	11	*Applications of differential equations.(Take programme specific problems)	1	CO3
LLO 12.1 Solve problems on Bisection method and Regula falsi method.	12	*Bisection method and Regula falsi method.	1	CO4
LLO 13.1 Solve problems on Newton-Raphson method.	13	Newton- Raphson method.	1	CO4
LLO 14.1 Solve problems on Jacobi's method and Gauss Seidal Method.	14	Jacobi's method and Gauss Seidal Method.	1	CO4
LLO 15.1 Use Bakhshali iterative methods for finding approximate value of square root. (IKS)	15	*Bakhshali iterative methods for finding approximate value of square root. (IKS)	1	CO4
LLO 16.1 Solve engineering problems using Binomial distribution.	16	*Binomial Distribution	1	CO5
LLO 17.1 Solve engineering problems using Poisson distribution.	17	*Poisson Distribution	1	CO5
LLO 18.1 Solve engineering problems using Normal distribution.	18	Normal Distribution	1	CO5
LLO 19.1 Solve problems on Laplace transform and properties of Laplace transform.	19	* # Laplace transform and properties of Laplace transform.(Only for Electrical and Electronics Engineering Group)	1	CO2
LLO 20.1 Solve problems on Inverse Laplace transform and properties of Inverse Laplace transform.	20	* # Inverse Laplace transform and properties of Inverse Laplace transform.(Only for Electrical and Electronics Engineering Group)	1	CO2

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

- NA

Assignment

- NA

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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.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- 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	Open-source software like wolfram alpha, SageMaths, MATHS3D, GeoGebra, Graph, DPLOT, and Graphing Calculator (Graph Eq2.13), ORANGE can be used for Algebra, Calculus, Trigonometry and Statistics respectively.	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	Indefinite Integration	CO1	15	2	6	12	20
2	II	Definite Integration	CO2	8	2	4	6	12
3	III	Differential Equation	CO3	8	2	4	6	12
4	IV	Numerical Methods	CO4	6	2	4	8	14
5	V	Probability Distribution	CO5	8	2	4	6	12
		Grand Total		**45**	**10**	**22**	**38**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Tests

Summative Assessment (Assessment of Learning)

- End Term Exam

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	3	1	-	-	1	-	1			

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

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Grewal B. S.	Higher Engineering Mathematics	Khanna publication New Delhi, 2013 ISBN: 8174091955
2	Dutta. D	A text book of Engineering Mathematics	New age publication New Delhi, 2006 ISBN: 978- 81-224-1689-3
3	Kreysizg, Ervin	Advance Engineering Mathematics	Wiley publication New Delhi 2016 ISBN: 978-81- 265-5423-2
4	Das H.K.	Advance Engineering Mathematics	S Chand publication New Delhi 2008 ISBN: 9788121903455
5	S. S. Sastry	Introductory Methods of Numerical Analysis	PHI Learning Private Limited, New Delhi. ISBN-978-81-203-4592-8
6	C. S. Seshadri	Studies in the History of Indian Mathematics	Hindustan Book Agency (lndia) P 19 Green Park Extension New Delhi. ISBN 978-93-80250-06-9
7	Marvin L. Bittinger David J.Ellenbogen Scott A. Surgent	Calculus and Its Applications	Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1
8	Gareth James, Daniela Witten,Trevor Hastie Robert andTibshirani	An Introduction to StatisticalLearning with Applications in R	Springer New York Heidelberg Dordrecht LondonISBN 978-1-4614-7137-0 ISBN 978-1-4614-7138-7 (eBook)

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://nptel.ac.in/courses/106102064/1	Online Learning Initiatives by IITs and IISc
2	https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig	Concept of Mathematics through video lectures and notes
3	https://www.wolframalpha.com/	Solving mathematical problems, performing calculations, and visualizing mathematical concepts.
4	http://www.sosmath.com/	Free resources and tutorials
5	http://mathworld.wolfram.com/	Extensive math encyclopedia with detailed explanations of mathematical concepts
6	https://www.mathsisfun.com/	Explanations and interactive lessons covering various math topics, from basic arithmetic to advanced
7	http://tutorial.math.lamar.edu/	Comprehensive set of notes and tutorials covering a wide range of mathematics topics.
8	https://www.purplemath.com/	Purplemath is a great resource for students seeking help with algebra and other foundational mathematics to improve learning.
9	https://www.brilliant.org/	Interactive learning in Mathematics
10	https://www.edx.org/	Offers a variety of courses
11	https://www.coursera.org/	Coursera offers online courses in applied mathematics from universities and institutions around the globe.

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Sr.No	Link / Portal	Description
12	https://ocw.mit.edu/index.htm	The Massachusetts Institute of Technology (MIT) offers free access to course materials for a wide range of mathematical courses.

Note :

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

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BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	**Course Code : 312302**

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Software Technology/ Computer Science & Engineering/ Data Sciences/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Computer Science/**
Programme Code	**: AI/ AN/ BD/ CM/ CO/ CST/ CW/ DS/ HA/ IF/ IH/ SE**
Semester	**: Second**
Course Title	**: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**
Course Code	**: 312302**

I. RATIONALE

Diploma engineers have to deal with electrical and electronic systems. Modern engineering systems, irrespective of the field, are increasingly incorporating smart technologies that rely on electrical and electronic components. A well-rounded education in electrical and electronics principles enables engineers to work seamlessly across disciplines. Electrical and Electronics Engineering forms the foundation for understanding the hardware components of computer systems. This knowledge is crucial for students in computer science as it helps them comprehend how computers process and store information at the hardware level. This course is designed with basic information to help students apply basic concepts, rules, and safety rules of electrical engineering and electronic engineering and perform practicals thereof.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

This course is to be taught and implemented with the aim to develop in the student, the course outcomes (COs) leading to the attainment of following industry identified outcomes expected from this course: Apply basic concept of electrical and electronics engineering in various applications in relevent technical fields.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Calculate and measure basic electrical quantities and parameters.
- CO2 - Use different electrical machines by making connections.
- CO3 - Use electrical safety devices in electrical circuit
- CO4 - Use relevant diode in different electronic circuits.
- CO5 - Use BJT and FET in various electronic circuits.
- CO6 - Use various types of sensors and transducers.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL			
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA			
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min		
312302	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	BEE	AEC	4	-	4	2	10	5	1.5	30	70*#	100	40	50	20	50@	20	50	20		250

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING   **Course Code : 312302**

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 Apply Faraday's law of electomagnetic induction and Fleming's right hand rule, Lenz's law for induced emf to find its magnitude and direction. TLO 1.2 Differentiate alertnating current (AC) and direct current (DC) TLO 1.3 Explain parameters of single phase AC sinusoidal waveform. TLO 1.4 Describe the silent features of three phase AC supply system. TLO 1.5 Explain star and delta connection in three phase AC system. TLO 1.6 Calculate the phase and line current and voltage in star and delta connections.	**Unit - I Basic Electrical Fundamentals** 1.1 Electric and magnetic circuits. 1.2 Series and parallel magnetic circuits. 1.3 Faraday's laws of electromagnetic induction, Fleming's right hand rule,Lenz's law 1.4 Dynamically and statically induced emf, self and mutual inductance 1.5 AC and DC quantity, advantages of AC over DC supply. 1.6 Single phase AC, sinusoidal AC wave: instantaneous value, cycle, amplitude, time period, frequency, angular frequency, RMS value, Average value for sinusoidal waveform, form factor, peak factor. 1.7 Three phase supply system over single phase supply system, Phase sequence and balanced and unbalanced load 1.8 Star and delta connections, Phase and line current, phase and line voltage in star connected and delta connected balanced system.	Chalk-Board Presentations Demonstration

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING   **Course Code : 312302**

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 Explain the working principle of the given type of transformer. TLO 2.2 Distinguish the construction of the given type of transformer. TLO 2.3 Describe the construction and working of the given type of DC motor. TLO 2.4 Select relevant type of DC motor for the given application with justification TLO 2.5 Explain working principle and operation of Universal motor. TLO 2.6 Describe the procedure to connect stepper motor for the given application with sketches.	**Unit - II Electrical Machines.** 2.1 Transformer: Working principle, emf equation, Voltage ratio, current ratio and transformation ratio, losses. 2.2 DC motor construction - parts its function and material used. 2.3 DC motor -Principle of operation. 2.4 Types of DC motors, schematic diagram, applications of dc shunt, series and compound motors. 2.5 Universal motor: principle of operation, reversal of rotation and applications. 2.6 Stepper motor: types, principle of working and applications.	Chalk-Board Presentations Demonstration
3	TLO 3.1 Describe the characteristics and features of the given type of protective device. TLO 3.2 Select the relevant protective device for the given application with justification TLO 3.3 Select suitable switchgear for the given situation with justification. TLO 3.4 state the I.E. rule related to be applied for the given type of earthing with justifications.	**Unit - III Electrical Safety and Protective Devices.** 3.1 Low rating Fuse: Operation, types 3.2 Switch Fuse Unit and Fuse Switch Unit: Differences, use of multimeter for electrical quantities/ parameters measurements. 3.3 MCB and ELCB/RCB: Operation and general specifications 3.4 Earthing: Types, Importance of earthing, factors affecting eatthing resistance. 3.5 Measures for reducing earth resistance, I.E rules relevant to earthing.	Chalk-Board Demonstration Presentations
4	TLO 4.1 Measure Zener voltage on given V-I characteristics of the Zener diode. TLO 4.2 Explain the working principle of LED. TLO 4.3 Describe the working principle of given type of filter. TLO 4.4 Explain the working principle of regulated power supply and UPS.	**Unit - IV Special purpose diodes and their applications.** 4.1 Zener diode: working, symbol, applications. 4.2 LED: working, symbol, applications. 4.3 Filters: Need for filters, circuit diagram and working of L, C and CLC filter. 4.4 Working principle and block diagram of regulated power supply. 4.5 UPS: Block diagram of Online and Offline UPS.	Chalk-Board Demonstration Assignment
5	TLO 5.1 Describe with sketches the construction and working of the given type of transistors. TLO 5.2 Compare the performance of the given transistor configurations TLO 5.3 Explain applications of transistor as a switch and amplifier. TLO 5.4 Explain with sketches the construction and working of the given type of FET.	**Unit - V Transistors** 5.1 BJT: Types, symbol, construction and working principle of NPN transistor. 5.2 Transistor configurations: CB, CE, CC 5.3 Characteristics of transistor in CE configuration. 5.4 Transistor parameters: alpha, beta and derive relation between them. 5.5 Applications-Transistor as a switch and as an amplifier. 5.6 FET: Types, symbol, construction and working principle of n channel JFET. 5.7 Characteristics of JFET: Drain and Transfer characteristics.	Chalk-Board Demonstration Assignments

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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.
6	TLO 6.1 Select relevant transducer for given application. TLO 6.2 Differentiate the features of transducers and sensors for given quantity measurement. TLO 6.3 Explain with sketches the working principle of given type of thermal, optical sensors.	**Unit - VI Sensors and Transducers** 6.1 Sensors and Transducers: Basic definition, difference, classification. 6.2 Thermal, Optical, Electric sensors 6.3 Transducers: Need of transducer, types of transducers: Primary, Secondary, Active, Passive, Analog, Digital 6.4 Selection criteria of transducer	Chalk-Board Demonstration Assignments

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 Use electrical meters for measurement of electrical parameters. LLO 1.2 Identify presence of magnetic flux lines.	1	*Measure the parameters of simple electrical and identify presence of flux lines in magnetic circuit.(e.g. current, voltage, power, flux)	2	CO1
LLO 2.1 Interpret the AC waveform for resistive and inductive circuit displayed on CRO.	2	*Measure frequency, time period, rms value, peak value of sinusoidal AC waveform for resistive and inductive circuit using CRO.	2	CO1
LLO 3.1 Measure the phase difference between voltage and current in the AC circuit of the inductive circuit.	3	Phase difference of voltage and current in inductive circuit.	2	CO1
LLO 4.1 Measure the line voltage, phase voltage a, phase current, and line current in three phase star connected balanced load. LLO 4.2 Determine phase voltage and line current relation in star connected load.	4	*Measure the line voltage, phase voltage and phase current and line current in three phase star connected balanced load.	2	CO1
LLO 5.1 Find the phase voltage and line current relation in delta connected load.	5	Measure the line voltage, phase voltage and phase current and line current in three phase delta connected balanced load.	2	CO1
LLO 6.1 Determine the transformation ratio.	6	*Determination of the voltage and current ratio of single phase transformer.	2	CO2
LLO 7.1 DC shunt motor operation.	7	*Operate DC shunt motor by connecting three point starter.	2	CO2
LLO 8.1 DC series motor operation	8	Operate DC series motor by connecting three point starter	2	CO2
LLO 9.1 Speed reversal of universal motor.	9	*Reverse the direction of rotation of universal motor.	2	CO2
LLO 10.1 Demonstrate stepper motor operation.	10	Demonstrate the operation of stepper motor for various speed rotation.	2	CO2
LLO 11.1 Use of multimeter for measurement.	11	*Use multimeter for measurement of voltage, current (AC,DC), resistance and continuity of the given electrical circuit.	2	CO3
LLO 12.1 Connection of fuses in electrical circuit.	12	Connect fuse in electrical circuit and check its operation at normal and abnormal conditions.	2	CO3
LLO 13.1 Connection of MCB in electrical circuit	13	*Connect MCB in electrical circuit and check its operation at normal and abnormal conditions.	2	CO3

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BASIC ELECTRICAL AND ELECTRONICS ENGINEERING			Course Code : 312302	
Practical / Tutorial / Laboratory Learning Outcome (LLO)	**Sr No**	**Laboratory Experiment / Practical Titles / Tutorial Titles**	**Number of hrs.**	**Relevant COs**
LLO 14.1 Connection of ELCB in electrical circuit.	14	Connect ELCB in electrical circuit and check its operation at normal and abnormal conditions.	2	CO3
LLO 15.1 Measurement of earth resistance.	15	Use of earth tester for meaurement of earthing resistance of a installed earthing of laboratory.	2	CO3
LLO 16.1 Check the forward and reverse bias V-I characteristics of Zener diode.	16	*Connect the Zener diode in the circuit and test its operation in forward and reverse bias mode.	2	CO4
LLO 17.1 Find the voltage regulation of Zener diode.	17	*Determine the voltage regulation by using Zener diode under variable input and output conditions.	2	CO4
LLO 18.1 Filter the ripples by using L, C and pi filter.	18	Check the output waveform of L, C and π filters on CRO of rectifier circuit.	2	CO4
LLO 19.1 Check the operation of UPS under online and offline mode.	19	*Make the input and output connections of UPS and measure the output voltage under online and offline mode.	2	CO4
LLO 20.1 Check the abnormal and normal operation of UPS.	20	*Make the input, output connections and check the operation of UPS under normal and overload condition.	2	CO4
LLO 21.1 Check the operation of NPN transistor under CE configuration.	21	*Test input /output characteristics of NPN transistor in CE configuration.	2	CO5
LLO 22.1 Check the operation of NPN transistor under CB configuration.	22	Test input /output characteristics of NPN transistor in CB configuration.	2	CO5
LLO 23.1 Check operation of transistor for ON and OFF conditions.	23	*Check the switch ON and switch OFF condition of LED by using transistor.	2	CO5
LLO 24.1 Use FET (BFW10) to plot drain and transfer characteristics.	24	Determine the Drain and Transfer characteristics of FET.	2	CO5
LLO 25.1 Use of RTD (PT-100) for measurement of temperature.	25	*Measure temperature of liquid using RTD (PT-100) transducer.	2	CO6
LLO 26.1 Use active transducer (thermocouple) for measurement of temperature.	26	Measure temperature of liquid using thermocouple measurement.	2	CO6
LLO 27.1 Use of photoelectric sensor to sense motion.	27	Check the motion of given object using photoelectric sensor.	2	CO6
LLO 28.1 Use Passive transducer to measure resistance.	28	*Measure the resistance of LDR in varying light intensity.	2	CO6
LLO 29.1 Use Passive transducer to measure displacement.	29	Measure displacement using LVDT.	2	CO6
LLO 30.1 Use Passive transducer to measure displacement.	30	Measurement of displacement using potentiometer.	2	CO6

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

- Basic Electrical Engineering:
1) Prepare an electrical circuit comprising of one lamp and switch and measure current of the circuit.

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2) Prepare a model of two resistances connected in series and parallel and measure the resistance of both circuits.

3) Prepare a magnetic circuit model to demonstrate magnetic force of line (flux) and check its properties.

4) Prepare a model to demonstrate Faraday's laws of electromagnetic induction.

5) Prepare a model to demonstrate dynamically and statically induced EMF.

6) Prepare a test lamp and check the supply continuity using it.

7) Connect two small battery cells (AA size) make series and parallel connections and measure the voltage of both connections.

8) Visit to supply panel of 3-phase and 1-phase AC supply and identify the supply connection.

9) Prepare star /delta connection model using three filament lamps.

10) Collect a small transformer and make model showing the input and output winding connection.

11) Collect the parts of a small transformer and make a demonstration model.

12) Prepare a demonstration model of DC motor. Collect different types of small rating fuses and make a demonstration chart.

13) Prepare a switchboard containing one switch, one fuse, and one socket and test it.

14) Collect MCB dismantle it and prepare a demonstration model showing actual parts of MCB.

• Basic Electronics Engineering:

1) Transistor: Build a circuit to switch ON and OFF LED using BJT as a switching component.

2) Voltage Regulator: Build a DC regulated power supply circuit on a general purpose PCB for +9V output voltage.

3) Transistor: Build a circuit using transistor to amplify the AC input signal of 200mV.

4) FET: Build a circuit using FET to amplify the AC input signal of 300mV.

5) LDR: Build a circuit of an Automatic street light controller using LDR on general purpose PCB.

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.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- 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 Multimeter: 3 1/2 digit	1,16,17,21,22,23
2	Lamp Bank load -230 V 0-10 A	13,14
3	Earth tester analog/digital type	15
4	Electronic Work Bench: Bread Board: 840 tie points, Withstanding Voltage: 1,000V AC, Positive and Negative power rails on opposite side of the board, connecting wires.	16,17,18,21,22,23,24
5	Variable DC power supply 0-30V, 2A, SC protection, display for voltage and current.	16,17,21,22,23,24
6	CRO - 20 MHz. Dual channel	2,3,18
7	Three phase Auto Transformer -10/5 kVA, Input 415 V 3 phase. 50 Hz. Output 0-415 V, 10/20 A	4,5
8	AC Voltmeter Range (150/300/600V), Portable analog MI type as per relevant BIS standard	5,6
9	AC Ammeter range (0-2.5-5-10A), Portable analog MI type as per relevant BIS standard	5,6,13,14
10	Single Phase Transformer: 1kVA, single-phase, 230/150 V, air cooled	6
11	Single phase auto transformer (Dimmer stat) – 0-230 volt 2/5Amp	6,13

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BASIC ELECTRICAL AND ELECTRONICS ENGINEERING		**Course Code : 312302**
Sr.No	**Equipment Name with Broad Specifications**	**Relevant LLO Number**
12	Rheostat (0-500 Ohm, 1.2A), Nichrome wire wound rheostat on epoxy resin or class F insulating tube with two fixed and one sliding contact	7
13	DC Ammeter range (0-5-10A), Portable analog PMMC type as per relevant BIS standard	7
14	DC series and shunt machines at least one each (up to 230 V, 3/5 HP).	7,8
15	D. C. Supply, A 230 V d.c. supply (with inbuilt rectifier to convert a.c.to d.c)	7,8
16	DC Voltmeter Range (0-150/300V), Portable analog PMMC type as per relevant BIS standard.	7,8
17	Tachometer, noncontact type 0-10000rpm	7,8,9,10
18	Rheostat (0-100 Ohm, 5A), Nichrome wire wound rheostat on epoxy resin or class F insulating tube with two fixed and one sliding contact	8
19	Single phase Universal motor -1/4 or 1/2 HP ,230 V	9

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	Basic Electrical Fundamentals	CO1	11	4	6	4	14
2	II	Electrical Machines.	CO2	10	2	6	4	12
3	III	Electrical Safety and Protective Devices.	CO3	9	2	4	4	10
4	IV	Special purpose diodes and their applications.	CO4	10	4	4	4	12
5	V	Transistors	CO5	12	4	6	2	12
6	VI	Sensors and Transducers	CO6	8	2	4	4	10
Grand Total				**60**	**18**	**30**	**22**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

• Two offline unit tests of 30 marks (Basic Electrical of 15 marks, Basic Electronics of 15 marks) and average of two unit test marks will be consider for out of 30 marks.
• For formative assessment of laboratory learning 50 marks (Basic Electrical -25 marks, Basic Electronics- 25 marks).
• Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
• Note: Unit test will be conducted on written pattern (Not MCQ based)

Summative Assessment (Assessment of Learning)

• End semester assessment of 70 marks through online MCQ examination.
• End semester summative assessment of 50 marks for laboratory learning (Basic Electrical- 25 marks, Basic Electronics- 25 marks)

XI. SUGGESTED COS - POS MATRIX FORM

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BASIC ELECTRICAL AND ELECTRONICS ENGINEERING | **Course Code : 312302**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	--	--	2	--		2			
CO2	2	--	--	2	--		2			
CO3	2	--	--	3	2		3			
CO4	3	--	--	1	--		2			
CO5	3	--	--	1	--		2			
CO6	2	--	--	2	2		3			

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	Theraja, B. L. Theraja, A. K.	A Text Book of Electrical Technology Vol-I	S.Chand and Co. New Delhi 2014 ISBN: 9788121924405
2	Mittle, V. N.	Basic Electrical Engg.	Tata McGraw-Hill, New Delhi ISBN : 978-0-07-0088572-5
3	Hughes, Edward	Electrical Technology	Pearson Education, New Delhi ISBN-13: 978-0582405196
4	Saxena, S. B. Lal	Fundamentals of Electrical Engineering	Cambridge University Press, New Delhi ISBN : 9781107464353
5	Jegathesan, V.	Basic Electrical and Electronics Engineering	Wiley India, New Delhi 2014 ISBN : 97881236529513
6	Sedha R.S.	Applied Electronics	S. Chand, New Delhi,2015 ISBN:9788121927833
7	V.K. Mehta	Principles of Electronics	S.Chand and Co Ram Nagar, New Delhi-110055,11th edition 2014 ISBN 9788121924504
8	Boylestad, Robert Nashelsky Louis	Electronic Devices and Circuit Theory	Pearson Education. New Delhi 2014 ISBN:9780132622264
9	Sawhney A.K.	Electrical and Electronic Measurements and Instrumentation	Dhanpat Rai and Sons, New Delhi,2005, ISBN:13-9788177000160
10	Kalsi H.S.	Electronic Instrumentation	McGraw Hill, New Delhi,2010 ISBN:13-9780070702066

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=anCnrtjNLQM	LVDT
2	https://qr.page/g/4PABoASTZYW	Transistor as an Amplifier
3	https://youtu.be/XT-UmPviH64?si=MLIZBB5BgOA2SWBk	Electromagnetic Induction
4	https://youtu.be/M-QfX2fvpp4?si=xpZDAiX3-_7xrnnr	Basics of magnetic circuits
5	https://archive.nptel.ac.in/courses/117/106/117106108/	Basic electrical circuits
6	https://archive.nptel.ac.in/courses/108/105/108105155/	Electrical Machines-1

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BASIC ELECTRICAL AND ELECTRONICS ENGINEERING		**Course Code : 312302**
Sr.No	**Link / Portal**	**Description**
7	https://youtu.be/ivP_8w4FegE?si=5BLH_hvyhros570A	Single phase and Three phase electrical system
8	https://byjus.com/physics/working-principle-of-an-electrical-fuse/	Electrical fuse
9	https://youtu.be/9Xgn40eGcqY?si=YQy0vmxQ_yGR8-tz	Miniature circuit breaker
10	https://youtu.be/ikLhqUCQKkc?si=8VqRbV1zZlQUSYLd	Earth leakage circuit breaker
11	https://www.tutorialspoint.com/difference-between-bjt-and-fet	BJT's and FET's
12	https://www.tutorialspoint.com/difference-between-sensor-and-transducer	Sensors and Transducers
13	https://www.electrical4u.com/jfet-or-junction-field-effect-transistor/	Junction Field Effect Transistor
14	https://fossee.in/	Open Source Electronics Simulation software
15	https://cloud.scilab.in/	Open Source Scilab Cloud for Electronics Simulation

Note :

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

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PROGRAMMING IN C **Course Code : 312303**

Programme Name/s	: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Software Technology/ Computer Science & Engineering/ Data Sciences/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Computer Science/
Programme Code	: AI/ AN/ BD/ CM/ CO/ CST/ CW/ DS/ HA/ IF/ IH/ SE
Semester	: Second
Course Title	: PROGRAMMING IN C
Course Code	: 312303

I. RATIONALE

'C' programming language helps to build a strong foundation for computer programming. This course will help to solve beginner level problems such as mathematical operations, string processing, data structure and data structure related processing, with the help of basic concepts, control flow structures, and principles of C. This course is basically designed to create a base to develop foundation skills of procedure - oriented programming.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the students to attain the following industry identified outcome through various teaching learning experiences: Develop 'C' programs that address issues with processing strings, mathematic operations, and data structures.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Develop C program using input - output functions and arithmetic expressions
- CO2 - Develop C program involving branching and looping statements
- CO3 - Implement Arrays and structures using C programs
- CO4 - Develop C program using user-defined functions
- CO5 - Write C program using pointer

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme						Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH	Credits	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	
312303	PROGRAMMING IN C	PIC	AEC	4	1	4	1	10	5	3	30	70	100	40	50	20	50#	20	25	10	225

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Semester - 2, K Scheme

PROGRAMMING IN C   **Course Code : 312303**

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 Write algorithm for given problem statement. TLO 1.2 Identify the given building blocks of a C Program. TLO 1.3 Use basic constructs like constants, variables, data types for developing C program. TLO 1.4 Write C programs using printf() and scanf() functions. TLO 1.5 Write C programs using arithmetic operators, bitwise operators.	**Unit - I Basics of 'C' Programming** 1.1 Fundamentals of algorithms: Notion of algorithm, Notations used for assignment statements and basic control structures. 1.2 Introduction to 'C': General structure of ' C' program, Header file, 'main ()' function. 1.3 Fundamental constructs of 'C': Character set, tokens, keywords, Identifiers, Constants - number constants, character constants, string constants, Variables. Data types in 'C': Declaring variables, data type conversion. 1.4 Basic Input and Output functions: input and output statements using printf(), scanf() functions. 1.5 Assignments and expressions: simple assignment statements, arithmetic operators, shift operators, bitwise operators, sizeof operator.	Chalk-Board Demonstration Hands-on
2	TLO 2.1 Write a 'C' program using decision making statements. TLO 2.2 Use loop statements in C program to solve iterative problems. TLO 2.3 Use appropriate statement to alter the program flow in the loop.	**Unit - II Control structures** 2.1 Conditional statements: Relational operators, logical operators, if statement, if-else statements, nested if-else statements, if-else ladder, switch statement. 2.2 Looping statements : 2.1 while loop, do… while loop, for loop. 2.3 Branching Statements: goto statement, use of 'break' and 'continue' statements.	Chalk-Board Demonstration Presentations Hands-on

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PROGRAMMING IN C **Course Code : 312303**

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 a C Program to perform operations on one dimensional array. TLO 3.2 Declare, initialize, and access elements of two dimensional array. TLO 3.3 Declare ,initialize and access data using Structure. TLO 3.4 Explain typedef and enum	**Unit - III Arrays and structure** 3.1 Characteristics of an array, One dimension and two dimensional arrays, concept of multi-dimensional arrays. 3.2 Array declaration and Initialization. 3.3 Operations on Arrays. 3.4 Character and String input/output and String related operations. 3.5 Introduction and Features of Structures, Declaration and Initialization of Structures, array of structures. 3.6 Type def, Enumerated Data Type.	Chalk-Board Demonstration Hands-on Video Demonstrations
4	TLO 4.1 Explain need of Functions in C program. TLO 4.2 Write C Program involving C library functions. TLO 4.3 Write user defined functions for given problem in C program. TLO 4.4 Write C Program for calling function by 'value' and calling function by 'reference'. TLO 4.5 Implement recursive functions in C Program.	**Unit - IV Functions** 4.1 Concept and need of functions. 4.2 Library functions: Math functions, String handling functions, other miscellaneous functions such as getchar(), putchar(), malloc(), calloc(). 4.3 Writing User defined functions - function definition, functions declaration, function call, scope of variables - local variables, global variables. 4.4 Function parameters: Parameter passing- call by value & call by reference, function return values, function return types ,declaring function return types, The 'return' statement. 4.5 Recursive functions.	Chalk-Board Demonstration Presentations Hands-on
5	TLO 5.1 Declare and Define Pointer Variable. TLO 5.2 Write C program to print the address and values of pointer variables. TLO 5.3 Write C program to perform arithmetic operations using pointers. TLO 5.4 Write C Program to perform operations on Arrays using Pointers. TLO 5.5 Explain string related operations using pointer. TLO 5.6 Access individual variable of structure using Pointer.	**Unit - V Pointers** 5.1 Introduction to Pointers : Definition, use of pointers, '*' and '&' operators, declaring, initializing, accessing pointers. 5.2 Pointer arithmetic. 5.3 Pointer to array. 5.4 Pointer and Text string. 5.5 Function handling using pointers. 5.6 Pointers to structure.	Demonstration Chalk-Board Presentations 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 Write logical steps for given program flow LLO 1.2 Write the standard English like statements for programming flow of given problem statement	1	* Install and study the C programming environment	2	CO1

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 2.1 Write Simple C program using constant and variables LLO 2.2 Use the arithmetic operators for developing C Program	2	Implement C programs using Constants and Variables	2	CO1
LLO 3.1 Use Arithmetic operators in C Program	3	* Implement C programs using arithmetic operators to solve given arithmetic operations	2	CO1
LLO 4.1 Write code for type casting in C	4	Implement C programs using implicit and Explicit data type conversion	2	CO1
LLO 5.1 Write C code for displaying formatted output with comments wherever applicable.	5	* Write well commented C programs using formatted Input/Output statements. e.g. Sample Output: | Name	:	FName MName Lname
Roll No	:	XXXX
Percentage	:	(upto 2 decimal places)
Date of Birth	:	DD/MM/YYYY
Branch, College	:	XXXXXXXXXXXXX		4	CO1
LLO 6.1 Use Relational and logical operators in C to solve given problem LLO 6.2 Write C program using Relational and logical operators for solving given problem	6	* Implement minimum two C programs using Relational and conditional operator.	2	CO1 CO2
LLO 7.1 Use logical operators in given expressions	7	* Implement minimum two C programs using Logical Operators	2	CO1 CO2
LLO 8.1 Write expressions using bitwise operators in given problem statement	8	Implement minimum two C programs using Bitwise Operators	2	CO1 CO2
LLO 9.1 Write the syntax for various if statements LLO 9.2 Write C program for any problem using If statements	9	Implement minimum two C programs using simple If statement and if..else statement.	2	CO2
LLO 10.1 Write syntax of if.. else statements	10	* Implement minimum two C programs using nested If ..else statement and if.. else if ladder e.g.- Write and Execute the C program to print the grades of students based on percentage. Grade: Distinction If per>=75 Grade: A If per>=60 and Per<75 Grade: B If per>=55 and Per<60 Grade: Pass If per>=40 and Per<55 Grade:Fail if per<40	4	CO2

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 11.1 Write syntax of Switch statement to solving given problem	11	* Develop C program using Switch staements	2	CO2
LLO 12.1 Write C program using Switch statement.	12	* Write a C program to print English Calendar months as per given number(eg: If input is 4 then print "April") using Switch statement	2	CO2
LLO 13.1 Implement iterative solution to problem using while and do - - while loop	13	* Implement minimum two C programs using 'while' loop and 'do...while' loop statements.	2	CO2
LLO 14.1 Write the syntax for statement. LLO 14.2 Write C code for solving given problem using for loop.	14	Implement C programs using for loop statement (e.g.- Write a C Program to print numbers from 1 to 100)	2	CO1 CO2
LLO 15.1 Write syntax for while and do ... while loop LLO 15.2 Write syntax for 'for' loop	15	* Print various patterns using loops. e.g. - Write C Program to print following or similar pattern * * * * * * * * * *	2	CO2
LLO 16.1 Declare and initialize the Array. LLO 16.2 Write C program for implementation of one dimensional array.	16	* Implement C programs using One Dimensional Array. (e.g.-Write C program to input 5 numbers using array and display sum of it)	2	CO2 CO3
LLO 17.1 Declare and initialize two dimensional Array. LLO 17.2 Write C program for implementation of two dimensional array.	17	* Implement C programs using Two Dimensional Array. (e.g.-Write C program to calculate addition of two 3X3 matrices.)	4	CO3
LLO 18.1 Declare character array as Strings in C LLO 18.2 Write C programs for print string operations without using string handling functions	18	* Write C program to perform following operations without using standard string functions. i) Calculate Length of given string ii) Print reverse of given string.	2	CO3
LLO 19.1 Declare ,define and access structure variables	19	Implement 'Structure' in C (e.g. - Add and Substract complex numbers using structure)	4	CO3
LLO 20.1 Write C programs using Array of Structure	20	* Implement ' Array of Structure' in C (e.g.-Accept and Display 10 Employee information using structure)	2	CO3
LLO 21.1 Use built-in library functions in C programs	21	* Develop C program using in-built mathematical and string functions.	2	CO4
LLO 22.1 Write C programs using user defined functions	22	* Write C program to demonstrate User defined Functions	4	CO4
LLO 23.1 Write Recursive functions in C.	23	Implement recursive functions in C program.	2	CO4

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 24.1 Declare and initialize pointer variables LLO 24.2 Write C program to access variables using pointers.	24	* Write C Program to print addresses and values of variables using Pointer. (e.g.- Write C program to access and display address of variables.)	2	CO5
LLO 25.1 Perform arithmetic operations using pointers.	25	* Implement C Programs to perform arithmetic operations using Pointer.	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

- 1.Complete any one course related to Programming in C on Infosys Springboard

2.Develop C language code for relevant topics suggested by the teacher

Assignment

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

Micro project

- The micro project has to be Industry Application Based, Internet-based, Workshop-based, Laboratory-based or Field-based as suggested by Teacher

1. Prepare a simple calculator to perform mathematical operations. Accept values and operations to be performed from user. Allow only numeric values else show appropriate messages to user.

2. Prepare menu driven program for Invoice management system. Accept user inputs and generate receipt and calculate amounts as per purchased items.

3. Develop employee leave management system to display leave related information of employee.

4. Develop food menu card for restaurant. Display food items. Accept food menu, quantity and generate bill for the same.

5. Develop a menu-driven program to perform matrix operations - matrix addition, matrix multiplication, transpose of matrix .

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.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- 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

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Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	1 Computer system - (Any computer system with basic configuration)	All
2	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	Basics of 'C' Programming	CO1	10	4	2	6	12
2	II	Control structures	CO1,CO2	14	4	4	8	16
3	III	Arrays and structure	CO3	12	4	4	8	16
4	IV	Functions	CO4	12	2	4	8	14
5	V	Pointers	CO5	12	2	2	8	12
		Grand Total		**60**	**16**	**16**	**38**	**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
CO1	3	2	2	1	-	-	1			
CO2	2	3	3	2	-	-	2			
CO3	2	3	3	3	-	2	2			
CO4	1	3	3	3	1	2	3			
CO5	1	3	3	3	1	1	3			
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	Programming in ANSI 'C'	Mcgraw Hill Publications ISBN 0070534772
2	Yashwant Kanetkar	Let us 'C'	BPB Publication ISBN 9788183331630
3	David Griffiths, Dawn Griffiths	Head First C	O'Reilly Media, Inc. ISBN: 9781449345013

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PROGRAMMING IN C | **Course Code : 312303**

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://nptel.ac.in/courses/106104128	C Programming
2	https://jsommers.github.io/cbook/control.html	Control structures, flow control statements in C
3	https://www.learn-c.org/en/Functions	Functions
4	https://www.simplilearn.com/tutorials/c-tutorial/pointers-in -c	Pointers
5	https://www.w3schools.com/c/	C Programming
6	https://www.javatpoint.com/c-programming-language-tutorial	C Programming tutorial
7	https://www.programiz.com/c-programming	C Programming
8	https://www.programiz.com/c-programming/online-compiler/	online C compiler

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. 01/10/2024   **Semester - 2, K Scheme**

DATA STRUCTURE USING C   **Course Code : 313301**

Programme Name/s	**: Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Computer Science/**
Programme Code	**: BD/ CM/ CO/ CW/ HA/ IF/ IH/ SE**
Semester	**: Third**
Course Title	**: DATA STRUCTURE USING C**
Course Code	**: 313301**

I. RATIONALE

One of the most important courses in information and communication technology is data structures. Data organization or structuring is essential for developing effective algorithms and programs. Students will get the ability to develop logic to solve problem using principles of data structure with the aid of this course.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Implement algorithm using relevant Data Structures.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Perform basic operations on Arrays.
- CO2 - Apply different Searching and Sorting methods.
- CO3 - Implement basic operations on Linked List.
- CO4 - Perform operations on Stack using Array and Linked List Implementations.
- CO5 - Perform operations on Queue using Array and Linked List Implementations.
- CO6 - Create and Traverse Tree to solve problems.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	CL	TL	LL	SLH	NLH	Credits	Paper Duration	FA-TH Max	SA-TH Max	Total Max	Total Min	FA-PR Max	FA-PR Min	SA-PR Max	SA-PR Min	SLA Max	SLA Min	Total Marks
313301	DATA STRUCTURE USING C	DSU	DSC	3	1	4	-	8	4	3	30	70	100	40	50	20	25#	10	-	-	175

DATA STRUCTURE USING C   **Course Code : 313301**

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 Classify the given type of Data Structures based on their characteristics and space. TLO 1.2 Perform operations on the given type of Data Structure.	**Unit - I Introduction to Data Structures** 1.1 Introduction: Concept and Need of Data Structure, Definition, Abstract Data Type 1.2 Types of Data Structures: (i) Linear Data Structures (ii) Non-Linear Data Structures 1.3 Operations on Data Structures: (i) Traversing (ii) Insertion (iii) Deletion	Lecture Using Chalk-Board Presentations
2	TLO 2.1 Develop algorithm to search the given key using different Searching Techniques. TLO 2.2 Create algorithm to sort data using a given method.	**Unit - II Searching and Sorting** 2.1 Searching: Searching for an item in a data set using the following methods: (i) Linear Search (ii) Binary Search 2.2 Sorting: Sorting of data set in an order using the following methods: (i) Bubble Sort (ii) Selection Sort (iii) Insertion Sort (iv) Quick Sort (v) Merge Sort	Lecture Using Chalk-Board Demonstration Presentations Hands-on
3	TLO 3.1 Differentiate between Static and Dynamic Memory Allocation. TLO 3.2 Create a suitable structure using a Linked List to represent a Node. TLO 3.3 Create Algorithm to add or remove a specified item from a Linear Linked List.	**Unit - III Linked List** 3.1 Difference between Static and Dynamic Memory Allocation. 3.2 Introduction to Linked List, Terminologies: Node, Address, Pointer, Information field / Data field, Next pointer, Null Pointer, Empty List. 3.3 Type of Lists: Linear List, Circular List, Representation of Doubly Linked List. 3.4 Operations on a Singly Linked List: Creating a Linked List, Inserting a new node in a Linked List, Deleting a node from a Linked List, Searching a key in Linked List, Traversing a Singly Linked List. 3.5 Applications of Linked List.	Lecture Using Chalk-Board Demonstration Presentations Hands-on

DATA STRUCTURE USING C   **Course Code : 313301**

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 Represent Stack using Array and Linked List. TLO 4.2 Create Algorithm to carry out the PUSH and POP operations in a Stack. TLO 4.3 Use Stack to transform the given expression from Infix to Postfix. TLO 4.4 Evaluate Postfix Expression.	**Unit - IV Stack** 4.1 Introduction to Stack: Definition, Stack as an ADT, Operations on Stack-(Push, Pop), Stack Operation Conditions – Stack Full / Stack Overflow, Stack Empty /Stack Underflow. 4.2 Stack Implementation using Array and representation using Linked List. 4.3 Applications of Stack: Reversing a List, Polish Notations, Conversion of Infix to Postfix Expression, Evaluation of Postfix Expression. 4.4 Recursion: Definition and Applications.	Lecture Using Chalk-Board Demonstration Presentations Hands-on
5	TLO 5.1 Represent Queue using Array and Linked List. TLO 5.2 Explain the characteristics of different types of Queue. TLO 5.3 Create Algorithm to carry out the INSERT and DELETE Operations on a Queue.	**Unit - V Queue** 5.1 Introduction to Queue: Queue as an ADT, Queue representation in memory using Array and representation using a Linked List. 5.2 Types of Queues: Linear Queue, Circular Queue, Concept of Priority Queue, Double-Ended Queue. 5.3 Queue Operations: INSERT, DELETE, Queue Operation Conditions: Queue Full, Queue Empty. 5.4 Applications of Queue.	Lecture Using Chalk-Board Demonstration Presentations Hands-on
6	TLO 6.1 Describe the given Tree Terminology. TLO 6.2 Create a Binary Search Tree based on the provided data. TLO 6.3 Create Algorithms to Traverse the Tree using the given method. TLO 6.4 Create an Expression Tree. TLO 6.5 Create Heap.	**Unit - VI Tree** 6.1 Introduction to Trees Terminologies: Tree, Degree of a Node, Degree of a Tree, Level of a node, Leaf Node, Depth / Height of a Tree, In-Degree and Out-Degree, Path, Ancestor and Descendant Nodes. 6.2 Tree Types and Traversal methods, Types of Trees: General Tree, Binary Tree, Binary Search Tree (BST). Binary Tree Traversal: In-Order Traversal, Preorder Traversal, Post-Order Traversal. 6.3 Expression Tree, Heap	Lecture Using Chalk-Board Demonstration Presentations 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 Implement Array Operations.	1	* Write a 'C' program to perform following Operations on Array: Create, Insert, Delete, Display.	4	CO1
LLO 2.1 Implement Linear Search Method on Numbers.	2	Write a 'C' Program to Search a particular data from the given Array of numbers using: Linear Search Method.	2	CO2
LLO 3.1 Implement Linear Search Method on Strings.	3	* Write a 'C' Program to Search a particular data from the given Array of Strings using Linear Search Method.	2	CO2
LLO 4.1 Implement Binary Search Method on Numbers.	4	* Write a 'C' program to Search a particular data from the given Array of numbers using Binary Search Method.	2	CO2
LLO 5.1 Implement Binary Search Method on Strings.	5	Write a 'C' Program to Search a particular data from the given Array of Strings using Binary Search Method.	2	CO2
LLO 6.1 Apply Bubble Sort method for Sorting Numbers.	6	* Write a 'C' Program to Sort an Array of numbers using Bubble Sort Method.	2	CO2

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DATA STRUCTURE USING C   **Course Code : 313301**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Apply Bubble Sort method for Sorting Strings.	7	Write a 'C' Program to Sort an Array of Strings using Bubble Sort Method.	2	CO2
LLO 8.1 Apply Selection Sort for Sorting Numbers.	8	* Write a 'C' Program to Sort an Array of numbers using Selection Sort Method.	2	CO2
LLO 9.1 Apply Selection Sort for Sorting Strings.	9	Write a 'C' Program to Sort an Array of Strings using Selection Sort Method.	2	CO2
LLO 10.1 Apply Insertion Sort for Sorting Numbers.	10	* Write a 'C' Program to Sort an Array of numbers using Insertion Sort Method.	2	CO2
LLO 11.1 Apply Insertion Sort for Sorting Strings.	11	Write a 'C' Program to Sort an Array of Strings using Insertion Sort Method.	2	CO2
LLO 12.1 Create Singly Linked List.	12	* Write a 'C' Program to Implement Singly Linked List with Operations: (i) Insert at beginning, (ii) Search, (iii) Display	2	CO3
LLO 13.1 Perform given Operations on Singly Linked List.	13	* Write a C Program to Implement Singly Linked List with Operations: (i) Insert at end, (ii) Insert After, (iii) Delete (iv) Display	2	CO3
LLO 14.1 Create Polynomials using Linked List.	14	Write a C Program to Create Two Polynomials using a Linked List.	2	CO3
LLO 15.1 Perform the Addition of Two Polynomials using a Linked List.	15	* Write a 'C' Program to add Two Polynomials using a Linked List.	2	CO3
LLO 16.1 Perform Operations on the Stack using the Array.	16	* Write a 'C' Program to perform PUSH and POP Operations on Stack using an Array.	2	CO4
LLO 17.1 Perform Operations on the Stack using a Linked List.	17	* Write a 'C' Program to perform PUSH and POP Operations on a Stack using a Linked List.	2	CO4
LLO 18.1 Apply recursive procedure to multiply two numbers.	18	* Write a 'C' program to perform multiplication of two numbers using recursion.	2	CO4
LLO 19.1 Apply recursive procedure to reverse the string.	19	Write a 'C' program to print given string in reverse using recursion.	2	CO4
LLO 20.1 Apply recursive procedure to display linked list in reverse.	20	Write a 'C' program to create a Singly Linked List and traverse in reverse order using recursion.	4	CO3 CO4
LLO 21.1 Perform Operations on Linear Queue using Array.	21	* Write a 'C' Program to perform INSERT and DELETE Operations on Linear Queue using an Array.	2	CO5
LLO 22.1 Perform Operations on Linear Queue using Linked List.	22	* Write a 'C' Program to perform INSERT and DELETE operations on Linear Queue using a Linked List.	2	CO5
LLO 23.1 Perform Operations on Circular Queue using Array.	23	* Write a 'C' Program to perform INSERT and DELETE operations on Circular Queue using an Array.	2	CO5
LLO 24.1 Perform Operations on Circular Queue using a Linked List.	24	Write a 'C' Program to perform INSERT and DELETE operations on Circular Queue using a Linked List.	2	CO5
LLO 25.1 Implement Priority Queue using Linked List.	25	Write a 'C' Program to Create a Priority Queue using a Linked List.	4	CO5
LLO 26.1 Implement Tutori Binary Search Tree and perform In-Order Traversal.	26	* Write a 'C' Program to Implement BST (Binary Search Tree) and Traverse in In-Order.	2	CO6

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DATA STRUCTURE USING C | **Course Code : 313301**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 27.1 Implement Tree Traversal Operations.	27	Write a 'C' Program to Traverse BST in Preorder, and Post-Order.	2	CO6

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	Computer System with all necessary Peripherals and Internet Connectivity. 'C' Compiler / GCC Compiler/ Online 'C' Compiler	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 Data Structures	CO1	2	2	2	0	4
2	II	Searching and Sorting	CO2	8	2	2	8	12
3	III	Linked List	CO3	12	2	4	10	16
4	IV	Stack	CO4	8	2	4	6	12
5	V	Queue	CO5	6	2	2	6	10
6	VI	Tree	CO6	9	2	4	10	16
		Grand Total		45	12	18	40	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

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

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CO1	2	-	-	1	-	-	1		
CO2	2	2	2	1	-	-	1		
CO3	2	2	2	1	1	1	1		
CO4	2	2	2	1	-	1	1		
CO5	2	2	2	1	-	1	1		
CO6	2	2	2	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	Lipschutz	Data Structures with 'C' (SIE) (Schaum's Outline Series)	McGraw Hill Education, New Delhi ISBN: 978-0070701984
2	Balgurusamy, E.	Data Structures using 'C'	McGraw Hill Education, New Delhi 2013, ISBN: 978-1259029547
3	ISRD Group	Data Structures using 'C'	McGraw Hill Education, New Delhi 2013, ISBN: 978-12590006401
4	Yashwant Kanetkar	Understanding Pointers in C	BPB ISBN 8170298911

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.javatpoint.com/data-structure-introduction	For All Content
2	https://www.geeksforgeeks.org/introduction-to-data-structures/	For All Content
3	https://studytonight.com/data-structures/	For All Content
4	https://www.tutorialspoint.com/data_structures_algorithms/	For All Content
5	https://www.w3schools.in/data-structures/	For All Content
6	https://www.mygreatlearning.com/blog/data-structure-tutorial-for-beginners/	For All Content
7	https://byjus.com/gate/introduction-to-data-structure-notes/	For All Content

Note :

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