



IV SEMESTER													
Sl. No.	Course Code	Course Title	Credit Allocation				BoS	Category	Max Marks CIE		SEE Duration (H)	Max Marks SEE	
			L	T	P	Total			Theory	Lab		Theory	Lab
1	CS241AT	Discrete Mathematical Structures and Combinatorics (Common to CS, IS, CD, AI & CY)	3	0	0	3	CS	Theory	100	****	3	100	****
2	CV242AT	Environment & Sustainability	3	0	0	3	CV	Theory	100	****	3	100	****
	ME242AT	Material Science for Engineers					ME						
	BT242AT	Bio Safety Standards and Ethics					BT						
3	CD343AI	Design and Analysis of Algorithms (Common to CS, IS, CD, AI & CY)	3	0	1	4	CD	Theory + Lab	100	50	3	100	50
4	CS344AI	IoT and Embedded Computing (Common to CS, CD & CY)	3	0	1	4	CS	Theory + Lab	100	50	3	100	50
5	CY245AT	Computer Networks (Common to CS, IS, CD, AI & CY)	3	0	0	3	CY	Theory	100	****	3	100	****
6	CS246XT	Professional Core Courses 3 - Group A	2	0	0	2	CS	MOOC	50	****	2	50	****
7	HS247XL	Ability Enhancement Course	0	0	2	2	HSS	Lab	****	50	2	****	50
8	HS248XT	Universal Human Values	2	0	0	2	HSS	Theory	50	****	2	50	****
9	MAT149DT	Bridge Course: Mathematics	2 (A)	1	0	AUDIT	MAT	Theory	50	****	****	****	****
						23							

<b>Professional Core Courses 3 - Group A [MOOC COURSES]</b>				
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Credits</b>
1.	CS246AT	Machine Learning For Earth System Sciences	MOOC	2
2.	AI246BT	Modern Algebra (Common to CS, IS, CD, <b>AI</b> & CY)	MOOC	2
3.	CS246CT	Distributed Systems (Common to <b>CS</b> , IS, CD & CY)	MOOC	2
4.	IS246DT	Introduction To Haskell Programming (Common to CS, <b>IS</b> , CD & CY)	MOOC	2
5.	CS246ET	Google Cloud Computing Foundations (Common to <b>CS</b> , IS, CD & CY)	MOOC	2

<b>Ability Enhancement Course-Group B</b>				
<b>Sl. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Credits</b>
1.	HS247AL	National Service Scheme	LAB	2
2.	HS247BL	National Cadet Corps	LAB	2
3.	HS247CL	Physical Education : Sports & Athletics	LAB	2
4.	HS247DL	Music	LAB	2
5.	HS247EL	Dance	LAB	2
6.	HS247FL	Theater (Light Camera & Action)	LAB	2
7.	HS247GL	Art Work & Painting	LAB	2
8.	HS247HL	Photography & Film Making	LAB	2

Semester: IV					
DISCRETE MATHEMATICAL STRUCTURES AND COMBINATORICS					
Category: PROFESSIONAL CORE COURSE					
(Theory)					
(Common to CS, IS, CD, AI & CY)					
Course Code	:	CS241AT		CIE	: 100 Marks
Credits: L:T:P	:	3:0:0		SEE	: 100 Marks
Total Hours	:	45L		SEE Duration	: 3 Hours

Unit-I	9 Hrs
<b>Fundamental Principles of Counting and Combinatorics</b> The Rule of Sum and Product, Permutations, Combinations, Principle of Inclusion and Exclusion, Derangements, The Binomial Theorem, Combinations with repetition. <b>Recursive Definitions, Recurrence Relations</b> Recursive definition, First order linear recurrence relation- Formulation problems and examples, Second order linear recurrence relations with constant coefficients- Homogeneous and Non homogeneous, Generating functions.	
Unit – II	9 Hrs
<b>Fundamentals of Logic</b> Basic Connectives and Truth Tables, Tautologies, Logical Equivalence: The laws of logic, Logical Implications, Rules of inference. Open Statement, Quantifiers, Definition and the use of Quantifiers, Definitions, and the proofs of theorems.	
Unit –III	9 Hrs
<b>Relations</b> Properties of relations, Composition of Relations, Partial Orders, Hasse Diagrams, Equivalence Relations, and Partitions. <b>Functions</b> Functions-plain, One-to-one, onto functions, Stirling numbers of the second kind, Function composition and Inverse function, Growth of function.	
Unit –IV	9 Hrs
<b>Groups theory</b> Definition, Examples and Elementary properties, Abelian groups, Homomorphism isomorphism, cyclic groups, cosets and Lagrange's theorem. <b>Coding Theory:</b> Elementary coding theory, the hamming metric, the parity-Check and Generator Matrices	
Unit-V	9 Hrs
<b>Introduction to Graph Theory:</b> Graphs and their basic properties - degree, path, cycle, complement, subgraphs, isomorphism, Computer representations of graphs. Eulerian and Hamiltonian graphs, Graph coloring, Planar graphs. <b>Trees:</b> Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Spanning trees.	

<b>Course Outcomes: After completing the course, the students will be able to</b>	
<b>CO 1:</b>	Apply the concepts of discrete mathematical structures for effective computation and relating problems in the computer science domain.
<b>CO 2:</b>	Analyze the concepts of discrete mathematics to various fields of computer science.
<b>CO 3:</b>	Design solutions for complex problems using different concepts of discrete mathematical structure as a logical predictable system.
<b>CO 4:</b>	Explore/Develop new innovative ideas to solve some open problems in theoretical computer science.
<b>CO 5:</b>	Effectively communicate, work in groups in order to accomplish a task and engage in continuing professional development.

<b>Reference Books:</b>	
<b>1.</b>	Ralph P. Grimaldi and B V Ramana, Discrete and Combinatorial Mathematics- An Applied Introduction, Pearson Education, Asia, 5th Edition – 2017, ISBN 978-0321385024
<b>2.</b>	J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata – McGraw Hill, 1st Edition 2017, ISBN 13:978-0074631133
<b>3.</b>	Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata – McGraw Hill, 6th Edition, 7 edition 2017, ISBN-(13): 978-0070681880

### **EXPERIENTIAL LEARNING**

Based on the concepts learnt in this course like relations, functions- problems on graph theory such as graph coloring, scheduling problems could be given for Experiential learning.

Also using the concepts of logical reasoning and group theory some of the NLP problems could also be given for Experiential learning.

<b>RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)</b>		
<b>#</b>	<b>COMPONENTS</b>	<b>MARKS</b>
1.	<b>QUIZZES:</b> Quizzes will be conducted in online/offline mode. <b>TWO QUIZZES</b> will be conducted & Each Quiz will be evaluated for 10 Marks adding up to 20 Marks. <b>THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.</b>	<b>20</b>
2.	<b>TESTS:</b> Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). <b>TWO TESTS</b> will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. <b>FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.</b>	<b>40</b>
3.	<b>EXPERIENTIAL LEARNING:</b> Students will be evaluated for their creativity and practical implementation of the problem. <b>Phase I (20) &amp; Phase II (20) ADDING UPTO 40 MARKS.</b>	<b>40</b>
<b>MAXIMUM MARKS FOR THE CIE THEORY</b>		<b>100</b>



<b>RUBRIC FOR SEMESTER END EXAMINATION (THEORY)</b>	
<b>CONTENTS</b>	<b>MARKS</b>
<b>PART A</b>	
Objective type questions covering entire syllabus	20
<b>PART B</b> (Maximum of FOUR Sub-divisions only)	
Unit 1 : (Compulsory)	16
Unit 2 : Question 3 or 4	16
Unit 3 : Question 5 or 6	16
Unit 4 : Question 7 or 8	16
Unit 5: Question 9 or 10	16
<b>TOTAL</b>	<b>100</b>

Semester: III/ IV						
ENVIRONMENT & SUSTAINABILITY						
Category: PROFESSIONAL CORE COURSE						
(Theory)						
(Common to all Programs)						
Course Code	:	CV232AT / CV242AT		CIE	:	100 Marks
Credits: L:T:P	:	3:0:0		SEE	:	100 Marks
Total Hours	:	45L		SEE Duration	:	3.00 Hours
Unit-I						10 Hrs
ENVIRONMENT AND BIODIVERSITY						
Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity.						
ENVIRONMENTAL POLLUTION						
Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollution. Solid, Hazardous and E-Waste management.						
Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.						
Unit – II						09 Hrs
RENEWABLE SOURCES OF ENERGY						
Energy management and conservation, New Energy Sources: Need of new sources. Different types of new energy sources.						
Energy Cycles, carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socioeconomical and technological change.						
Applications of - Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.						
Unit –III						09 Hrs
SUSTAINABILITY AND MANAGEMENT						
Introduction to Environmental Economics, Environmental Audit, Development, GDP, Sustainability - concept, needs and challenges-economic, social and aspects of sustainability - from unsustainability to sustainability-millennium development goals and protocols						
Sustainable Development Goals - targets, indicators and intervention areas Climate change - Global, Regional and local environmental issues and possible solutions. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry.						
Unit –IV						09 Hrs
SUSTAINABILITY PRACTICES						
Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment.						
Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports.						
Linear vs. cyclical resource management systems, need for systems thinking and design of cyclical systems, circular economy, industrial ecology, green technology. Specifically apply these concepts to: Water Resources, Energy Resources, Food Resources, Land & Forests, Waste management.						

Unit –V	08 Hrs
<b>Corporate Social Responsibility (CSR)</b> - Meaning & Definition of CSR, History & evolution of CSR. Concept of Charity, Corporate philanthropy, Corporate Citizenship, CSR-an overlapping concept. Concept of sustainability & Stakeholder Management. Relation between CSR and Corporate governance; environmental aspect of CSR; Chronological evolution of CSR in India. Sustainability Reporting: Flavor of GRI, Dow Jones Sustainability Index, CEPI. Investor interest in Sustainability.	

Course Outcomes: After completing the course, the students will be able to:	
<b>CO1</b>	Understand the basic elements of Environment and its Biodiversity.
<b>CO2</b>	Explain the various types of pollution and requirement for sustainable strategy for present scenario.
<b>CO3</b>	Evaluate the different concepts of sustainability and its significance for welfare of all life forms.
<b>CO4</b>	Recognize the role of Corporate social responsibility in conserving the Environment.

Reference Books	
1.	‘Environmental Science and Engineering’, Benny Joseph, Tata McGraw-Hill, New Delhi, 2016. ISBN-13 - 978-9387432352
2.	‘Introduction to Environmental Engineering and Science’, Gilbert M.Masters, Wendell P Ela, 3 <sup>rd</sup> edition, Pearson Education, 2006. ISBN-13 - 978-0132339346
3.	Environment Impact Assessment Guidelines, Notification of Government of India, 2006
4.	A Handbook of Corporate Governance and Social Responsibility (Corporate Social Responsibility), David Crowther and Guler Aras, Gower Publishing Ltd, ISBN - 13 - 978-0566088179

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	COMPONENTS	MARKS
1.	<b>QUIZZES:</b> Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. <b>THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.</b>	<b>20</b>
2.	<b>TESTS:</b> Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom’s Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. <b>FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS</b>	<b>40</b>
3.	<b>EXPERIENTIAL LEARNING:</b> Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) <b>Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS.</b>	<b>40</b>
<b>MAXIMUM MARKS FOR THE CIE THEORY</b>		<b>100</b>



<b>RUBRIC FOR SEMESTER END EXAMINATION (THEORY)</b>		
<b>Q. NO.</b>	<b>CONTENTS</b>	<b>MARKS</b>
<b>PART A</b>		
1	Objective type questions covering entire syllabus	20
<b>PART B</b> (Maximum of TWO Sub-divisions only)		
2	Unit 1 : (Compulsory)	16
3 & 4	Unit 2 : Question 3 or 4	16
5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
<b>TOTAL</b>		<b>100</b>



<b>Semester: III / IV</b>					
<b>MATERIALS SCIENCE FOR ENGINEERS</b>					
<b>Category: PROFESSIONAL CORE COURSE</b>					
<b>(Theory)</b>					
<b>(Common to all Programs)</b>					
<b>Course Code</b>	<b>:</b>	ME232AT		<b>CIE</b>	<b>: 100 Marks</b>
<b>Credits: L:T:P</b>	<b>:</b>	3:0:0		<b>SEE</b>	<b>: 100 Marks</b>
<b>Total Hours</b>	<b>:</b>	40L		<b>SEE Duration</b>	<b>: 3 Hours</b>

<b>Unit-I</b>	<b>06 Hrs</b>
<b>The Fundamentals of Materials</b> The electronic structure of atoms, Types of atomic and molecular bonds; ionic bonding; covalent bonding; metallic bonding; secondary bonding; mixed bonding; hybridization. Energy bands in metals, insulators, and semiconductors. Basic crystallography. Defects and dislocations. Types of Materials: Polymers, metals and alloys, semiconductors, ceramics, composites	
<b>Unit – II</b>	<b>10 Hrs</b>
<b>Material behaviour</b> Conductivity, thermal properties, thermal conductivity, thermoelectric effects. Dielectric behaviours and temperature dependence of the dielectric constant, insulating materials, ferroelectricity, piezoelectricity. thermocouple, super conductor, optical properties. Stress-strain, Elastic deformation, plastic deformation, hardness, viscoelastic deformation, impact energy, Fracture toughness, Fatigue, Heat capacity, Thermal expansion, Thermal conductivity, thermal shock	
<b>Unit –III</b>	<b>10 Hrs</b>
<b>Materials and their Applications</b> Semiconductors, Dielectric, optoelectronics and structural materials, Ferrous alloys, Nonferrous alloy, cement, concrete, ceramic and glasses, processing the structural Materials, polymers, Thermoset and thermoplastic polymers, composites: fibre-reinforced, aggregated composites, mechanical properties of composites, Electronic Packaging Materials, Biomaterials	
<b>Unit –IV</b>	<b>07 Hrs</b>
<b>Heat Treatment</b> Post Processing heat treatment of electronic devices for long duration, Thermal Oxidation, Diffusion, Rapid Thermal Processing for electronic devices, Heat treatment, stress relieving, Annealing, spheroidizing, Normalizing, hardening, Tempering process, Ferrous heat treatment, formation of austenite of heating, construction of Time Temperature Transformation curves. Special heat treatment such as carburizing, nitriding, Cyaniding, Surface hardening, Flame and induction hardening, defect in the heat treatment	
<b>Unit-V</b>	<b>07 Hrs</b>
<b>Nanomaterials</b> Introduction, Synthesis of Nanomaterials: ball milling, Solgel, Vapour deposition growth, pulse laser, Magnetron sputtering, lithography. Nano porous Materials such Zeolites, mesoporous materials, carbon nanotubes and graphene. Characterisation such as Nano structure, spectroscopic technique, automatic force microscopy, FRPs, fabrics bioresorbable and bio-erodable materials, ceramic, glasses, biomaterials: biocompatibility, implant associated materials	

<b>Course Outcomes: After completing the course, the students will be able to:</b>	
<b>CO1</b>	Understand behaviour of various materials such as metals, composites and special materials
<b>CO2</b>	Analyse materials, composition, and their phase transformation
<b>CO3</b>	Investigate solidification process during casting and materials degradation
<b>CO4</b>	Recognize different types of Non-destructive testing methods to find subsurface defects in the materials.

<b>Reference Books</b>	
1.	Material Science and Engineering, William D Callister, 6 <sup>th</sup> Edition, 1997, John Wiley and Sons, ISBN: 9812-53-052-5
2.	Introduction to Physical Metallurgy, Sydney H Avner, 1994, Mc. Graw Hill Book Company, ISBN: 0-07-Y85018-6
3.	Material Science and Engineering, William F Smith, 4 <sup>th</sup> Edition, 2008, Mc. Graw Hill Book Company, ISBN: 0-07-066717-9

<b>RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)</b>		
#	COMPONENTS	MARKS
1.	<b>QUIZZES:</b> Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. <b>THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.</b>	<b>20</b>
2.	<b>TESTS:</b> Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. <b>FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.</b>	<b>40</b>
3.	<b>EXPERIENTIAL LEARNING:</b> Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) <b>Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS.</b>	<b>40</b>
<b>MAXIMUM MARKS FOR THE CIE THEORY</b>		<b>100</b>

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5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
<b>TOTAL</b>		<b>100</b>

Semester: III / IV						
BIO SAFETY STANDARDS AND ETHICS						
Category: PROFESSIONAL CORE COURSE						
(Theory)						
(Common to all Programs)						
Course Code	:	BT232AT/ BT242AT		CIE	:	100 Marks
Credits: L: T:P	:	3:0:0		SEE	:	100 Marks
Total Hours	:	45L		SEE Duration	:	3 Hours

Unit-I	09 Hrs
<b>Biohazards, Bio safety levels and cabinets:</b> Introduction to Biohazards, Biological Safety levels, Bio safety Cabinets, Study of various types of Bio safety cabinets. Various parameters for design of Biosafety cabinets (Materials used for fabrication, sensors, filters, pumps, compressors)	
Unit – II	08 Hrs
<b>Biosafety Guidelines:</b> Biosafety guidelines of Government of India, GMOs & LMOs, Roles of Institutional Biosafety Committee, RCGM (Review Committee on Genetic Manipulation), GEAC (Genetic Engg Approval Committee) for GMO applications in food and agriculture. Overview of National Regulations and relevant International Agreements including Cartagena Protocol.	
Unit –III	10 Hrs
<b>Food safety standards:</b> FSSAI (Food Safety and Standards Authority of India), Functions, License, types of FSSAI Licences and compliance rules. <b>Food Hygiene:</b> General principles of food microbiology and overview of foodborne pathogens, sources of microorganisms in the food chain (raw materials, water, air, equipment, etc.) Quality of foods, Microbial food spoilage and Foodborne diseases, Overview of beneficial microorganisms and their role in food processing and human nutrition, Food Analysis and Testing, General principles of food safety management systems, Hazard Analysis Critical Control Point (HACCP).	
Unit –IV	09 Hrs
<b>Food Preservations, processing, and packaging</b> Food Processing Operations, Principles, Good Manufacturing Practices HACCP, Good production, and processing practices (GMP, GAP, GHP, GLP, BAP, etc) Overview of food preservation methods and their underlying principles including novel and emerging methods/principles Overview of food packaging methods and principles including novel packaging materials.	
Unit-V	09 Hrs
<b>Food safety and Ethics:</b> Food Hazards, Food Additives, Food Allergens Drugs, Hormones, and Antibiotics in Animals. Factors That Contribute to Foodborne Illness, Consumer Lifestyles and Demand, Food Production and Economics, History of Food Safety, The Role of Food Preservation in Food Safety. Ethics: Clinical ethics, Health Policy, Research ethics, ethics on Animals. Biosafety and Bioethics.	

Course Outcomes: After completing the course, the students will be able to:	
CO1	Have a comprehensive knowledge of Biohazards and bio safety levels
CO2	Understand the biosafety guidelines and their importance to the society
CO3	Acquire knowledge with respect to the Food standards, Hygiene, food processing and packing
CO4	Appreciate the food safety, Ethics, biosafety and bio ethics

Reference Books	
1.	Deepa Goel, Shomini Parashar IPR, Biosafety and Bioethics 1st Edition, 2013 ,ISBN :978-8131774700.
2.	Cynthia A Roberts, The Food Safety, Oryx Press, first edition, 2001, ISBN: 1-57356-305-6.
3.	Hal King, <a href="#">Food Safety Management Systems, Springer Cham, 2020, ISBN: 978-3-030-44734-2.</a>
4.	Alastair V. Campbell , <a href="#">Bioethics: The Basics, Routledge; 2nd edition, 2017, ISBN: 978-0415790314.</a>

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	COMPONENTS	MARKS
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2.	<b>TESTS:</b> Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. <b>FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.</b>	40
3.	<b>EXPERIENTIAL LEARNING:</b> Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) <b>ADDING UPTO 40 MARKS.</b>	40
MAXIMUM MARKS FOR THE CIE THEORY		100

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	CONTENTS	MARKS
<b>PART A</b>		
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<b>PART B</b> (Maximum of TWO Sub-divisions only)		
2	Unit 1: (Compulsory)	16
3 & 4	Unit 2: (Internal Choice)	16
5 & 6	Unit 3: (Internal Choice)	16
7 & 8	Unit 4: (Internal Choice)	16
9 & 10	Unit 5: (Internal Choice)	16
<b>TOTAL</b>		<b>100</b>

Semester: IV						
DESIGN AND ANALYSIS OF ALGORITHMS						
Category: PROFESSIONAL CORE COURSE						
(Theory and Practice)						
(Common to CS, IS, CD, AI & CY)						
Course Code	:	CD343AI		CIE	:	100+50 Marks
Credits: L:T:P	:	3:0:1		SEE	:	100+50 Marks
Total Hours	:	45L+30P		SEE Duration	:	3 +3 Hours

Unit-I	8Hrs
<b>Introduction- Perspectives</b> <b>Business domain:</b> Banking, Finance services, IT, Manufacturing, e-Commerce, Online services and marketing, Logistics and Supply Chain Management, Telecommunication. <b>Applications:</b> Communication & Networking, Search engines, Machine learning, Database management, Software tools development, Data organization, GPS navigation systems <b>Introduction:</b> Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithmic Efficiency: Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms. <b>Brute Force:</b> Selection Sort and Bubble Sort.	
Unit – II	10Hrs
<b>Divide and Conquer:</b> Merge sort, Quicksort, Multiplication of Long Integers, Strassen's Matrix Multiplication. <b>Decrease and Conquer:</b> Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Application of DFS and BFS.	
Unit –III	10Hrs
<b>Transform and Conquer:</b> Presorting, Heapsort, Problem reduction. <b>Space and Time Tradeoffs:</b> Sorting by Counting, Naive String Matching, Input Enhancement in String Matching: Horspool's and Boyer-Moore algorithm.	
Unit –IV	10Hrs
<b>Dynamic Programming:</b> Computing a Binomial Coefficient, Warshall's and Floyd's Algorithms, 0/1 Knapsack Problem and Memory Functions. <b>Greedy Technique:</b> Prim's Algorithm, Dijkstra's Algorithm, Huffman Trees and codes, Fractional Knapsack Problem.	
Unit-V	7 Hrs
<b>Backtracking:</b> N-Queen's Problem, Sum of Subset Problem. <b>Branch-and-Bound:</b> Travelling Salesperson Problem, Assignment Problem <b>Decision Trees:</b> Decision Trees for Sorting <b>NP and NP-Complete Problems:</b> Basic Concepts, Non- Deterministic Algorithms, P, NP, NP Complete, and NP-Hard classes	

<b>Course Outcomes: After completing the course, the students will be able to:-</b>	
CO1	Apply knowledge of computing and mathematics to algorithm analysis and design
CO2	Analyze a problem and identify the computing requirements appropriate for a solution
CO3	Apply algorithmic principles and computer science theory to the modeling for evaluation of computer-based solutions in a way that demonstrates comprehension of the trade-offs involved in design choices.
CO4	Investigate and use optimal design techniques, development principles, skills and tools in the construction of software solutions of varying complexity.
CO5	Demonstrate critical, innovative thinking, and display competence in solving engineering problems.
CO6	Exhibit effective communication and engage in continuing professional development through experiential learning.

<b>Reference Books</b>	
1.	Introduction to the Design and Analysis of Algorithms, Anany Levitin, University, 3rd Edition, 2012, Pearson, ISBN 13: 978-0-13-231681-1.
2.	Introduction to Algorithms, Cormen T.H., Leiserson C.E., Rivest R.L., Stein C., 3rd Edition, 2010, PHI, ISBN:9780262033848.
3.	Computer Algorithms, Horowitz E., Sahani S., Rajasekharan S., 2nd Edition, 2006, Galgotia Publications, ISBN:9780716783169.

### **Laboratory Component**

**Note: The following programs should be implemented in C++ language**

#### **Practice Programs:**

- Implementation and execution of simple programs to understand running time analysis of non-recursive algorithms
  - Finding maximum element in a given array.
  - Linear search,
  - Bubble sort,
  - Determine whether all the elements in a given array are distinct.
  - Given 2 NXN matrices, perform matrix multiplication using brute force approach.
- Implementation and execution of simple programs to understand running time analysis of recursive algorithms
  - Find the Factorial of a given number.
  - Print Fibonacci series
  - Given a positive decimal integer n, find the number of binary digits in n's binary representation.
  - To solve tower of Hanoi problem.
  - Recursive linear search.

#### **Lab Programs:(At-least one application from each of the following group)**

1. Apply divide and conquer strategy to solve sorting problem
  - Merge sort
  - Quicksort
2. Apply decrease and conquer strategy to solve graph problem
  - Breadth first search
  - Topological sorting using depth first search



3. Apply transform and conquer strategy
  - Heapsort
  - Checking element uniqueness after presorting
4. Apply input enhancement strategy to solve string-matching problem
  - Horspool's algorithm
  - Boyer – Moore's algorithm
5. Apply dynamic programming strategy to solve optimization problem
  - Warshall - Floyd's Algorithms,
  - Knapsack problem solution using memory function.
6. Apply greedy strategy to solve graph problem
  - Dijkstra's algorithm
  - Prim's algorithm
7. Apply backtracking strategy to solve combinatorial problem
  - N- Queen's problem
  - Subset – sum problem
8. Apply branch and bound strategy to solve combinatorial problem
  - Travelling salesperson problem
  - Assignment problem

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION		
#	COMPONENTS	MARKS
1.	<b>QUIZZES:</b> Quizzes will be conducted in online/offline mode. <b>TWO QUIZZES</b> will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	20
2.	<b>TESTS:</b> Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). <b>TWO tests will be conducted.</b> Each test will be evaluated for <b>50Marks</b> , adding upto 100 Marks. <b>FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.</b>	40
3.	<b>EXPERIENTIAL LEARNING:</b> Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing & Modeling (10) <b>Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS.</b>	40
4.	<b>LAB:</b> Conduction of laboratory exercises, lab report, observation, and analysis (30 Marks), lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (10 Marks) adding up to 50 Marks. <b>THE FINAL MARKS WILL BE 50MARKS</b>	50
<b>MAXIMUM MARKS FOR THE CIE</b>		<b>150</b>



RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	CONTENTS	MARKS
<b>PART A</b>		
1	Objective type of questions covering entire syllabus	20
<b>PART B</b> (Maximum of THREE Sub-divisions only)		
2	Unit 1 : (Compulsory)	16
3 & 4	Unit 2 : Question 3 or 4	16
5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
<b>TOTAL</b>		<b>100</b>

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	CONTENTS	MARKS
1	Write Up	10
2	Conduction of the Experiments	20
3	Viva	20
<b>TOTAL</b>		<b>50</b>



Semester: IV						
IOT AND EMBEDDED COMPUTING						
Category: PROFESSIONAL CORE COURSE						
(Theory and Practice)						
(Common to CS, CD & CY)						
Course Code	:	CS344AI		CIE	:	100+50 Marks
Credits: L:T:P	:	3:0:1		SEE	:	100+50 Marks
Total Hours	:	45L+30P		SEE Duration	:	3+3 Hours
Unit – I						9 Hrs
Introduction to Embedded Systems and Applications						
Embedded Systems: Definition, Desirable Features & General Characteristics. Embedded Systems Vs General Computing Systems, Model of an Embedded System, Classification of Embedded Systems, Examples of Embedded Systems.						
ARM Processor/Controllers: History of the ARM Processor, the ARM Core, features of ARM Processors, ARM Processor families - Cortex A, Cortex R and Cortex M.						
Interfacing and Application Development Using ARM Microcontroller:LPC 2148 ARM Microcontroller-Features of the LPC 214X Family,Internal Block Diagram of LPC 2148. Block Diagram of MCB 2140 compatible board / RV-ARM-Board, Keil IDE features for embedded application development						
Unit – II						9 Hrs
Embedded System Design using ARM Micro-controllerLPC 2148						
Digital Interfacing: LPC 2148 GPIO, Interfacing and Programming with LEDs, Switches, seven segment displays, LCD, Matrix Keypad, Stepper motor, DC Motor, Relay, Opto-isolators.						
Analog Interfacing:Analog Interfacing using LPC 2148 ADC Channels, Interfacing with LDR and Temperature sensors. Using DAC for Waveform Generations. (Programs using embedded C )						
Unit-III						9 Hrs
Timers, PWM, Interrupts & Embedded Serial protocols						
PWM, Timers and Interrupts:Timers – working of the Timer unit, Programming Timers and Writing Delay programs.Interrupts – Types, Nested Vectored Interrupt Controller, priorities and programming Timers with Interrupts. PWM – working of The Pulse Width Modulation Unit and Programming Using PWM Channels. (Programs using embedded C)						
Embedded Serial Protocols:Working & Programming of LPC 2148 UART – Registers, Baud rate calculation, Interface to PC and program development for data transmission.I2C, SPI:Working and Applications of serial protocols I2C and SPI Buses. (No programs)						
Unit – IV						9 Hrs
Internet Of Things – Introduction, Concepts and Use-Cases						
Introduction and Concepts:Definition & Characteristics of IOT, Physical Design of IOT, Logical Design of IOT, IOT Enabling technologies, Levels of IOT deployment.						
Use-Cases:Use cases of IOT pertaining to different domains.(Chapters 1,2 from the Reference book 2)						
Unit – V						9 Hrs
Design and Deployment of Internet ofThings (IOT)Applications						
IOT physical devices and End points:NodeMCU/ESP32(RV-IOT-Board),RaspberryPi: Block diagram, Features and Interfaces.						
IOT Physical Servers & Cloud Offerings: Xively /Thing Speak, AWS IOT : Features, Usage and Deployment.						
Case Studies: Case studies illustrating IOT design – Home automation, Smart Cities, Agriculture. (Chapters 5,7,8,9 from Reference book 2)						

<b>Course Outcomes: After completing the course, the students will be able to:-</b>	
<b>CO 1</b>	Apply Embedded System and IoT fundamentals and formulate sustainable societal relevant cost-effective solutions.
<b>CO 2</b>	Demonstrate the development of software programs using Embedded C, using Microcontrollers and different sensors and peripheralsto build embedded system applications.
<b>CO3</b>	Design smart systems using various I/O peripherals, Sensors, embedded protocols like UART,I2C,SPI using modern tools like Keil IDE software for various domains like Healthcare, automation, agriculture, smart cities and others.
<b>CO 4</b>	Indulge in developing Novel multi-disciplinary IoT projects using prototype boards, with effective oral & written communication skills and working in teams.
<b>CO 5</b>	Engage in Lifelong Learning by investigating and executing real world societal problems using engineering tools – Cross compilers, debuggers and simulators, emerging processor and controller-based hardware platforms, IOT cloud infrastructure & protocols.

<b>Reference Books</b>	
1.	Embedded Systems – An integrated approach, Lyla B. Das, 2013, Pearson Education, ISBN- 978-81-317-8766-3.
2.	Internet of Things – A Hands on approach, ArshdeepBahga, Vijay Madiseti, 2016, Universities Press, ISBN – 978-81-7371-954-7.
3.	Embedded Systems, Architecture, Programming and Design, Raj Kamal, 2 <sup>nd</sup> Edition-Reprint 2011, Tata McGraw-Hill, ISBN-978-0-07-066764-8.
4.	Interfacing Digital & Analog Peripherals using ARM LPC 2148 based RV-ARM-Board Handbook
5.	Internet of Things,V.K.Jain, Khanna Publications, 2021, ISBN No: 978-81-952075-2-7

<b>Laboratory Component</b>	
Laboratory Experiments comprises of,	
1.	Part A – Embedded Systems Programs Using RV-AllInOne-ARM Board with Embedded C (Keil IDE)
2.	Part B – IOT Projects, Using RV-IOT-Kit / RasberrPie, ThingSpeak / AWS Cloud, Web/MobileApp
3.	Prototype the New idea (Productathon, a hackathon style product development competition)

### **PART A:**

Laboratory Experiments using RV-ARM-Board (LPC 2148 ARM Microcontroller) comprises of,

1B) Simulator Elevator Interface using switches and LEDs.

2B) Seven Segment Display Interface: Write a C program to display messages “FIRE” & “HELP” on 4-digit seven segment display alternately with a suitable delay. Extend the program to implement moving display and displaying the numbers.

3B) Stepper Motor Interface: Write an Embedded C program to rotate stepper motor in clockwise direction for “M” steps, anti-clock wise direction for “N” steps. Extend the program to link the movement with the keys and realize the required RPM.

4B) DAC Interface: Write an Embedded C program to generate sine, full rectified, triangular, sawtooth and square waveforms using DAC module.

5B) Matrix Keyboard Interface: Write an Embedded C program to interface 4 X 4 matrix keyboard using lookup table and display the key pressed on the Terminal. Extend the program to read multi digit number.

6B) DC Motor Interface: Write an Embedded C program to generate PWM wave to control speed of DC motor. Control the duty cycle by analog input. Extend the program to link the speed with LDR/Temperature sensors.

7B) Character/Graphics LCD Interface: Write an Embedded C program to display text messages on the display.

### **PART-B**

Design & Develop IOT based Solutions, using (RV-IOT-Board / Raspberry Pi, Use ThingSpeak /AWS cloud services, Use Web Application Frameworks like Django/Mobile App using C/C++/ Python coding and relevant libraries/APIs

1b. Smart Lighting

2b. Intrusion Detection System

3b. Smart Parking

4b. Weather Monitoring System

5b. Weather Reporting Bot

6b. Forest Fire Detection

7b. Smart Irrigation

### **Prototype the New idea (Productathon)**

Then students are given specific time ( a Day or Two) to build their idea into a prototype using the previous Lab Programs carried out. Then an academic & industry panel of judges will evaluate their works and the best three prototypes will be awarded. All the students are required to submit the report, consisting of Hardware circuits, software codes and screenshots of the prototype.

<b>RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)</b>		
#	COMPONENTS	MARKS
1.	<b>QUIZZES:</b> Quizzes will be conducted in online/offline mode. <b>TWO QUIZZES</b> will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	<b>20</b>
2.	<b>TESTS:</b> Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). <b>TWO tests will be conducted.</b> Each test will be evaluated for <b>50Marks</b> , adding upto 100 Marks. <b>FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.</b>	<b>40</b>
3.	<b>EXPERIENTIAL LEARNING:</b> Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing & Modeling (10) <b>Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS.</b>	<b>40</b>
4.	<b>LAB:</b> Conduction of laboratory exercises, lab report, observation, and analysis (30 Marks), lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (10 Marks) adding up to 50 Marks. <b>THE FINAL MARKS WILL BE 50MARKS</b>	<b>50</b>
<b>MAXIMUM MARKS FOR THE CIE THEORY</b>		<b>150</b>

<b>RUBRIC FOR SEMESTER END EXAMINATION (THEORY)</b>		
Q.NO.	CONTENTS	MARKS
<b>PART A</b>		
1	Objective type of questions covering entire syllabus	20
<b>PART B</b> (Maximum of THREE Sub-divisions only)		
2	Unit 1 : (Compulsory)	16
3 & 4	Unit 2 : Question 3 or 4	16
5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
<b>TOTAL</b>		<b>100</b>

<b>RUBRIC FOR SEMESTER END EXAMINATION (LAB)</b>		
Q.NO.	CONTENTS	MARKS
1	Write Up	10
2	Conduction of the Experiments	20
3	Viva	20
<b>TOTAL</b>		<b>50</b>

Semester: IV						
COMPUTER NETWORKS						
Category: PROFESSIONAL CORE COURSE						
(Theory)						
(Common to CS, IS, CD, AI & CY)						
Course Code	:	CY245AT		CIE	:	100 Marks
Credits: L:T:P	:	3:0:0		SEE	:	100 Marks
Total Hours	:	45L		SEE Duration	:	3 Hours

Unit-I	10Hrs
Introduction-Perspectives <b>Business Domains:</b> Networks. <b>Applications:</b> Resource Sharing, Client Server programming, e-commerce and digital communications. Introduction: Networks, Network types. Network Models: TCP / IP protocol suite, Addressing, The OSI Model. Transmission Modes: Parallel Transmission and Serial Transmission. Link Layer: Data Link Control(DLC): DLC Services, Data Link Layer Protocols, High Level Data Link Control (HDLC), Point-to-Point Protocol (PPP): Framing, Transition phases. Media Access Control (MAC): Random Access: CSMA/CD,CSMA/CA.	
Unit – II	09Hrs
<b>Network layer design issues:</b> Store and Forward packet Switching, Services Provided to the Transport Layer Implementation of Connectionless Service, Implementation of Connection Oriented Service, Comparison of Virtual Circuit and Datagram Subnets; Routing algorithms: Shortest Path Routing, Flooding, Distance Vector Routing, Link state Routing, Hierarchical Routing Broadcast Routing, and Multicast Routing.	
Unit –III	08 Hrs
<b>Congestion Control Algorithms:</b> General Principles of Congestion Control, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets, Load Shedding, Jitter Control; Quality Of Service: Requirements, Techniques for Achieving Good Quality of Service Integrated Services Differentiated Services.	
Unit –IV	09 Hrs
<b>Internetworking:</b> How networks differ, How networks can be connected Connectionless Internetworking, Tunnelling, Internetwork Routing, Fragmentation. <b>The Network Layer in the Internet:</b> The IP Protocol, IP Addresses, Internet Control Protocols, OSPF-Interior Gateway Routing Protocol, BGP- Exterior Gateway Routing Protocol, IPv6.	
Unit-V	09Hrs
<b>The Internet Transport Protocols:</b> Introduction to UDP, Introduction to TCP. The TCP Service Model. <b>The TCP Protocol:</b> TCP protocol, TCP Segment Header, TCP Connection Establishment, TCP Connection Release. TCP Transmission Policy, TCP Congestion Control, TCP Timer Management. <b>Application Layer:</b> World Wide web and HTTP, Telnet.	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Apply the algorithms/techniques of routing and congestion control to solve problems related to Computer Networks.
CO2	Analyse the services provided by various layers of TCP/IP model to build effective solutions.
CO3	Design sustainable networking solutions with societal and environmental concerns by engaging in lifelong learning for emerging technology.
CO4	Exhibit network configuration, protocol usage and performance evaluation in networks.
CO5	Demonstrate the solutions using various algorithms/protocols available to address networking issues using modern tools by exhibiting team work and effective communication.

Reference Books	
1.	Data Communications and Networking, Behrouz A Forouzan, 5th Edition, 2013, Tata McGraw-Hill, ISBN –9781259064753.
2.	Computer Networks, Andrew S Tanenbaum, 5th Edition, 2014, Pearson Education; ISBN– 978-81-7758-165-2.
3.	Computer Networking, A Top-Down Approach, James Kurose and Keith Ross, 6th Edition, 2013, ISBN-13: 978-0-13-285620-1.
4.	Data and Computer Communications, William Stallings, 8th Edition, 2009, Pearson Education, ISBN-13: 978-0131392052.

### EXPERIENTIAL LEARNING

To work on Problems similar to following aspects of Networks: Modern Networking tools usage to solve problems in Networking (Path Characterization & Bandwidth Estimation, Analysing Real-time information about the global routing system, Measure latency and packet loss reason in wired and wireless network). Online data Privacy, Host/Network Intrusion detection, Detection of potential DDoS attacks, Network analysis to monitor Ethernet and WLAN traffic in real time, IP Spoofing, TCP Off path attacks, Privacy Preserving network log data, wireless Security).

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	COMPONENTS	MARKS
1.	<b>QUIZZES:</b> Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. <b>THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.</b>	20
2.	<b>TESTS:</b> Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. <b>FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.</b>	40
3.	<b>EXPERIENTIAL LEARNING:</b> Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) <b>Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS.</b>	40
<b>MAXIMUM MARKS FOR THE CIE THEORY</b>		<b>100</b>

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	CONTENTS	MARKS
<b>PART A</b>		
1	Objective type questions covering entire syllabus	20
<b>PART B</b> (Maximum of TWO Sub-divisions only)		
2	Unit 1 : (Compulsory)	16
3 & 4	Unit 2 : Question 3 or 4	16
5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
<b>TOTAL</b>		<b>100</b>



Semester: IV					
NATIONAL SERVICE SCHEME(NSS) (Practical)					
Course Code	:	HS247AL		CIE	: 50 Marks
Credits: L: T: P	:	0:0:2		SEE	: 50 Marks
Total Hours	:	26P		SEE Duration	: 02 Hrs
<b>Prerequisites:</b> <ol style="list-style-type: none"> <li>Students should have service-oriented mindset and social concern.</li> <li>Students should have dedication to work at any remote place, any time with available resources and proper time management for the other works.</li> <li>Students should be ready to sacrifice some of the timely will and wishes to achieve service-oriented targets on time.</li> </ol>					
Content					26 Hrs
<p>Students must take up any one activity on below mentioned topics and must prepare contents for awareness and technical contents for implementation of the projects and has to present strategies for implementation of the same. Compulsorily must attend one camp.</p> <p>CIE will be evaluated based on their presentation, approach, and implementation strategies. (Any one of the below mentioned activity)</p> <ol style="list-style-type: none"> <li>Helping local schools to achieve good result and enhance their enrolment in Higher/technical/ vocational education.</li> <li>Preparing an actionable business proposal for enhancing the village/ farmer income and approach for implementation.</li> <li>Developing Sustainable Water management system for rural/ urban areas and implementation approaches.</li> <li>Setting of the information imparting club for women leading to contribution in social and economic issues.</li> <li>Spreading public awareness/ government schemes under rural outreach program. (Minimum 5 programs)</li> <li>Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc...</li> <li>Social connect and responsibilities</li> <li>Plantation and adoption of plants. Know your plants</li> <li>Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing</li> <li>Waste management – Public, Private and Govt organization, 5 R's</li> <li>Water conservation techniques – Role of different stakeholders - Implementation</li> <li>Govt. School Rejuvenation and assistance to achieve good infrastructure.</li> <li>Organize National integration and social harmony events/ workshops / seminars. (Minimum 2 programs) and ONE NSS-CAMP.</li> </ol>					



<b>Course Outcomes: After completing the course, the students will be able to: -</b>	
<b>CO1</b>	Understand the importance of his/her responsibilities towards society.
<b>CO2</b>	Analyze the environmental and societal problems/ issues and will be able to design solutions for the same.
<b>CO3</b>	Evaluate the existing system and to propose practical solutions for the same for sustainable development.

<b>ASSESSMENT AND EVALUATION PATTERN</b>		
<b>WEIGHTAGE</b>	<b>50%</b>	<b>50%</b>
	<b>CIE</b>	<b>SEE</b>
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	<b>10</b>	*****
<b>EXPERIENTIAL LEARNING</b> Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	<b>10</b>	*****
Case Study-based Teaching-Learning	<b>10</b>	Implementation strategies of the project with report
Sector wise study & consolidation	<b>10</b>	
Video based seminar (4-5 minutes per student)	<b>10</b>	
<b>TOTAL MARKS FOR THE COURSE</b>	<b>50 MARKS</b>	<b>50 MARKS</b>



University, Belagavi

Semester: IV						
NATIONAL CADET CORPS(NCC)						
(Practical)						
Course Code	:	HS247BL		CIE	:	50 Marks
Credits: L:T:P	:	0:0:2		SEE	:	50 Marks
Total Hours	:	26P		SEE Duration	:	02 Hrs
Unit-I						10 Hrs
Drill: Foot Drill- Drill ki Aam Hidayaten, Word ki Command, Savdhan, Vishram, Aram Se, Murdna, Kadvar Sizing, Teen Line Banana, Khuli Line, Nikat Line, Khade Khade Salute Karna						
Unit – II						06 Hrs
Weapon Training (WT): Introduction & Characteristics of 7.62 Self Loading rifle, Identification of rifle parts						
Unit –III						06 Hrs
Adventure activities: Trekking and obstacle course						
Unit –IV						04 Hrs
Social Service and Community Development (SSCD): Students will participate in various activities throughout the semester e.g., Blood donation Camp, Swachhata Abhiyan, Constitution Day, All National Festival						

<b>Course Outcomes: After completing the course, the students will be able to: -</b>	
<b>CO1</b>	Understand that drill as the foundation for discipline and to command a group for common goal.
<b>CO2</b>	Understand the importance of a weapon its detailed safety precautions necessary for prevention of accidents and identifying the parts of weapon.
<b>CO3</b>	Understand that trekking will connect human with nature and cross the obstacles to experience army way of life.
<b>CO4</b>	Understand the various social issues and their impact on social life, Develop the sense of self-less social service for better social & community life.

<b>Reference Books</b>	
<b>1.</b>	NCC Cadet Hand Book by R K Gupta, Ramesh Publishing House, New Delhi, Book code:R-1991, ISBN: 978-93-87918-57-3, HSN Code: 49011010
<b>2.</b>	nccindia.ac.in

<b>ASSESSMENT AND EVALUATION PATTERN</b>		
<b>WEIGHTAGE</b>	<b>50%</b>	<b>50%</b>
	<b>CIE</b>	<b>SEE</b>
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	<b>10</b>	*****
<b>EXPERIENTIAL LEARNING</b> Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	<b>10</b>	*****
Case Study-based Teaching-Learning	<b>10</b>	Implementation strategies of the project with report
Sector wise study & consolidation	<b>10</b>	
Video based seminar (4-5 minutes per student)	<b>10</b>	
<b>TOTAL MARKS FOR THE COURSE</b>	<b>50 MARKS</b>	<b>50 MARKS</b>

University, Belagavi

Semester: IV						
PHYSICAL EDUCATION						
(SPORTS & ATHLETICS)						
(Practical)						
Course Code	:	HS247CL		CIE	:	50 Marks
Credits: L:T:P	:	0:0:2		SEE	:	50 Marks
Total Hours	:	26P		SEE Duration	:	2.5 Hrs
Content						26 Hrs
Topics for Viva:						
1. On rules and regulations pertaining to the games / sports						
2. On dimensions of the court, size / weight of the ball and standards pertaining to that sports / game						
3. Popular players and legends at state level / National level/ International level						
4. Recent events happened and winner / runners in that sport / game						
5. General awareness about sport / game, sports happenings in the college campus						

<b>Course Outcomes: After completing the course, the students will be able to: -</b>	
<b>CO1</b>	Understand the basic principles and practices of Physical Education and Sports.
<b>CO2</b>	Instruct the Physical Activities and Sports practices for Healthy Living.
<b>CO3</b>	To develop professionalism among students to conduct, organize & Officiate Physical Education and Sports events at schools and community level.

<b>Reference Books</b>	
<b>1.</b>	Health, Exercise and Fitness, Muller, J. P. (2000), Delhi: Sports.
<b>2.</b>	Play Field Manual, Anaika ,2005, Friends Publication New Delhi.
<b>3.</b>	IAAF Manual.
<b>4.</b>	Track and Field Marking and Athletics Officiating Manual, M.J Vishwanath,2002, Silver Star Publication, Shimoga.
<b>5.</b>	Steve Oldenburg (2015) Complete Conditioning for Volleyball, Human Kinestics.
Note: Skills of Sports and Games (Game Specific books) may be referred	

<b>ASSESSMENT AND EVALUATION PATTERN</b>		
<b>WEIGHTAGE</b>	<b>50%</b>	<b>50%</b>
	<b>CIE</b>	<b>SEE</b>
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	<b>10</b>	*****
<b>EXPERIENTIAL LEARNING</b> Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	<b>10</b>	*****
Case Study-based Teaching-Learning	<b>10</b>	Implementation strategies of the project with report
Sector wise study & consolidation	<b>10</b>	
Video based seminar (4-5 minutes per student)	<b>10</b>	
<b>TOTAL MARKS FOR THE COURSE</b>	<b>50 MARKS</b>	<b>50 MARKS</b>

Semester: IV						
MUSIC (Practical)						
Course Code	:	HS247DL		CIE	:	50 Marks
Credits: L: T: P	:	0:0:2		SEE	:	50 Marks
Total Hours	:	26P		SEE Duration	:	02 Hrs
Content						26 Hrs
1. Introduction to different genres of music 2. Evolution of genres in India: Inspiration from the world 3. Ragas, time and their moods in Indian Classical Music 4. Identification of ragas and application into contemporary songs 5. Adding your touch to a composition 6. Maths and Music: A demonstration 7. Harmonies in music 8. Chords: Basics and application into any song 9. Music Production-I 10.Music Production-II  Students have to form groups of 2-4 and present a musical performance/ a musical task which shall be given by the experts. The experts shall judge the groups and award marks for the same. CIE will be evaluated based on their presentation, approach, and implementation strategies. Students need to submit their certificates of any event they participated or bagged prizes in. This shall also be considered for CIE evaluation.						
Course Outcomes: After completing the course, the students will be able to: -						
CO1	Understand basics of Music and improve their skills.					
CO2	Appreciate the impacts on health and well-being.					
CO3	Perform and present music in a presentable manner.					
CO4	Develop skills like team building and collaboration.					
Reference Books						
1.	Music Cognition: The Basics by Henkjan Honing.					
2.	Basic Rudiments Answer Book - Ultimate Music Theory: Basic Music Theory Answer Book by Glory St Germain.					
3.	Elements Of Hindustani Classical Music by Shruti Jauhari.					
4.	Music in North India: Experiencing Music, Expressing Culture (Global Music Series) by George E. Ruckert.					



<b>ASSESSMENT AND EVALUATION PATTERN</b>		
<b>WEIGHTAGE</b>	<b>50%</b>	<b>50%</b>
	<b>CIE</b>	<b>SEE</b>
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	<b>10</b>	*****
<b>EXPERIENTIAL LEARNING</b> Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	<b>10</b>	*****
Case Study-based Teaching-Learning	<b>10</b>	Implementation strategies of the project with report
Sector wise study & consolidation	<b>10</b>	
Video based seminar (4-5 minutes per student)	<b>10</b>	
<b>TOTAL MARKS FOR THE COURSE</b>	<b>50 MARKS</b>	<b>50 MARKS</b>

<b>Semester: IV</b>					
<b>DANCE (Practical)</b>					
<b>Course Code</b>	<b>:</b>	<b>HS247EL</b>		<b>CIE</b>	<b>:</b> <b>50 Marks</b>
<b>Credits: L:</b>	<b>:</b>	<b>0:0:2</b>		<b>SEE</b>	<b>:</b> <b>50 Marks</b>
<b>T: P</b>					
<b>Total Hours</b>	<b>:</b>	<b>26P</b>		<b>SEE Duration</b>	<b>:</b> <b>02 Hrs</b>
<b>Contents</b>					<b>26 Hrs</b>
<ol style="list-style-type: none"> <li>1. Introduction to Dance</li> <li>2. Preparing the body for dancing by learning different ways to warm up.</li> <li>3. Basics of different dance forms i.e., classical, eastern, and western.</li> <li>4. Assessing the interest of students and dividing them into different styles based on interaction.</li> <li>5. Advancing more into the styles of interest.</li> <li>6. Understanding of music i.e., beats, rhythm, and other components.</li> <li>7. Expert sessions in the respective dance forms.</li> <li>8. Activities such as cypher, showcase to gauge learning.</li> <li>9. Components of performance through demonstration.</li> <li>10. Introduction to choreographies and routines.</li> <li>11. Learning to choreograph.</li> <li>12. Choreograph and perform either solo or in groups.</li> </ol>					

<b>Course Outcomes: After completing the course, the students will be able to: -</b>	
<b>CO1</b>	Understand the fundamentals of dancing.
<b>CO2</b>	Adapt to impromptu dancing.
<b>CO3</b>	Ability to pick choreography and understand musicality.
<b>CO4</b>	To be able to do choreographies and perform in front of a live audience.

<b>Reference Books</b>	
<b>1.</b>	Dance Composition: A practical guide to creative success in dance making, Jacqueline M. Smith

<b>ASSESSMENT AND EVALUATION PATTERN</b>		
<b>WEIGHTAGE</b>	<b>50%</b>	<b>50%</b>
	<b>CIE</b>	<b>SEE</b>
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	<b>10</b>	*****
<b>EXPERIENTIAL LEARNING</b> Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	<b>10</b>	*****
Case Study-based Teaching-Learning	<b>10</b>	Implementation strategies of the project with report
Sector wise study & consolidation	<b>10</b>	
Video based seminar (4-5 minutes per student)	<b>10</b>	
<b>TOTAL MARKS FOR THE COURSE</b>	<b>50 MARKS</b>	<b>50 MARKS</b>

<b>Semester: IV</b>					
<b>Theater (Light Camera &amp; Action) (Practical)</b>					
<b>Course Code</b>	<b>:</b>	<b>HS247FL</b>		<b>CIE</b>	<b>:</b> <b>50 Marks</b>
<b>Credits: L:T:P</b>	<b>:</b>	<b>0:0:2</b>		<b>SEE</b>	<b>:</b> <b>50 Marks</b>
<b>Total Hours</b>	<b>:</b>	<b>26P</b>		<b>SEE Duration</b>	<b>:</b> <b>02 Hrs</b>
<b>Contents</b>					<b>26 Hrs</b>
1. Break the ICE 2. Introduction to freedom Talk to each and every single person for a period of 5 complete minutes. This is aimed at to make everyone in the room comfortable with each other. This helps everyone get over social anxiety, Shyness and Nervousness. 3. Ura 4. Rhythm Voice Projection, Voice Modulation, Weeping & Coughing Voice projection is the strength of speaking or singing whereby the voice is used powerfully and clearly. It is a technique employed to command respect and attention, as when a teacher talks to a class, or simply to be heard clearly, as used by an actor in a theatre. 5. It's Leviosa, Not Leviosaaa! 6. Speech work: Diction, Intonation, Emphasis, Pauses, Pitch and Volume Tempo Dialogues delivery. The art of dialogue delivery plays a vital role in in ensuring the efficacy of communication especially from the dramatic aspect of it, this unit discusses some tips to help the young actors improve their dialogue delivery skills: 7. Elementary, My dear Watson. 8. Responsibilities of an actor tools of an actor character analysis Observations aspects, Stage presence, concentration, conviction, confidence, energy and directionality. 9. Show time 10. Pick a genre: COMEDY, THRILLER, HORROR, and TRAGEDY: Showcase a performance. Stylized acting with reference to historical and mythological plays. Mime: conventional, occupational and pantomime Mono acting: different types of characters					

<b>Course Outcomes: After completing the course, the students will be able to: -</b>	
<b>CO1</b>	Develop a range of Theatrical Skills and apply them to create a performance.
<b>CO2</b>	Work collaboratively to generate, develop, and communicate ideas.
<b>CO3</b>	Develop as creative, effective, independent, and reflective students who are able to make informed choices in process and performance.
<b>CO4</b>	Develop an awareness and understanding of the roles and processes undertaken in contemporary professional theatre practice.

<b>Reference Books</b>	
<b>1.</b>	The Empty Space by Peter Brook.
<b>2.</b>	The Viewpoints Book: A Practical Guide to Viewpoints and Composition by Anne Bogart and Tina Landau.



<b>ASSESSMENT AND EVALUATION PATTERN</b>		
<b>WEIGHTAGE</b>	<b>50%</b>	<b>50%</b>
	<b>CIE</b>	<b>SEE</b>
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	<b>10</b>	*****
<b>EXPERIENTIAL LEARNING</b> Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	<b>10</b>	*****
Case Study-based Teaching-Learning	<b>10</b>	Implementation strategies of the project with report
Sector wise study & consolidation	<b>10</b>	
Video based seminar (4-5 minutes per student)	<b>10</b>	
<b>TOTAL MARKS FOR THE COURSE</b>	<b>50 MARKS</b>	<b>50 MARKS</b>



Semester: IV					
ART WORK & PAINTING (Practical)					
Course Code	:	HS247GL		CIE	: 50 Marks
Credits: L: T: P	:	0:0:2		SEE	: 50 Marks
Total Hours	:	26P		SEE Duration	: 02 Hrs
Contents					26 Hrs
<ol style="list-style-type: none"> <li>1. Use points, line and curves to create various shapes and forms</li> <li>2. Use of shapes and forms to create various objects and structures</li> <li>3. Recognizing distinctions in objects when viewed from various perspectives and grasping basic notions of perspective</li> <li>4. Students will be introduced to the significance of color in art, as well as the principles of color theory and application.</li> <li>5. Applied the concepts of unity, harmony, balance, rhythm, emphasis and proportion, abstraction and stylization to create a composition.</li> <li>6. Learn how to use which materials and for what types of art and textures.</li> <li>7. Use of the above concepts to create art through the medium of collage, mosaic, painting, mural, batik, tie and dye.</li> <li>8. Real world application of the above concepts in the form of book cover design and illustration, cartoon, poster, advertisements, magazine, computer graphics and animation</li> <li>9. Familiarization with the many art forms and techniques of expression found throughout India.</li> </ol> <p style="text-align: center;">AND</p> <p style="text-align: center;">ONE EDUCATIONAL VISIT TO AN ART MUSEUM / INSTITUTE / GALLERY</p> <p>Students must turn in assignments for each of the above said topics on a weekly basis and have to compulsorily take part in the museum visit. CIE will be evaluated based on a still life piece, a composition using any one of the media of composition and a presentation on Indian art styles and creation of a piece pertaining to the presented art style.</p>					

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Use lines, shapes, and colors to depict the various sentiments and moods of life and nature.
CO2	Use one's creativity to develop forms and color schemes, as well as the ability to portray them effectively in drawing and painting on paper.
CO3	Develop the ability to properly use drawing and painting materials (surfaces, tools and equipment, and so on).
CO4	Improve their observation abilities by studying everyday items as well as numerous geometrical and non- geometrical (i.e., organic) shapes found in life and nature and to hone their drawing and painting talents in response to these insights.

Reference Books	
1.	Catching the Big Fish: Meditation, Consciousness, and Creativity, David Lynch
2.	Art & Fear: Observations on the Perils (and Rewards) of Artmaking, David Bayles & Ted Orland





ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	50%	50%
	CIE	SEE
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	10	*****
<b>EXPERIENTIAL LEARNING</b> Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	10	*****
Case Study-based Teaching-Learning	10	Implementation strategies of the project with report
Sector wise study & consolidation	10	
Video based seminar (4-5 minutes per student)	10	
<b>TOTAL MARKS FOR THE COURSE</b>	<b>50 MARKS</b>	<b>50 MARKS</b>

Semester: IV					
PHOTOGRAPHY & FILM MAKING (Practical)					
Course Code	:	HS247HL		CIE	: 50 Marks
Credits: L: T: P	:	0:0:2		SEE	: 50 Marks
Total Hours	:	26P		SEE Duration	: 02 Hrs
Contents					26 Hrs
<ol style="list-style-type: none"> <li>1. Introduction to photography.</li> <li>2. Understanding the terminologies of DSLR.</li> <li>3. Elements of photography.</li> <li>4. Introduction to script writing, storyboarding.</li> <li>5. Understanding the visualization and designing a set.</li> <li>6. Basics of film acting</li> <li>7. Video editing using software</li> <li>8. Introduction to cinematography.</li> <li>9. Understanding about lighting and camera angles.</li> <li>10. Shooting a short film.</li> </ol> <p>Students must form groups of 2-4 and present a short film which shall be given by the experts. The experts shall judge the groups and award marks for the same.</p> <p>CIE will be evaluated based on their presentation, approach and implementation strategies. Students need to submit their certificates of any event they participated or bagged prizes in. This shall also be considered for CIE evaluation.</p>					

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Understand basics of photography and videography and improve their skills.
CO2	Appreciate the skills acquired from photography.
CO3	Perform and present photos and films in a presentable manner.
CO4	Develop skills like team building and collaboration.

Reference Books	
1.	Read This If You Want to Take Great Photographs – Henry Carroll
2.	The Digital Photography Book: Part 1 – Scott Kelby

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	50%	50%
	CIE	SEE
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	10	*****
<b>EXPERIENTIAL LEARNING</b> Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	10	*****
Case Study-based Teaching-Learning	10	Implementation strategies of the project with report
Sector wise study & consolidation	10	
Video based seminar (4-5 minutes per student)	10	
<b>TOTAL MARKS FOR THE COURSE</b>	<b>50 MARKS</b>	<b>50 MARKS</b>



**RV Educational Institutions<sup>®</sup>**  
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Autonomous  
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New Delhi

*Go, change the world*

Semester: IV					
UNIVERSAL HUMAN VALUES					
(Theory)					
(Common to all Programs)					
Course Code	:	HS248XT		CIE	: 50 Marks
Credits: L:T:P	:	2:0:0		SEE	: 50 Marks
Total Hours	:	28L		SEE Duration	: 02 Hours

Unit-I	10 Hrs
<p><b>Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:</b> Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration 'Natural Acceptance' and Experiential Validation Continuous Happiness and Prosperity- Human Aspirations, Right understanding, Relationship and Physical Facility, Understanding Happiness and Prosperity correctly. Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility.</p> <p><b>Understanding Harmony in the Human Being - Harmony in Myself!:</b> Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' Understanding the Body as an instrument of Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health; Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life.</p>	
Unit – II	10 Hrs
<p><b>Understanding Harmony in the Family and Society- Harmony in Human Human Relationship:</b> Understanding values in human-human relationship; meaning of Justice and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust.</p> <p>Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.</p> <p>Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives</p>	
Unit –III	08 Hrs
<p><b>Understanding Harmony in the Nature and Existence - Whole existence as Coexistence:</b> Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all pervasive space, Holistic perception of harmony at all levels of existence.</p> <p>Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.</p>	

Course Outcomes: After completion of the course the students will be able to	
CO1	Become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions,
CO2	Understand human relationships and human nature in mind so that they will have better critical ability.
CO3	Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO4	Apply what they have learnt to their own self in different day-to-day settings in real life.

Reference Books	
1	Human Values and Professional Ethics, R. R. Gaur, R Sangal, G P Bagaria, 1st Edition, 2010, Excel Books, New Delhi, ISBN: 9788174467812.
2	Human Values, A.N. Tripathi, 3rd Edition, 2019, New Age Intl. Publishers, New Delhi, ISBN: 9788122425895.
3	India Wins Freedom, Maulana Abdul Kalam Azad, 1st Edition, 1988, Orient Blackswan, ISBN: 97881250051481.
4	The Story of My Experiments with Truth, Mohandas Karamchand Gandhi, 1st Edition, 2011, Create Space Publishing platform, ISBN: 9781463694876.
5	Small is Beautiful, E. F Schumacher, 1st Edition, 2011, (PBD)VINTAGE, ISBN: 9780099225614.

ASSESSMENT AND EVALUATION PATTERN												
This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation. Example: Assessment by faculty mentor: 10 marks Self-assessment: 10 marks Assessment by peers: 10 marks Socially relevant project/Group Activities/Assignments: 20 marks Semester End Examination: 50 marks. The overall pass percentage is 40%. In case the student fails, he/she must repeat the course												
CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	3	1	3	3	-	-	3
CO2	-	-	-	-	-	2	1	3	3	-	-	3
CO3	-	-	-	-	-	2	1	3	3	-	-	3
CO4	-	-	-	-	-	3	1	3	3	-	-	3

**High-3: Medium-2: Low-1**

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (LAB)		
#	COMPONENTS	MARKS
1.	<b>QUIZZES:</b> Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 05 Marks. <b>THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.</b>	10
2.	<b>TESTS:</b> Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). <b>TWO</b> tests will be conducted. Each test will be evaluated for 25 Marks, adding upto 50 Marks. <b>FINAL TEST MARKS WILL BE REDUCED TO 20 MARKS.</b>	20
3.	<b>EXPERIENTIAL LEARNING:</b> Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video based seminar/presentation/demonstration (10). <b>Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). THE SUM OF ALL WILL BE THE FINAL MARKS OF 20.</b>	20
<b>MAXIMUM MARKS FOR THE CIE THEORY</b>		<b>50</b>

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	CONTENTS	MARKS
<b>PART A</b>		
1	Objective type questions covering entire syllabus	10
<b>PART B</b> (Maximum of TWO Sub-divisions only)		
2	Unit 1 : (Compulsory)	14
3 & 4	Unit 2 : Question 3 or 4	13
5 & 6	Unit 3 : Question 5 or 6	13
<b>TOTAL</b>		<b>50</b>

Semester: IV						
Bridge Course: MATHEMATICS (Mandatory Audit Course) (Common to all Programs)						
Course Code	:	MAT149DT		CIE	:	50 Marks
Credits: L: T:P	:	2:0:0		SEE	:	NO SEE(AUDIT COURSE)
Total Hours	:	30L				

Unit-I					10Hrs
<b>Multivariable Calculus:</b> <b>Partial Differentiation:</b> Introduction, simple problems. Total derivative, composite functions. Jacobians – simple problems. <b>Vector Differentiation:</b> Introduction, velocity and acceleration, gradient, divergence – solenoidal vector function, curl – irrotational vector function and Laplacian, simple problems.					
Unit – II					10Hrs
<b>Differential Equations:</b> Higher order linear differential equations with constant coefficients, solution of homogeneous equations - Complementary functions. Non-homogeneous equations–Inverse differential operator method of finding particular integral based on input function (force function).					
Unit –III					10Hrs
<b>Numerical Methods:</b> Solution of algebraic and transcendental equations – Intermediate value property, Newton-Raphson method. Solution of first order ordinary differential equations – Taylor series and 4 <sup>th</sup> order Runge-Kutta methods. Numerical integration – Simpson's 1/3 <sup>rd</sup> , 3/8 <sup>th</sup> and Weddle's rules. (All methods without proof).					

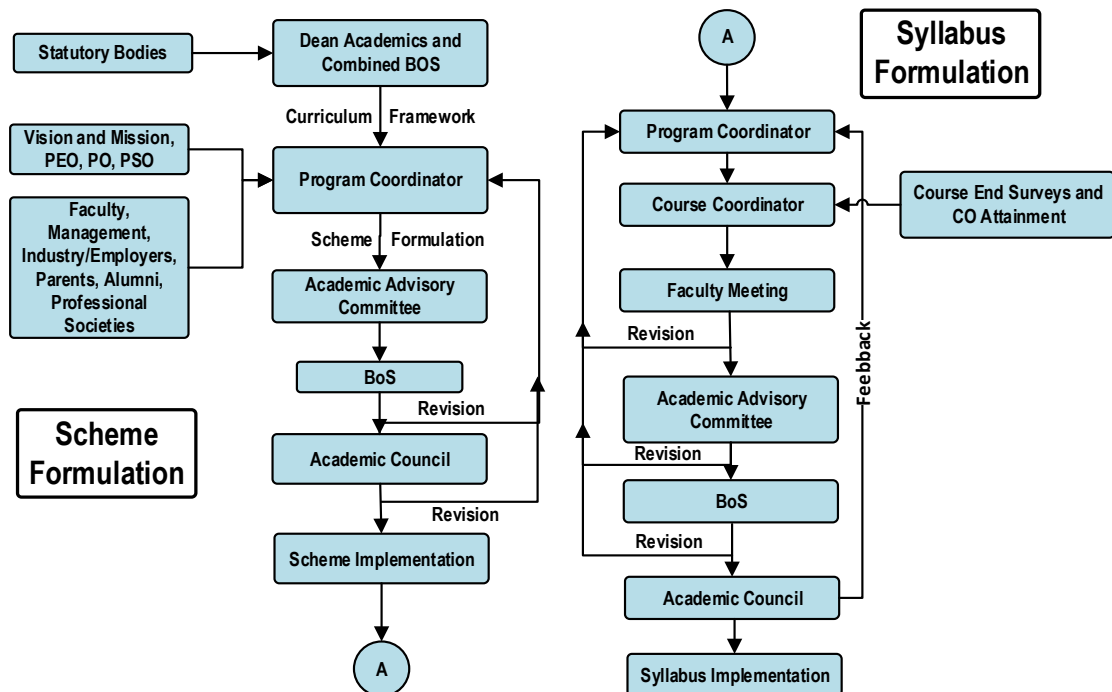
Course Outcomes: After completing the course, the students will be able to	
<b>CO1:</b>	Illustrate the fundamental concepts of partial differentiation, vector differentiation, higher order linear differential equations and numerical methods.
<b>CO2:</b>	Derive the solution by applying the acquired knowledge of differential calculus, differential equations, velocity, and acceleration vectors to the problems of engineering applications.
<b>CO3:</b>	Evaluate the solution of the problems using appropriate techniques of differential calculus, vector differentiation, differential equations, and numerical methods.
<b>CO4:</b>	Compile the overall knowledge of differential calculus, vector differentiation, differential equations and numerical methods gained to engage in life – long learning.

Reference Books	
1	Higher Engineering Mathematics, B.S. Grewal, 44 <sup>th</sup> Edition, 2015, Khanna Publishers, ISBN: 978-81-933284-9-1.
2	Higher Engineering Mathematics, B.V. Ramana, 11 <sup>th</sup> Edition, 2010, Tata McGraw-Hill, ISBN: 978-0-07-063419-0.
3	A Textbook of Engineering Mathematics, N.P. Bali & Manish Goyal, 7 <sup>th</sup> Edition, 2010, Lakshmi Publications, ISBN: 978-81-31808320.
4	Advanced Engineering Mathematics, E. Kreyszig, 10 <sup>th</sup> Edition (Reprint), 2016. John Wiley & Sons, ISBN: 978-0470458365.

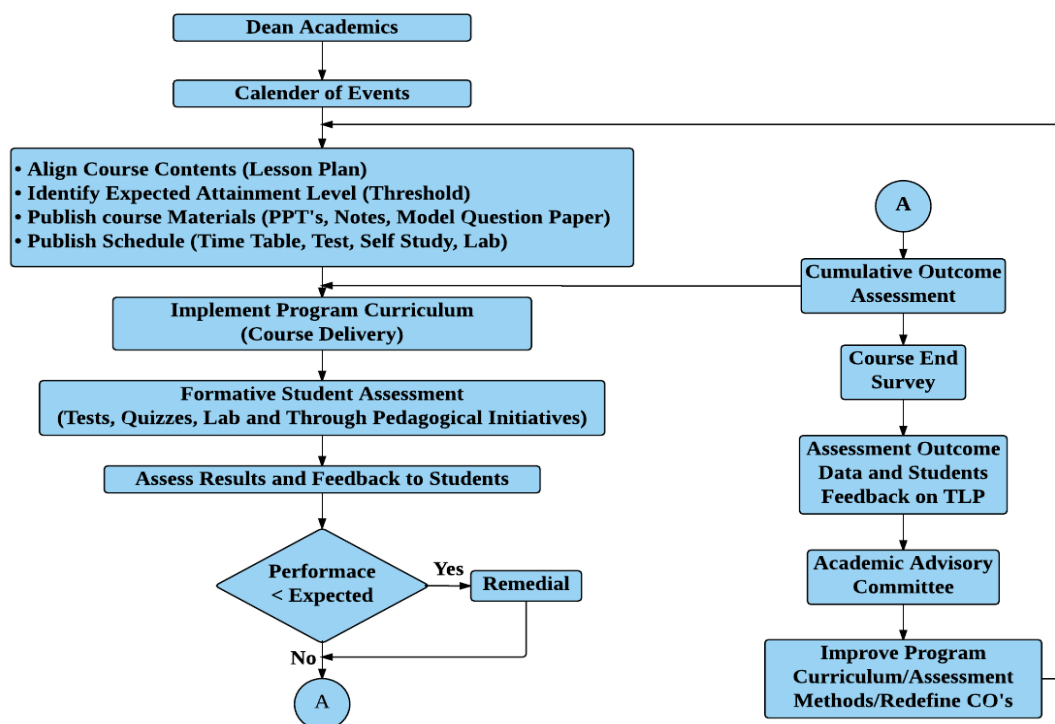


<b>RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)</b>		
<b>#</b>	<b>COMPONENTS</b>	<b>MARKS</b>
1.	<b>QUIZZES:</b> Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. <b>THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.</b>	<b>20</b>
2.	<b>TESTS:</b> Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 30 Marks, adding upto 60 Marks. <b>FINAL TEST MARKS WILL BE AVERAGE OF TWO TESTS.</b>	<b>30</b>
<b>MAXIMUM MARKS FOR THE CIE THEORY</b>		<b>50</b>

## Curriculum Design Process

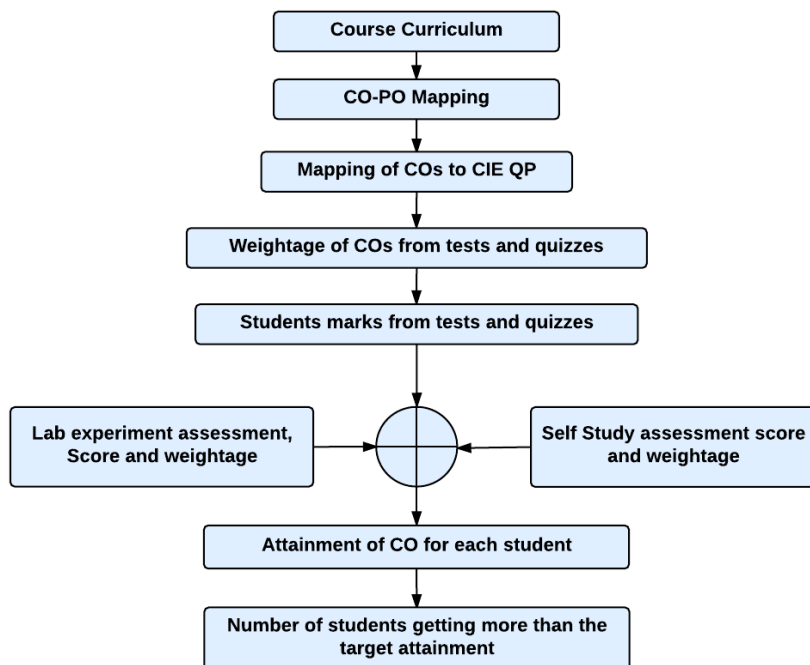


## Academic Planning And Implementation

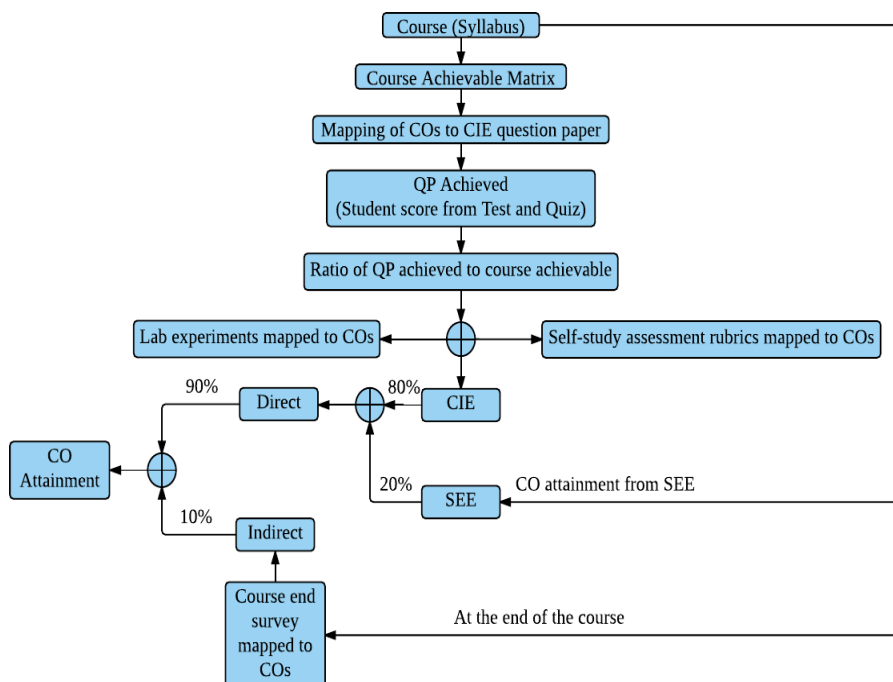




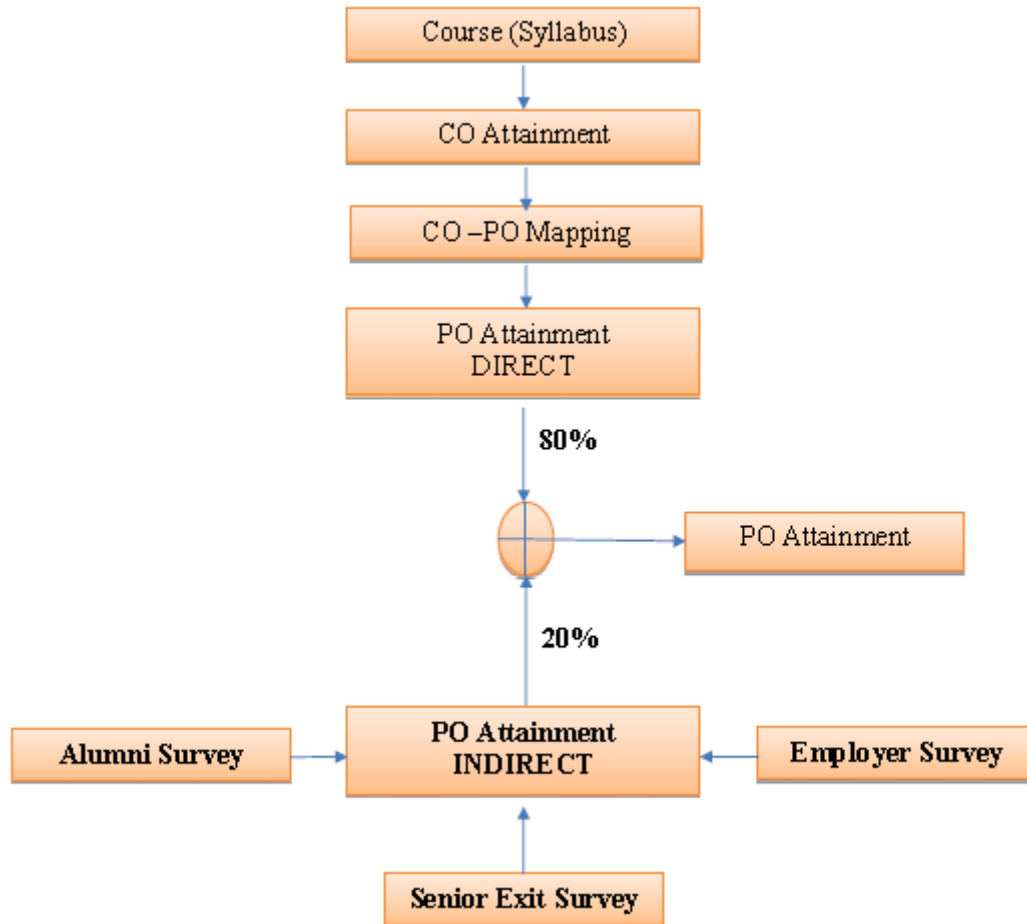
## Process For Course Outcome Attainment



## Final CO Attainment Process



### Program Outcome Attainment Process





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**PROGRAM OUTCOMES (POs)**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



# RV College of Engineering®

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Technological  
University, Belagavi

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