BASAVESHWAR ENGINEERING COLLEGE(AUTONOMOUS), BAGALKOT

MODEL COURSE PLAN

Title of Course	:	Universal Human Values-II	Course Code	:	22UHS424C
Credits	:	1	Lecture Hours/Week	:	01
Total Lecture Hours	:	15	Tutorial Hours	:	00
CIE Marks	:	50	SEE Marks	:	50
Semester	:	IV	Year	:	2024-25(Even)
Faculty Name	:	Prof. R.S.Allurakar	HOD Signature	:	

Prerequisites: Nil

Course Objectives:

1	To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2	TofacilitatethedevelopmentofaHolisticperspectiveamongstudentstowardslifeandprofessionas wellastowardshappinessandprosperitybasedonacorrectunderstandingoftheHumanrealityand the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3	TohighlightplausibleimplicationsofsuchaHolisticunderstandingintermsofethicalhumanconduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4	Development of commitment and courage to act**.**

Course Outcomes:

	On successful completion of this course, students will be able to
1	Explore holistic vision of life - themselves and their surroundings.
2	Develop competence and capabilities for maintaining Health and Hygiene.
3	Analyse various problems in life, family, Society and in handling problems with Sustainable Solutions.
4	Apply values to their own self in different day-to-day settings inreal life and in handling problems with sustainable solutions.
5	Adopt the value of appreciation and aspiration for excellence and gratitude for all.

Course Articulation Matrix: Mapping of Course Outcomes(CO)with Programme Outcomes(PO)and Programme Specific Outcomes(PSO)

		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
No	Programme Outcomes / Course Outcomes															
The Students will be able to:																
1	Explore holistic vision of life - themselves and their surroundings.							3	2	3			1			
2	Develop competence and capabilities for maintaining Health and Hygiene.						3	3	1	1			1			
3	Analyse various problems in life, family, Society and in handling problems with Sustainable Solutions.						3	3	2	1			1			
4	Apply values to their own self in different day-to-day settings in real life and in handling problems with sustainable solutions.						2	2	3	2			1			
5	Adopt the value of appreciation and aspiration for excellence and gratitude for all.								3				1			

Competencies Addressed in the course and Corresponding Performance Indictors

Programme Outcome: Any of 1 to 12 PO's:

Competency	Indicators
Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts.	**7.1.1- Identify the risks / impacts in the life cycle of an engineering product or activity** **7.1.2- Understand the relationship between the technical, socio-economic environmental dimensions of sustainability.**

Unit Learning Outcomes(ULO)

Sl.No	Unit Learning Outcomes(ULO)	CO's	BLL	CA addresses
	Unit-I			
1	Explore holistic vision of life - themselves and their surroundings..	**1**	**L1**	**7.1.1**
	Unit- II			
1	Develop competence and capabilities for maintaining Health and Hygiene.	**2**	**L1**	**7.1.1**
	Unit-III			
1	Analyse various problems in life, family, Society and in handling problems with Sustainable Solutions.	**2 & 3**	**L1**	**7.1.1**
	Unit-IV			
1	Apply values to their own self in different day-to-day settings inreal life and in handling problems with sustainable solutions.	**3 & 4**	**L1**	**7.1.2**
2	Adopt the value of appreciation and aspiration for excellence and gratitude for all.	**4**	**L1**	**7.1.1**

Course Content:

Sl.No	Hours Required	Topic to be covered	Mode of Delivery
1	**01**	Right Understanding; Relationship and Physical Facility	**Combined - Chalk and Talk Lecture with discussion PPT and conducting quizzes**
2	**01**	Understanding Value Education; Self-exploration as the Process for Value Education	
3	**01**	Continuous Happiness and Prosperity	
4	**01**	The Basic Human aspiration-Current Scenario and Method to Fulfil the Basic Human Aspirations	
5	**01**	Understanding Human being as the Co-existence of the Self and the Body, ,	
6	**01**	Distinguishing between the Needs of the Self and the Body. The Body as an Instrument of the Self	
7	**01**	Understanding Harmony in the Self,	
8	**01**	Harmony of the Self with the Body, Programme to ensure self-regulation and Health.	
9	**01**	Harmony in the Family – the Basic Unit of Human Interaction; 'Trust' – the Foundational Value in Relationship.;	
10	**01**	'Respect' – as the Right Evaluation: Other Feelings, Justice in Human-to-Human Relationship;	
11	**01**	Understanding Harmony in the Society; Vision for the Universal Human Order	
12	**01**	Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature.	
13	**01**	Definitiveness of (Ethical) Human Conduct; A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order.	
14	**01**	Competence in Professional Ethics; Holistic Technologies,	
15	**01**	Production Systems and Management Models; Strategies for Transition towards Value-based Life and Profession.	

Review Questions:

Review Questions	ULO	BLL
Unit-I		
1. The process to understand human _____ is self exploration. a. Goal b. Values c. Aspirations d. All of the above **2. In this course, whatever is being said is a _____ for an individual.** a. Conclusion b. Decision c. Proposal d. Request **3. Natural acceptance is?** a. Universal b. Definite c. Continuous d. All of the above **4. Self exploration is a process of _____ through self investigation.** a. Self-Evolution b. Self Verification c. Experience d. All of the above **5.What is the goal of UHV -II course** a. To explore human reality b. To explore into nature and existence as coexistence c. To understand the role of human being d. All the above **6.To understand the role of human being what we try to understand in UHV-II** a. To understand the co-existence b. To have the feeling and the thought of coexistence. To live in coexistence in mutual relation with human being and the rest of nature d. All the above **7. Harmony within myself is known as _____.** a. Excitement b. Happiness c. Both d. None of the above **8. Happiness is the state of _____.** a. Excitement b. Harmony c. Satisfaction d. Pleasure **9. Continuous happiness and prosperity are the _____.** a. Impractical thought b. Impossible desires b. Basic human aspirations d. None of the above **10. _____ means harmony within myself.** a. Happiness b. Pleasure c. Excitement d. All	1	L1
Unit-II		
1.Harmony within myself is known as _____. a. Excitement b. Happiness c. Both a & b d. None of the above **2. _____ means harmony within myself.** a. Happiness b. Pleasure c. Excitement d. All **3.To be in a state of liking is _____.** a. Prosperity b. Happiness c. Stress d. Selfishness 4**. Animal consciousness is** a. Giving weight age to physical facilities, to the maximization of sensory pleasures, to accumulation of wealth. b. Giving weight age to relationships, to the inherent feelings, and right understanding. c. Both d. none **5.Existence is** a. Unit submerged in space b. Gathensheel and Gathanpurn c. none of the above d. both a and b **6. The activities of body (in response) are: (i) Assuming (ii) Knowing (iii) Recognizing(iv) Fulfilling**	2	L1

a. i &ii b. iii& iv c. ii&iv d. i&iv **7. "Seeing the Self by the Self" means.** a. The consciousness observing the consciousnessb.The consciousness observing the material c. The consciousness observing the co-existence d.None **8. Which statement is correct about existence?** a. To understand and to live in harmony at the level of Individual b. There are two realities in this existence-Units and Space c. Whatever exists is existence d. All **9. What is/are the program for "Continuous Happiness"?** a. To understand and to live in harmony at the level of Individual b. To understand and to live in harmony at the level of Family and society c. o understand and to live in harmony at the level of Nature d.All **10.what is central in relationship** a. Body b. Physical facility c. Behaviour d. Feeling		
Unit-III		
1.When we consider FORM of a unit we notice its a. Shape b. Size c. Density d. All the above **2. Self organization means** a. Innateness b. Co-existence c. Form d. Natural Characteristics **3. Which among the following is variable in units** a. Natural Characteristic b. Innateness c. Co-existence d. Form **4. Relationship is the need of** a. Self b. Body c. Both self and body d. None of the above **5.To ensure justice from family to world family is said as-** a. Work b. Behaviour c. Undivided human society d. Judgement **6. Which among the following is a comprehensive human goal at the level of Family?** a. Right understanding and right feeling b. Feeling of prosperity c. Fearlessness (Abhay) d. Harmony/mutual fulfillment/mutual enrichment/balance **7. Which among the following is a comprehensive human goal at the level of Society?** a. Right understanding and right feeling b. Feeling of prosperity c. Fearlessness (Abhay) d. Harmony/mutual fulfillment/mutual enrichment/balance **8.Which among the following is a comprehensive human goal at the level of Nature?** a. Right understanding and right feeling b. Feeling of prosperity c. Fearlessness (Abhay) d.Harmony/mutual fulfillment/mutualenrichment/balance	**2** **2** **3** **2** **2** **2** **3** **3**	

Unit-IV		
1.Read the statement carefully and fill the correct word/term in the given blank space."On the basis of understanding my participation in existence, I can see that I have a definite role to play. Then my _____ is to fulfill that definite role and thus my _____ become definite " a. Desire b.Thought c. Expectation d. None **2. Which among the following is not a higher activities of Self (I)?** a. Realization b. Understanding c. Contemplation d.Tasting **3. Which among the following is not a lower activities of self?** a. Imaging b. Analyzing c. Selection/tasting d. Contemplation **4. What ensures continuous happiness in Self?** a. Right understanding (GYAN) in Self b. Right feeling and Right thought (RESOLUTION) in Self c. Both d. Preconditioning and sensation based imagination **5.Which is the prevailing notion of happiness in society (current state)?** a. Owning / accumulating physical facility- b. Pleasure (from favourable sensation) c. Attention, appreciation… (favourable feelings) from others d. All **6. _____ and _____ together are the innateness of the pranic order.** a. Composition/Decomposition and Respiration b. Composition/Decomposition and Growth c. Existence and Respiration d. Existence and Growth **7. The value or participation of different orders in existence is also referred to as their _____.** a. Natural Characteristics b. Innateness c. Activity d. Conformance **8.Today our system of knowledge tends to neglect** a. Form b. Property c. Coexistence d. All the above **9. All pervading, ever, unlimited, no activity and energy in equilibrium are the characteristics of-** a. Space b. Consciousness c. Material unit d. All **10._____ include plan, program, implementation, results, evaluation** a. Values b. Policies c. Character d. None of the above	**4**	**L1**

Evaluation Scheme:

Assessment	Marks	Weight age
CIE-I	20	20%
CIE-II	20	20%
Assignment/Quizzes/Seminar/Survey	10	10%
SEE	50	50%
Total	100	100%

Details of Assignment :

Assignment	Marks(10)	CO
Assignment 1	02	1 ,2
Assignment 2	O2	3 ,4&5
Seminar/Survey Report	03	1,2,3,4&5
Course Project	03	1,2,3,4& 5

SEE Scheme

Semester end assessment (SEE) is Objective Type Multiple Choice examination of one and half hour duration of 50 marks with 50% weight age.

Course Utilization for CIE and SEE

Unit	Teaching Hours	Number of Questions in CIE-I	CIE - II	Number of Questions in SEE
I	4	40		13
II	4			13
III	4		40	13
IV	3			11

SEE Model Question Papers:

Course Assessment Plan(CAP)

COs	Weight age in assessment	CIE-I	CIE-II	Quiz	Assignment	Course Project	SEE
1	19%						
2	19%						
3	21%						
4	22%						
5	19%						
Weight age	100%	20%	20%	10%			50%

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE PLAN

Title of Course	:	**Electric Motors**	**Course Code**	:	**UEE425C**
Credits	:	**03**	**Contact Hours/ Week**	:	**03**
Total Hours	:	**40**	**Tutorial Hours**	:	**-**
CIE Marks	:	**50**	**SEE Marks**	:	**50**
Semester	:	**IV**	**Year**	:	**2025**

Prerequisites: Fundamental electrical concepts, including Ohm's Law, Kirchhoff's Laws, basic circuit analysis, and DC circuits. Understanding of concepts like magnetic fields, Faraday's Law, Ampere's Law, and inductance. Proficiency in analysing AC circuits, phasor analysis, and understanding of complex impedance. Basic physics knowledge, especially in the areas of mechanics and thermodynamics, may be beneficial for understanding the physical principles underlying electrical machines.

Course Objectives:

	The Course objectives are:
1	To comprehend the construction, working principles, and characteristics of DC motors, three-phase induction motors, single-phase induction motors, and synchronous motors.
2	To analyze the performance of different types of electric motors using power flow diagrams, torque equations, equivalent circuits, and efficiency calculations.
3	To study various starting, speed control, and testing methods of electric motors, including direct and indirect testing techniques.
4	To evaluate the applications of different motors in industrial, domestic, and renewable energy systems, including advanced motors like BLDC, PMSM, SRM, and linear induction motors.

Course Outcomes:

	At the end of the course the student should be able to:
1	Analyze the construction and operation, classification and characteristics of DC Motors, Induction motors, Synchronous motors.
2	Test and evaluate to find efficiency, losses for DC motors, three phase induction motors and single phase IM.
3	Examine starting, running performances and different speed control methods and applications of three phase and single phase Induction motors.
4	Evaluate basic operation and performance of motors for different application and can select motors for different purposes.

Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

S.No	Programme Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE425C.1	3	1	2	3								1	3		1
2	UEE425C.2	3	1	2	3								1	3		1
3	UEE425C.3	3	1	2	3		1	1					1	3		1
4	UEE425C.4	3	1	2	3		1	1					2	3		3

Unit Learning Outcomes (ULO):

Sl.	Unit Learning Outcome (ULO)	CO's	BLL
	Module –I		
1.	Students shall be able to understand and describe the construction and working principle of DC motors.	1	2
2.	Students shall be able to explain the significance of back EMF and derive the torque equation of DC motors.	1	3
3.	Students shall be able to classify DC motors into shunt, series, and compound types and analyze their characteristics.	1	4
4.	Students shall be able to examine different speed control methods of DC motors and determine their applications.	3	4
5.	Students shall be able to evaluate the losses occurring in DC motors and illustrate the power flow diagram.	2	4
6.	Students shall be able to determine the efficiency of DC motors under different load conditions.	2	3
7.	Students shall be able to perform and interpret results from Swinburne's test and Field's test on DC motors.	2	5
8.	Students shall be able to compare direct and indirect testing methods of DC motors and discuss their merits and demerits.	2	5
	Module –II		
9.	Students shall be able to explain the concept of rotating magnetic field and its role in motor operation.	1	2
10.	Students shall be able to describe the construction and working principle of squirrel-cage and slip-ring induction motors.	1	2
11.	Students shall be able to analyze the slip of an induction motor and interpret its significance in motor performance.	1	3
12.	Students shall be able to derive and interpret the torque equation of an induction motor.	1	3
13.	Students shall be able to evaluate the torque-slip characteristics and identify motoring, generating, and braking regions.	1	4
14.	Students shall be able to determine the condition for maximum torque in an induction motor.	1	3
15.	Students shall be able to assess industrial applications of three-phase induction motors.	4	5
	Module –III		
16.	Students shall be able to create and interpret phasor diagrams of an induction motor under no-load and load conditions.	1	6
17.	Students shall be able to analyze and quantify different types of losses occurring in an induction motor.	2	3
18.	Students shall be able to apply No-load and Blocked Rotor tests to calculate the equivalent circuit parameters.	2	3

19.	Students shall be able to construct the equivalent circuit and use it to analyze motor performance.	2	4
20.	Students shall be able to explain cogging and crawling phenomena in induction motors.	3	2
21.	Students shall be able to describe high-torque rotors such as double-cage and deep-bar rotors.	3	2
22.	Students shall be able to analyze the working of an induction motor as an induction generator.	3	4
23.	Students shall be able to explain the construction and working principle of a doubly fed induction generator.	3	4
	Module -IV		
24.	Students shall be able to justify the necessity of starters in induction motors.	3	2
25.	Students shall be able to implement and compare different starting methods such as DOL, Star-Delta, and Autotransformer.	3	3
26.	Students shall be able to apply rotor resistance starting in slip-ring induction motors.	3	3
27.	Students shall be able to analyze speed control methods of induction motors, including frequency control.	3	4
28.	Students shall be able to explain the double revolving field theory of single-phase induction motors.	1	2
29.	Students shall be able to describe the working principles of split-phase, capacitor start, and capacitor run motors.	1	3
30.	Students shall be able to analyze the construction and operation of shaded pole motors.	1	3
31.	Students shall be able to compare single-phase induction motor types and their applications.	4	5
	Module -V		
32.	Students shall be able to explain the principle of operation of synchronous motors.	1	2
33.	Students shall be able to construct and analyze phasor diagrams for synchronous motors under different operating conditions.	1	4
34.	Students shall be able to evaluate the torque equation and torque-angle characteristics of synchronous motors.	1	4
35.	Students shall be able to analyze the effect of excitation and load variation on synchronous motors.	1	4
36.	Students shall be able to interpret and plot V and Inverted V curves of synchronous motors.	1	4
37.	Students shall be able to evaluate the role of synchronous condensers in power factor correction.	4	5
38.	Students shall be able to describe the construction and working of Universal motors and AC servomotors.	4	3
39.	Students shall be able to analyze the characteristics and applications of PMSM, SRM, BLDC, and Linear Induction Motors.	4	4

Programme Outcomes with Respective Competencies & Performance Indicators

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

	Competency	PI	Indicators
1.1	Demonstrate the competence in solving engineering mathematical problems	1.1.1	Apply fundamentals of mathematics to solve problems
		1.1.2	Apply advanced mathematical techniques to modelling and problem solving in electrical engineering
1.2	Demonstrate the competence in basic sciences	1.2.1	Apply laws of natural science to an engineering problem
1.3	Demonstrate competence in engineering fundamentals	1.3.1	Apply elements of electrical engineering principles and laws
1.4	Demonstrate competence in Electrical engineering knowledge	1.4.1	Apply discipline specific laws and principles to solve an engineering problem

PO2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

	Competency	PI	Indicators
2.1	Demonstrate an ability to identify and characterize an engineering problem	2.1.1	Evaluate problem statements and Identify objectives
		2.1.2	Identify engineering systems, variables, and parameters to solve the problems
		2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem
2.2	Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.1	Reframe complex problems into interconnected sub-problems.
		2.2.2	Identify, assemble and evaluate information and resources.
		2.2.3	Identify existing processes/solution methods for solving the problem, including justified approximations and assumptions
		2.2.4	Compare and contrast alternative solution processes to select the best process.
2.3	Demonstrate an ability to formulate and interpret a system / model	2.3.1	Combine scientific and engineering principles to formulate models (mathematical or otherwise) of a system or process that isappropriate in terms of applicability and required accuracy.
		2.3.2	Identify assumptions (mathematical and physical) necessary to allow modelling of a system at the level of accuracy required.
2.4	Demonstrate an ability to execute a solution, process and analyse results	2.4.1	Apply engineering mathematics and computations to solve (form & analyse) mathematical models.
		2.4.2	Produce and validate results through skilful use of contemporary engineering tools and models
		2.4.3	Identify sources of error in the solution process, and limitations of the solution.
		2.4.4	Extract desired understanding and conclusions consistent with objectives and limitations of the analysis

PO3: Design/Development of Solutions: 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.

	Competency	PI	Indicators
3.1	Demonstrate an ability to define a complex open-ended problem in engineering terms	3.1.1	Recognize that good problem definition assists in the design process
		3.1.2	Elicit and document engineering requirements from stakeholders
		3.1.3	Synthesize engineering requirements from a review of the State of the Art
		3.1.4	Extract engineering requirements from relevant engineering Codes and Standards
		3.1.5	Explore and synthesize engineering requirements from larger social and professional concerns
		3.1.6	Determine design objectives, functional requirements and arrive at specifications
3.2	Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.1	Apply formal idea generation tools to develop multiple engineering design solutions
		3.2.2	Build models, prototypes, etc., to develop diverse set of design solutions
		3.2.3	Identify the suitable criteria for evaluation of alternate design solutions
3.3	Demonstrate an ability to select the optimal design scheme for further development	3.3.1	Apply formal multi-criteria decision making tools to select optimal engineering design solutions for further development
		3.3.2	Consult with domain experts and stakeholders to select candidate engineering design solution for further development
3.4	Demonstrate an ability to advance an engineering design to defined end state	3.4.1	Refine a conceptual design into a detailed design within the existing constraints (of the resources)
		3.4.2	Generates information through appropriate tests to improve, or revise design states

PO4: 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.

	Competency	PI	Indicators

4.1	Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1	Define a problem for purpose of investigation, its scope and importance
		4.1.2	Relate modern engineering experimentation including experiment design, system calibration, data acquisition, analysis and presentation
		4.1.3	Apply appropriate instrumentation, and/or software tools to make measurements of physical quantities
		4.1.4	Establish or validate a relationship between measured data and underlying physical principles.
4.2	Demonstrate an ability to design experiments to solve open ended problems	4.2.1	Develop and design experimental approach, specify appropriate equipment and procedures, implement these procedures, and interpret the resulting data to characterise an engineering material, component, or system.
		4.2.2	Understand the importance of statistical design of experiments and choose an appropriate experimental design plan based on the study objectives
4.3	Demonstrate an ability to critically analyze data to reach a valid conclusion	4.3.1	Use appropriate procedures, tools and techniques to collect and analyse data
		4.3.2	Critically analyse data for trends and correlations, stating possible errors and limitations
		4.3.3	Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and draw conclusions
		4.3.4	Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions

PO5: 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.

	Competency	PI	Indicators
5.1	Demonstrate an ability to identify/create modern engineering tools, techniques and resources	5.1.1	Identify modern engineering tools, techniques and resources for engineering activities
		5.1.2	Create / adapt / modify / extend tools and techniques to solve problems
5.2	Demonstrate an ability to select and apply discipline specific tools, techniques and resources	5.2.1	Identify the strengths and limitations of tools for (i) acquiring information, (ii) modelling and simulation, (iii) monitoring system performance, and (iv) creating engineering designs.
		5.2.2	Demonstrate proficiency in using computing, mathematical, circuit simulation, and document presentation/preparation software. (MATLAB / Scilab, PSPICE, SABER, PROTEUS software tools, AutoCAD, project management tools, Latex and others)
5.3	Demonstrate an ability to evaluate the suitability and limitations of the tools used to solve an engineering problem	5.3.1	Identify limitations and validate tools, techniques and resources
		5.3.2	Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.

PO6: 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.

	Competency	PI	Indicators
6.1	Demonstrate the ability to describe engineering roles in a broader context, e.g. as pertains to the environment, health, safety, and public welfare	6.1.1	Identify and describe various engineering roles; particularly pertaining to protection of the public and public interest
6.1	Demonstrate an understanding of professional engineering regulations, legislation and standards	6.2.1	Interpret legislation, regulations, codes, and standards relevant to electrical and electronics engineering discipline (such as IEEE) and explain its contribution to the protection of the public

PO7: 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.

	Competency	PI	Indicators
7.1	Demonstrate an understanding of the impact of engineering and industrial practice on social, environmental and economic contexts	7.1.1	Identify risks/impacts in the life-cycle of an engineering product or activity
		7.1.2	Demonstrate an understanding of the relationship betweenthe technical, socio-economic and environmental dimensions of sustainability
7.2	Demonstrate an ability to apply principles of sustainable design and development	7.2.1	Describe management techniques for sustainable development
		7.2.2	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevantto Electrical and Electronics Engineering

PO8: Ethics: Apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

	Competency	PI	Indicators
8.1	Demonstrate an ability to recognize ethical dilemmas	8.1.1	Identify situations of unethical professional conduct and propose ethical alternatives
8.2	Demonstrate an ability to apply the Code of Ethics	8.2.1	Identify tenets of the IEEE professional code of ethics
		8.2.2	Examine and apply moral & ethical principles to historically famous case studies

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

	Competency	PI	Indicators
9.1	Demonstrate an ability to form a team and define a role for each member	9.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity in a team
		9.1.2	Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal.
9.2	Demonstrate effective individual & team operations -- communication, problem solving, resolution & leadership skills	9.2.1	Demonstrate effective communication, problem solving, conflict resolution and leadership skills
9.3	Demonstrate success in a team-based project	9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts

PO10: 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			
	Competency	PI	Indicators
10.1	Demonstrate an ability to comprehend technical literature and document project work.	10.1.1	Read, understand and interpret technical and non-technical information
		10.1.2	Produce clear, well-constructed, and well-supported written engineering documents
		10.1.3	Create *flow* in a document or presentation – a logical progression of ideas so that the main point is clear
10.2	Demonstrate competence in listening, speaking, and presentation	10.2.1	Listen to and comprehend information, instructions, and view point of others
		10.2.2	Deliver effective oral presentations to technical and non-technical audiences
10.3	Demonstrate the ability to integrate different modes of communication	10.3.1	Create engineering-standard figures, reports and drawings to complement writing and presentations
		10.3.2	Use a variety of media effectively to convey a message in a document or a presentation

PO 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.			
	Competency	PI	Indicators
11.1	Demonstrate an ability to evaluate the economic and financial performance of an engineering activity	11.1.1	Describe various economic and financial costs/benefits of an engineering activity
		11.1.2	Analyze different forms of financial statements to evaluate the financial status of an engineering project
11.2	Demonstrate and ability to Compare and contrast the costs/benefits of alternate proposals for an engineering activity	11.2.2	Analyze and select the most appropriate proposal based on economic and financial considerations.
11.3	Demonstrate an ability to plan/manage an engineering activity withintime and budget constraints	11.3.1	Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks.
		11.3.2	Use project management tools to schedule an engineering project so as to complete on time and within budget.

PO12: 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.			
	Competency	**PI**	**Indicators**
12.1	**Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps**	**12.1.1**	**Describe the rationale behind the requirement for continuing professional development**
		12.1.2	**Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to bridge the same**
12.2	**Demonstrate an ability to Identify changing trends in engineering knowledge and practice**	**12.2.1**	**Identify historic points of technological advance in engineering that require practitioners to seek education in order to stay updated**
		12.2.2	**Recognize the need and be able to clearly explain why it is vitally important to keep updated regarding new developments in the field**
12.3	**Demonstrate an ability to identify and access sources for new information**	**12.3.1**	**Demonstrate an ability to source and comprehend technical literature and other credible sources of information**

Course Content:

Day	Content	Mode of Delivery
1.	Introduction to DC motors: Construction, working principle, and key components.	Power Point Presentation, Chalk and talk in classroom
2.	Concept of back EMF, its significance, and its effect on motor performance.	
3.	Torque equation derivation and its practical implications.	
4.	Classification of DC motors: Shunt, Series, and Compound motors with characteristics.	
5.	Speed control methods: Armature control, field control, and voltage control.	
6.	Losses in DC motors and power flow diagram.	
7.	Testing of DC motors: Swinburne's test, Field's test – methods and interpretation.	
8.	Comparison of direct and indirect testing methods with advantages and limitations.	
9.	Concept of rotating magnetic field and its role in motor operation.	Power Point Presentation, Chalk and talk in classroom
10.	Construction and working principles of squirrel-cage and slip-ring induction motors.	
11.	Slip, its significance, and its effect on motor performance.	
12.	Torque equation derivation and significance in applications.	
13.	Torque-slip characteristics: Motoring, generating, and braking regions.	
14.	Condition for maximum torque and its practical applications.	
15.	Industrial applications of three-phase induction motors.	
16.	Summary and problem-solving session on induction motors.	
17.	Phasor diagrams of induction motors under no-load and load conditions.	Power Point Presentation, Chalk and talk in classroom
18.	Losses in three-phase induction motors and their classification.	
19.	No-load and Blocked Rotor tests: Purpose, procedure, and result analysis.	
20.	Equivalent circuit derivation and its application in performance analysis.	
21.	Cogging and crawling phenomena and their effects on motor operation.	
22.	High-torque rotors: Double-cage and deep-bar rotor construction and performance.	
23.	Working of an induction motor as an induction generator.	
24.	Introduction to doubly fed induction generators and their working principles.	

25.	Necessity of starters in induction motors and types of starting methods.	Power Point Presentation, Chalk and talk in classroom
26.	Direct-On-Line (DOL) starter: Working, advantages, and limitations.	
27.	Star-Delta and Autotransformer starting: Comparison and applications.	
28.	Rotor resistance starting in slip-ring induction motors.	
29.	Speed control methods: Stator voltage, frequency control, rotor resistance, and pole-changing methods.	
30.	Double revolving field theory of single-phase induction motors.	
31.	Types of single-phase induction motors: Split-phase, capacitor-start, and capacitor-run motors.	
32.	Shaded pole motor construction, working, and applications.	
33.	Principle of operation and construction of synchronous motors.	Power Point Presentation, Chalk and talk in classroom
34.	Phasor diagrams for synchronous motors under different load conditions.	
35.	Torque equation and torque-angle characteristics of synchronous motors.	
36.	Effect of excitation and load variation on synchronous motors.	
37.	V and Inverted V curves: Interpretation and significance.	
38.	Role of synchronous condensers in power factor correction.	
39.	Universal motors and AC servomotors: Construction, working, and applications.	
40.	Characteristics and applications of PMSM, SRM, BLDC, and Linear Induction Motors.	
41.	Revision of topics	

Review Questions:

Sl.	Review Questions	CO	BLL
1	Explain the construction and working principle of a DC motor.	1	2
2	Derive the torque equation of a DC motor and explain its significance.	1	3
3	Compare the characteristics of shunt, series, and compound DC motors.	1	4
4	Explain different methods of speed control for DC motors.	3	4
5	Describe Swinburne's test and Field's test for DC motors.	2	5
6	Compare direct and indirect testing methods for DC motors.	2	5
7	What is a rotating magnetic field? How is it generated in a three-phase motor?	1	2
8	Compare the construction and working principles of squirrel-cage and slip-ring induction motors.	1	2
9	Define slip and explain its significance in an induction motor.	1	3
10	Derive the torque equation of a three-phase induction motor.	1	3
11	Explain the torque-slip characteristics of an induction motor.	1	4
12	Discuss the different applications of three-phase induction motors.	4	5
13	Draw and explain the phasor diagram of an induction motor under load.	1	6
14	What are the different types of losses in an induction motor? How do they affect efficiency?	2	3
15	Explain how No-load and Blocked Rotor tests are conducted on an induction motor.	2	3
16	Derive the equivalent circuit of an induction motor and explain its significance.	2	4
17	What is cogging and crawling in induction motors? How can they be prevented?	3	2
18	Explain the construction and working of deep-bar and double-cage rotors.	3	2
19	Why is a starter required for an induction motor?	3	2
20	Explain the working of Direct-On-Line (DOL) and Star-Delta starters.	3	3
21	How does an autotransformer starter work? Where is it used?	3	3
22	Explain various speed control methods of induction motors.	3	4
23	Describe the construction and working of capacitor-start and capacitor-run motors.	1	3

24	Explain the working principle of a shaded pole motor.	1	3
25	Describe the principle of operation of synchronous motors.	1	2
26	Explain the torque-angle characteristics of synchronous motors.	1	4
27	What are V and Inverted V curves? How are they useful?	1	4
28	How does a synchronous condenser improve power factor?	4	5
29	Describe the construction and working of universal motors.	4	3
30	Compare the performance of PMSM, SRM, and BLDC motors.	4	4

Evaluation Scheme:

Sl. No.	Component	Examination conducted for marks		Minimum marks
1.	CIE theory	CIE test	25	10
		CCE	25	10
2.	SEE theory	SEE test	50	20
		Total :	100	40

Details of Assignment:

Assignment	Marks (25)	CO
Problem solving on transformer EMF equation and finding the efficiency	5	01
Numerical problems on induction motors to find slip, efficiency, maximum torque, line current	5	02, 03
Survey/case studies	5	01,02,03,04
Quiz-1	10	01,02,03, 04

BASAVESHWAR ENGINEERING COLLEGE, BAGALKOT

COURSE PLAN- UEE554C

Title of Course	**:**	**Transmission and Distribution**	**Course Code**	**:**	**22UEE426C**
Credits	**:**	**4**	**Contact Hours/ Week**	**:**	**4**
Total Hours	**:**	**50**	**Tutorial Hours**	**:**	**--**
CIE Marks	**:**	**50**	**SEE Marks**	**:**	**50**
Semester	**:**	**IV**	**Year**	**:**	**2024-2025**

Course Objectives:

	After completion of the course, students should be able
1	To justify the advantages of high voltage transmisssion
2	To analyse overhead transmission line (short, medium & long) with respect to : voltage regulation and transmission efficiency
3	To calculate the line constants of transmission line
4	To draw single line diagram showing a typical distribution system

Course Outcomes:

	At the end of the course the student should be able to:
1	Demonstrate a fundamental understanding of the mechanical components used in overhead and underground transmission lines, including conductors, towers, insulators, cables, supports, and junctions.
2	Estimate sag for equal and unequal supports with and without considering wind and ice loading.
3	Analyze and calculate the performance of short, medium and long transmission lines using simplified models for impedance and voltage regulation, and understand the primary effect of series impedance on power loss and voltage drop.
4	Demonstrate a thorough understanding of the basic concepts of electrical power distribution, including the components, structure, and operation of electrical distribution systems.

Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Sl.	PO's / CO's															
The students will be able to:																
1	UEE554C.1	3	2	2			1	1				2	3	3	2	
2	UEE554C.2	3	2	2				1				2	2	3	2	
3	UEE554C.3	3	2	2	2		1	1				3	2	3	2	
4	UEE554C.4	3	2	2	3		1	1				2	3	3	2	

Competencies Addressed in the course and Corresponding Performance Indicators

Programme Outcome: Any of 1 to 12 PO's:

PO	Competency		Performance Indicators	
1	1.1	Demonstrate the competence in solving engineering mathematical problems	1.1.1	Apply fundamentals of mathematics to solve problems
	1.2	Demonstrate the competence in basic sciences	1.2.1	Apply laws of natural science to an engineering problem
	1.3	Demonstrate competence in engineering fundamentals	1.3.1	Apply elements of electrical engineering principles and laws
	1.4	Demonstrate competence in Electrical engineering knowledge	1.4.1	Apply discipline specific laws and principles to solve an engineering problem
2	2.1	Demonstrate an ability to identify and characterize an engineering problem	2.1.1	Evaluate problem statements and Identify objectives
3	3.1	Demonstrate an ability to define a complex open-ended problem in engineering terms	3.1.1	Recognize that good problem definition assists in the design process
	3.3	Demonstrate an ability to select the optimal design scheme for further development	3.3.1	Apply for malmulti criteria decision making tools to select optimal engineering design solutions for further development
4	4.1	Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1	Define a problem for purpose of investigation, its scope and importance
	4.3	Demonstrate an ability to critically analyze data to reach a valid conclusion	4.3.1	Use appropriate procedures, tools and techniques to collect and analyse data
6	6.1	Demonstrate the ability to describe engineering roles in a broader context, e.g. as pertains to the environment, health, safety, and public welfare	6.1.1	identify and describe various engineering roles; particularly pertaining to protection of the public and public interest
7	7.1	Demonstrate and understanding of the impact of Engineering and industrial practice on social environmental and economic context	7.1.1	Identify risks/ impacts in the life cycle of Engineering product or activity
11	11.1	Demonstrate an ability to evaluate the economic and financial performance of anengineeringactivity	11.1.1	Describevariouseconomicandfinancialcosts/benefitsof anengineeringactivity
	11.2	Demonstrate an ability to Compare and contrast the costs/benefits of alternate Proposals for an engineering activity	11.2.1	Analyze and select the most appropriate proposal based on economic and financial considerations.
12	12.1	**Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps**	12.1.2	Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to bridge the samr

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **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 the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **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.

PO5. **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.

PO6. **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.

PO7. **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.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with 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.

PO11. **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.

PO12**. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Unit Learning Outcomes (ULO):

Sl.	Unit Learning Outcome (ULO)	CO's	BLL	PI addressed
	Unit -I			
1.	Students shall be able to draw and explain typical structure of electric power system	**1**	**2**	**2.1.2**
2.	Students shall be able to justify the advantages of high voltage transmisssion	**1**	**2**	**2.1.2**
3.	Students shall be able explain the functions of Feeders, distributors and service mains.	**2**	**2**	**2.1.2**
4.	Students shall be able to list different types of supporting structures	**2**	**1**	**1.2.1**
5.	Students shall be able to describe properties of various types of line conductors	**2**	**1**	**1.2.1**
6.	Students shall be able to carry out calculation of sag for equal and unequal supports.	**2**	**2**	**2.1.2**
7.	Students shall be able to give brief introduction to types of insulators	**1**	**3**	**2.1.1**
8.	Students shall be able to calculate potential distribution over suspension insulator string	**1**	**3**	**2.1.1**
9.	Students shall be able to define String efficiency and discuss different methods of increasing string efficiency.	**1**	**3**	**2.1.1**
10.	Students shall be able to brief function of Arcing horns	**1**	**1**	**2.1.1**
	Unit –II			
11.	Students shall be able to list constants of Transmission line	**2**	**1**	**1.3.1**
12.	Students shall be able to carry out analysis of Inductance of single phase two wire line equilateral spacing,	**3**	**2**	**2.1.1**
13.	Students shall be able to carry out analysis of Inductance of three phase line with unsymmetrical spacing.	**3**	**3**	**3.1.1**
14.	Students shall be able to carry out analysis of Capacitance of single phase two wire line equilateral spacing,	**3**	**3**	**3.1.1**
15.	Students shall be able to carry out analysis of Capacitance of three phase line with unsymmetrical spacing.	**3**	**3**	**7.1.1**
16.	Students shall be able to carry out calculation of Capacitance of single phase two wire line	**3**	**4**	**2.1.1**
17.	Students shall be able to solve problems to calculation of Inductance of single phase two wire line equilateral spacing,	**3**	**4**	**6.1.1**
18.	Students shall be able to calculation of Capacitance of three phase line with unsymmetrical spacing.	**3**	**4**	**2.1.1**
19.	Students shall be able to calculation of Capacitance of single phase two wire line equilateral spacing	**3**	**4**	**1.4.1**
20.	Students shall be able to analyse the constants of Transmission line	**3**	**4**	**9.2.1**
	Unit –III			
21.	Students shall be analyse short transmission line.	**3**	**2**	**4.1.1**
22.	Students shall be analyse various medium short transmission line	**3**	**2**	**4.1.1**
23.	Students shall be analyse various medium transmission line by	**3**	**2**	**4.1.1**

	end condenser method.			
24.	Students shall be analyse various medium transmission line by nominal T method	**3**	**2**	**4.1.1**
25.	Students shall be analyse various medium transmission line by nominal π method	**3**	**2**	**4.1.1**
26.	Students shall be analyse long short transmission line by rigorous method	**3**	**2**	**4.1.1**
27.	Students shall be able to calculate generalized circuit constants (ABCD) of a transmission line.	**3**	**3**	**6.1.1**
28.	Students shall be calculation sending end voltage and current of short transmission line	**3**	**2**	**2.1.1**
29.	Students shall be calculation sending end voltage and current of medium transmission line	**3**	**2**	**4.3.1**
30.	Students shall be calculation sending end voltage and current of long transmission line	**3**	**3**	**1.4.1**
Unit –IV				
31.	Students shall be able to define basic terms associated with corona in transmission lines.	**3**	**2**	**2.1.1**
32.	Students shall be calculation corona losses.	**3**	**2**	**1.3.1**
33.	Students shall be able to list Advantages and disadvantages of corona.	**3**	**2**	**2.1.1**
34.	Students shall be able to explain Methods of reducing corona.	**3**	**2**	**2.1.1**
35.	Students shall be able to identify various parts of underground cable.	**3**	**2**	**2.1.1**
36.	Students shall be able to list Insulating materials for underground cables	**4**	**2**	**1.3.1**
37.	Students shall be able to list and explain methods of laying underground cable.	**4**	**2**	**2.1.1**
38.	Students shall be able to calculate Insulation resistance of single core cable	**4**	**3**	**2.1.1**
39.	Students shall be able to calculate capacitance of single core cable	**4**	**3**	**1.3.1**
40.	Students shall be able to calculate dielectric stress in a single core cable.	**4**	**3**	**1.3.1**
Unit –V				
41.	Students shall be able to draw and explain single line diagram showing a typical distribution system.	**4**	**2**	**2.1.1**
42.	Students shall be able to list different types of DC distributors and their significance.	**4**	**2**	**4.1.1**
43.	Students shall be able to calculate voltage drop for a uniformly loaded distributor fed at one end.	**4**	**3**	**4.3.1**
44.	Students shall be able to explain the purpose of interconnector in DC ring main distributor	**4**	**2**	**2.1.1**
45.	Students shall be able to differentiate AC distribution and DC distribution	**4**	**2**	**2.1.1**
46.	Students shall be able to illustrate the importance of load factors in AC distribution	**4**	**3**	**6.1.1**

47.	Students shall be able to solve AC distribution problems.	**4**	**3**	**6.1.1**
48.	Students shall be able to briefly discuss reliability and Quality of Distribution System: I	**4**	**2**	**1.4.1**
49.	Students shall be able to definition of reliability, failure, probability concepts	**4**	**2**	**1.4.1**
50.	Students shall be able to list limitation of distribution systems, power quality, Reliability aids	**4**	**2**	**1.4.1**

Course Content:

Hours Required	Topic to be covered	Mode of Delivery
01	Introduction to Power System: Structure of electric power system: generation, transmission and distribution.	Chalk&talk, Ppt
01	Advantages of higher voltage transmission: HVAC, EHVAC, UHVAC and HVDC.	Chalk&talk, Ppt
01	Interconnection. Feeders, distributors and service mains	Chalk&talk, Ppt
01	Overhead Transmission Lines: A brief introduction to types of supporting structures	Chalk&talk, Ppt
01	Line conductors - Conventional conductors; Aluminium Conductor steel reinforced (ACSR), All – aluminium alloy conductor (AAAC) and All – aluminium conductor (AAC). High temperature conductors; Thermal resistant aluminium alloy (ATI),Super thermal resistant aluminium alloy (ZTAI),	Chalk&talk, Ppt
01	Importance of sag, Sag calculation – supports at same and different levels	Chalk&talk, Ppt
01	Effect of wind and ice on Sag calculation	Chalk&talk, Ppt
01	Overhead Line Insulators: A brief introduction to types of insulators, material usedporcelain, toughened glass and polymer (composite).	Chalk&talk, Ppt
01	Potential distribution over a string of suspension insulators. String efficiency, Methods of increasing string efficiency. Arcing horns.	Chalk&talk, Ppt
01	Numericals	Chalk&talk,Discussions
	Line Parameters: Introduction to line parameters- resistance, inductance and capacitance. Calculation of inductance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing. Calculation of capacitance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing.	
01	Line Parameters: Introduction to line parameters- resistance, inductance and capacitance.	Chalk&talk, Ppt
01	Analysis of Inductance of single phase two wire line equilateral spacing	Chalk&talk, Ppt
01	Analysis of Inductance of three phase line with unsymmetrical spacing.	Chalk&talk, Ppt
01	Analysis of Capacitance of single phase two wire line equilateral spacing,	Chalk&talk, Ppt
01	Analysis of Capacitance of three phase line with unsymmetrical spacing.	Chalk&talk, Ppt
01	Calculation of Inductance of single phase two wire line equilateral spacing	Chalk&talk, Ppt
01	Calculation of Inductance of three phase line with unsymmetrical spacing.	Chalk&talk, Ppt
01	Calculation of Capacitance of single phase two wire line equilateral spacing,	Chalk&talk, Ppt
01	Calculation of Capacitance of three phase line with unsymmetrical spacing.	Chalk&talk, Ppt
01	Numericals	Chalk&talk,Discussions
01	**Performance of Transmission Lines:** Classification of overhead Transmission line. Short Transmission line,	Chalk&talk, Ppt
01	Medium Transmission line – End condenser method	Chalk&talk, Ppt
01	Numericals	
01	Medium Transmission line Nominal T method,	Chalk&talk, Ppt
01	Medium Transmission line Nominal π method,	
01	Numericals	

01	Long short transmission line by rigorous method	
01	Long Transmission line - Generalized circuit constants (ABCD) of a transmission line.	
01	Numericals	Chalk&talk,Discussions
01	Numericals	Chalk&talk,Discussions
01	Define basic terms associated with corona in transmission lines.	Chalk&talk, Ppt
01	Calculation corona losses. Advantages and disadvantages of corona. Methods of reducing corona.	Chalk&talk, Ppt
01	Various parts of underground cable. Insulating materials for underground cables	Chalk&talk, Ppt
01	Methods of laying underground cable.	Chalk&talk, Ppt
01	Insulation resistance of single core cable	Chalk&talk, Ppt
01	Capacitance of single core cable	Chalk&talk, Ppt
01	Dielectric stress in a single core cable.	Chalk&talk, Ppt
01	Grading of cables – capacitance and inter-sheath.	Chalk&talk, Ppt
01	Dielectric loss. Comparison between ac and DC cables. Limitations of underground cables.	Chalk&talk, Ppt
01	Numericals	Chalk&talk, Ppt
01	**Distribution Systems:** Classification of distribution systems. Overhead Vs Underground distribution system,	Chalk&talk, Ppt
01	Connection schemes of distribution system, Requirements of a distribution system	Chalk&talk, Ppt
01	Types of DC distributors, DC distributor fed at one end- Concentrated loading,	Chalk&talk, Ppt
01	Numericals	Chalk&talk, Ppt
01	DC distributor fed at one end -Uniform loading, DC distributor fed at both ends - Concentrated loading	Chalk&talk, Ppt
01	AC distribution calculation, Methods of solving AC distribution issues.	Chalk&talk, Ppt
01	Numericals	Chalk&talk, Ppt
01	Numericals	Chalk&talk, Ppt
01	Introduction, definition of reliability, failure, probability concepts,	Chalk&talk, Ppt
01	Limitation of distribution systems, power quality, Reliability aids.	Chalk&talk, Ppt

Review Questions:

Review Questions	CO
What is electrical power supply scheme? Draw a single line diagram of a typical AC power supply scheme.	**1**
What are the advantages and disadvantages of DC transmission over AC transmission?	**1**
Discuss the advantages of high transmission voltage.	**1**
Compare the volume of conductor material required in three phase three wire and three phase four wire AC system.	**1**
Discuss the various conductor materials used for overhead lines what are their relative advantages and disadvantages.	**1**
List and explain various types of line supports.	**1**
Why are insulators used with overhead lines. Discuss the desirable properties of insulators.	**1**

Discuss the advantages and disadvantages of pin type insulator suspension type insulator	**2**
What is strain insulator? Where is it used.	**2**
Give reasons for unequal potential distribution over a string of suspension insulators	**2**
Define and explain string efficiency. Can its value be equal to 100%	**2**
Show that in a string of suspension insulators the disc nearest to the conductor has the highest voltage across it.	**2**
Explain various methods of improving string efficiency.	**3**
What is corona what are the reasons which affect corona?	**3**
Discuss the advantages and disadvantages of corona.	**3**
Explain the following terms with reference to corona critical disruptive voltage visual critical voltage power loss due to corona.	**3**
What is sag in overhead transmission lines? discuss the advantages of providing too small or too large sack on a line	**2**
Derive an appropriate equation for sag in overhead lines when • supports are at equal levels • supports are at unequal levels	**3**
With the new diagram show the various parts of high voltage single core cable and explain	**3**
List the desirable characteristics of insulating materials used in underground cables	**3**
Describe briefly some commonly used insulating materials for underground cables	**3**
Describe the various methods of laying underground cables what are the relative advantages and disadvantages of each method	**4**
Derive an expression for insulation resistance of single core cable	**4**
Deduce an expression for capacitance of single core cable	**4**
Deduce an equation for maximum stress in single core cable	**4**
Prove that g_{max} /g_{min} in a single core table is equal to D/d.	**4**
Draw and explain single line diagram showing a typical distribution system.	**4**
Define and explain the terms: feeder, distributor and service means.	**4**
Discuss the relative merits and demerits of underground and overhead systems.	**4**
Explain the following systems of distribution • radial system • ring main system • interconnected system	**4**

Evaluation Scheme:

Assessment	Marks	Weightage
CIE-I	**50**	**40%**
CIE-II	**50**	**40%**
Assignments/ Quizzes/ Case Study/ Course Project/ Term Paper/Field Work	**25**	**40%**
SEE	**100**	**40%**

In Charge Faculty : Prof. Sunita Tambakad

BASAVESHWAR ENGINEERING COLLEGE, BAGALKOTE

COURSE PLAN– 22UEE427C

Title of Course	**:**	**Microcontroller**	**Course Code**	**:**	**22UEE427C**
Credits	**:**	**4**	**Contact Hours/ Week**	**:**	**Theory 3 Hr/Week + Lab 2Hr/Week**
Total Hours	**:**	**40**	**Tutorial Hours**	**:**	**40**
CIE Marks	**:**	**50**	**SEE Marks**	**:**	**100**
Semester	**:**	**IV**	**Year**	**:**	**2024-25**

Prerequisites: Basic information on numbering system and C language.

Course Objectives:

	The Course objectives are:
1.	To understand Microcontroller Fundamentals
2	To understand Assembly and Embedded C Programming
3	To explore Memory Organization and Addressing Modes
4	To understand and Implement Timers, Counters, and Interrupts
5	To interface Peripherals with 8051
6	To understand the basics of RaspberryPi

Course Outcomes:

	At the end of the course the student should be able to:
1	Discuss the architecture of 8051 microcontroller and discuss the instruction set.
2	Formulate and analyze the assembly and C language programs in data movement, arithmetic, logical, branching operation and other operations.
3	Design and apply the knowledge of on-chip peripherals and also interface the external hardware to microcontroller.
4	Understand the basics of RaspberryPi and its programming using Python

Course Articulation Matrix: Mapping of Course Outcomes (CO) with Program Outcomes (PO) and Program Specific Outcomes (PSO)

No	CO'S / PO'S	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
The students will be able to:																
1	22UEE427C.1	3	1	2	1	1				1			2		2	
2	22UEE427C.2	3	2	1	1	3				1			1		3	
3	22UEE427C.3	3	3	2	2	3				1			1		2	
4	22UEE427C.4	3	3	2	2	3				1			2		3	1

Competencies Addressed in the course and Corresponding Performance Indicators

Programme Outcome: Any of 1 to 12 PO's:

PO	Competency		Performance Indicators	
1	1.3	Demonstrate competence in engineering fundamentals	1.3.1	Apply fundamental engineering concepts to solve engineering problems
2	2.1	Demonstrate an ability to identify and formulate complex engineering problem	2.1.2	Identify engineering systems, variables, and parameters to solve the problems
			2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem
3	3.1	Demonstrate an ability to define a complex/ open-ended problem in engineering terms	3.1.3	Synthesize engineering requirements from a review of the state-of-the-art
			3.1.6	Determine design objectives, functional requirements and arrive at specifications
	3.4	Demonstrate an ability to advance an engineering design to defined end state	3.4.2	Generate information through appropriate tests to improve or revise the design
4	4.2	Demonstrate an ability to design experiments to solve open-ended problems	4.2.1	Design and develop an experimental approach, specify appropriate equipment and procedures
5	5.1	Demonstrate an ability to identify/ create modern engineering tools, techniques and resources	5.1.1	Identify modern engineering tools such as computer-aided drafting, modeling and analysis; techniques and resources for engineering activities

			5.1.2	Create/adapt/modify/extend tools and techniques to solve engineering problems
9	9.2	Demonstrate effective individual and team operations--communication, problem-solving, conflict resolution and leadership skills	9.2.1	Demonstrate effective communication, problem-solving, conflict resolution and leadership skills
12	12.1	Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	12.1.1	Describe the rationale for the requirement for continuing professional development
			12.1.2	Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **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 the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **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.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. **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.

PO7. **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.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with 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.

PO11. **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.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Unit Learning Outcomes (ULO):

Sl.	Unit Learning Outcome (ULO)	CO's	BLL	PI Addressed
	Module-I			
1.	Students should be able to understand the history and difference between microcontrollers & microprocessors.	01	02	1.3.1
2.	Students should be able to understand and analyze the block diagram of microcontroller.	01	02	1.3.1
3.	Students should be able to understand the architecture of microcontroller 8051.	01	02	2.1.2
4.	Students should be able to understand the functions of pins of 8051.	01	02	2.1.2
5.	Students should be able to understand the memory address decoding.	01	02	2.1.2
6.	Students should be able to understand the interfacing of 8051 controller with external ROM and RAM.	01	02	2.1.2
7.	Students should be able to understand the various addressing modes of the 8051 controller.	01	02	2.1.2
	Module -II			
8.	Students should be able to understand the basic instructions of assembly programming of 8051.	02	02	1.3.1
9.	Students should be able to understand the assembling and running an 8051 program.	02	02	2.1.2
10.	Students should be able to understand the data types and assembler directives.	02	02	3.1.3
11.	Students should be able to understand the Arithmetic, logic instructions and programs.	02	02	2.1.3
12.	Students should be able to understand the jump, loop and call instructions.	02	02	2.1.2
13.	Students should be able to understand the IO programming.	02	02	3.1.3
	Module-III			
14.	Students should be able to understand the data types and time delay in 8051 C.	02	02	3.1.6
15.	Students should be able to understand the IO programming in 8051 C.	02	02	2.1.2
16.	Students should be able to understand the Logic operations in 8051 C.	02	02	2.1.3
17.	Students should be able to understand the Data conversion program in 8051 C.	02	02	3.1.3
18.	Students should be able to understand the accessing code for ROM space in 8051C.	02	02	3.1.6
19.	Students should be able to understand the Data serialization using 8051C.	02	02	3.1.6

20.	Students should be able to utilize the Programming timers in 8051.	02	02	3.1.6
21.	Students should be able to understand the Counter programming.	02	02	3.1.6
22.	Students should be able to understand the Programming timers 0 and 1 in 8051 C.	02	02	3.1.6
Module-IV				
23.	Students should be able to understand the 8051 interrupts.	02	02	3.1.3
24.	Students should be able to understand the Programming timer.	02	02	3.1.3
25.	Students should be able to understand the serial communication interrupt.	02	02	3.1.6
26.	Students should be able to understand the Interrupt priority in 8051.	02	02	3.1.6
27.	Students should be able to understand the Interrupt programming in C.	03	02	3.4.2
28.	Students should be able to understand the LCD interfacing with 8051 controller.	03	02	3.4.2
29.	Students should be able to understand the Keyboard interfacing with 8051 controller.	03	02	4.2.1
30.	Students should be able to understand the ADC 0808 interfacing to 8051.	03	02	4.2.1
31.	Students should be able to understand the Serial ADC Max1112 ADC interfacing to 8051.	03	02	4.2.1
32.	Students should be able to understand the DAC interfacing.	03	02	4.2.1
33.	Students should be able to understand the Sensor interfacing and signal conditioning.	03	02	4.2.1
Module-V				
34.	Students should be able to understand the Relays and opt isolators.	03	02	3.4.2
35.	Students should be able to understand the stepper motor interfacing.	03	02	4.2.1
36.	Students should be able to understand the DC motor interfacing and PWM.	03	02	4.2.1
37.	Students should be able to understand the basics of RaspberryPi.	04	02	4.2.1

38.	Students should be able to understand the Hardware layout of RaspberryPi.	04	02	4.2.1
39.	Students should be able to understand the Operating Systems on RaspberryPi.	04	02	4.2.1
40.	Students should be able to understand the Configuring RaspberryPi.	04	02	4.2.1
41.	Students should be able to understand the Programming RaspberryPi with Python.	04	02	4.2.1

Course Content:

Module – 1	8 Hours
8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins of 8051. Memory Address Decoding, 8031/51 Interfacing with External ROM And RAM.8051 Addressing Modes.	
Module – 2	**8 Hours**
Assembly Programming and Instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming.	
Module – 3	**8 Hours**
8051 Programming in C: Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, Data conversion program in 8051 C, accessing code ROM space in 8051C, Data serialization using 8051C. **8051 Timer Programming in Assembly and C:** Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C.	
Module – 4	**8 Hours**
8051 Interrupt Programming in Assembly and C: 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in C. **Interfacing:** LCD interfacing, Keyboard interfacing. **ADC, DAC and Sensor Interfacing:** ADC 0808 interfacing to 8051, Serial ADC Max1112 ADC interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning.	
Module – 5	**8 Hours**
Motor Control: Relay, PWM, DC and Stepper Motor: Relays and opt isolators, stepper motorinterfacing, DC motor interfacing and PWM. **Introduction to the RaspberryPi:** Basics of RaspberryPi, Hardware layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python.	
PRACTICAL COMPONENT OF IPCC	

Sl No.	Experiments
Note: For the experiments 1 to 6, 8051 assembly programming is to be used.	
1	Arithmetic instructions: Addition, subtraction, multiplication and division. Square using MATLAB/simulink.
2	Data transfer – Program for block data movement, sorting, exchanging, finding largest element in an array.
3	Up/Down BCD/ Binary Counters
4	Boolean and logical instructions (bit manipulation).

5	Code conversion programs – BCD to ASCII, ASCII to BCD, ASCII to decimal, Decimal to ASCII, Hexa.
6	Programs to generate delay, Programs using serial port and on-chip timer/counters.
Note: Single chip solution for interfacing 8051 and RaspberryPi is to be with C and Python Programs for the following experiments.	
7	Simulate and test a PWM controlled DC motor using Simscape.
8	Stepper motor interface for direction and speed control.
9	Alphanumerical LCD panel interface.
10	Generate different waveforms: Sine, Square, Triangular, Ramp using DAC interface.

Suggested Learning Resources:

Books

1. The 8051 Microcontroller and Embedded Systems Using Assembly and C, Muhammad Ali Mazadi, Pearson, 2nd Edition, 2008.
2. The 8051 Microcontroller, Kenneth Ayala, Cengage, 3rd Edition, 2005.
3. Microcontrollers: Architecture, Programming, Interfacing and System Design, Raj Kamal, Pearson, 1st Edition, 2012.

Web links and Video Lectures (e-Resources):

- NPTEL course on 8051 microcontrollers: **https://nptel.ac.in/courses/108105102**
- You tube videos on 8051 microccontrollers
- 8051 programming online course: **Complete 8051 Microcontroller Programming Course | Udemy**

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Mini projects using 8051 microcontroller
- Seminars
- Quizzes
- Assignments

Course Outcomes:

At the end of the course, the student will be able to:

1. Explain the architecture of 8051 microcontroller and discuss the instruction set.
2. Formulate and analyze the assembly and C language programs in data movement, arithmetic, logical, branching operation and other operations.
3. Design and apply the knowledge of on-chip peripherals and also interface external hardware to microcontroller.
4. Understand the basics of RaspberryPi and its programming using Python.

Course Content Delivery:

Sl No.	Hours Required	Topic to be covered	Mode of Delivery
1	01	History of Microprocessor and Microcontroller, Differences between Microprocessor & Microcontroller	Lecture with Visual Aids
2	03	Architecture of 8051	Lecture with Visual Aids
3	01	Pins of 8051	Lecture with Visual Aids
4	01	Memory Address Decoding	Chalk and Talk
5	01	8051 Interfacing with External ROM And RAM	Lecture with Visual Aids
6	01	8051 Addressing Modes.	Chalk and Talk
7	01	Introduction to 8051 assembly programming	Chalk and Talk
8	02	Assembling and running an 8051 program	Chalk and Talk
9	02	Data types and Assembler directives Arithmetic, logic instructions	Lecture with Visual Aids
10	02	Programs, Jump, loop and call instructions	Chalk and Talk
11	01	IO port programming	Chalk and Talk
12	01	Data types and time delay in 8051C	Chalk and Talk
13	01	IO programming in 8051C	Chalk and Talk
14	01	Logic operations in 8051 C	Chalk and Talk
15	01	Data conversion program in 8051 C	Chalk and Talk
16	01	Accessing code ROM space in 8051C and Data serialization using 8051C	Lecture with Visual Aids
17	01	Programming 8051 timers	Chalk and Talk
18	01	Counter programming	Chalk and Talk
19	01	Programming timers 0 and 1 in 8051 C	Chalk and Talk
20	01	8051 interrupts and Programming timer	Chalk and Talk
21	01	External Hardware and Serial Communication Interrupt	Chalk and Talk
22	01	Interrupt priority in 8051, Interrupt programming in C	Chalk and Talk
23	01	LCD interfacing, Keyboard interfacing	Chalk and Talk
24	02	ADC 0808 interfacing to 8051	Chalk and Talk
25	01	Serial ADC Max1112 ADC interfacing to 8051	Chalk and Talk
26	01	DAC interfacing, Sensor interfacing and signal conditioning	Lecture with Visual Aids
27	01	**Relays and opt isolators**	Chalk and Talk
28	01	**stepper motor interfacing**	Chalk and Talk
29	02	**DC motor interfacing and PWM**	Chalk and Talk
30	01	**Basics of RaspberryPi**	Chalk and Talk
31	01	**Hardware layout and operating systems on RaspberryPi**	Lecture with Visual Aids
32	02	**Configuring RaspberryPi**	Chalk and Talk
33	01	Programming RaspberryPi with Python	Chalk and Talk

Review Questions:

Qn No.	Review Questions	CO	BLL
1	Explain the block diagram of the 8051 microcontroller in detail.	1	2
2	Discuss the internal memory organization of the 8051 microcontroller.	2	3
3.	What are special function registers (SFRs)? Explain their role in 8051.	2	03
4.	Describe the functions of different pins of the 8051 microcontroller.	1	02
5.	Explain the concept of memory address decoding in microcontrollers.	2	03
6.	Write an assembly language program to add two 8-bit numbers and store the result in memory.	2	02
7.	Explain the different types of assembler directives used in 8051 programming.	2	03
8.	Differentiate between jump, loop, and call instructions with examples.	2	03
9.	Write a program to toggle all bits of Port 1 with a delay using assembly language.	2	03
10.	Explain how arithmetic and logical operations are performed in 8051 assembly language.	2	01
11.	Write a C program to generate a time delay using Timer 0 of the 8051 microcontroller.	2	02
12.	Explain how data conversion is handled in 8051 C programming.	2	02
13.	Write a C program to perform bitwise operations on an 8-bit number.	2	02
14.	Discuss counter programming in the 8051 microcontroller.	2	02
15.	Explain how data serialization is implemented using C in 8051.	2	02
16.	Describe the interrupt structure of the 8051 microcontroller.	2	03
17.	Explain the concept of interrupt priority and masking in 8051.	2	02
18.	Write a C program to interface an LCD display with the 8051 microcontroller.	3	02
19.	Explain the process of interfacing an ADC (Analog-to-Digital Converter) with 8051.	3	02
20.	Describe how sensor data can be read using the 8051 microcontroller.	3	01
21.	Explain the working of a relay and opt isolator in motor control.	3	02
22.	Discuss the PWM technique and its application in controlling a DC motor.	3	03
23.	Write a C program to control the direction and speed of a stepper motor.	3	02
24.	What are the key hardware features of the Raspberry Pi?	4	02
25.	Explain how Python can be used to program the Raspberry Pi for microcontroller applications.	4	02

Evaluation Scheme:

Sl. No.	Component	Examination conducted for marks			Minimum marks		Marks after scaling down
1.	CIE theory	CIE test	30	50	12	20	25
		CCE	20		08		
2.	CIE Lab	Conduction	30	50	12	20	25
		Test	20		08		
						Total	50

Details of Assignment:

Assignment	Marks (20)	CO	PO
Assignment 1 – Before 1st CIE	5	1,2	1,2,3,4,12
Assignment 2 – Before 2nd CIE	5	3,4	1,2,3,4,12
Assignment 3 – Quiz	10	1,2,3,4	1,2,3,4,12

Faculty Incharge:

(Mr. Basavaraju S. Hadapad)