BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU)

Scheme of Teaching and Examination: Effective from AY 2021–22 Choice Based Credit System (CBCS)

UG PROGRAM: ELECTRICAL & ELECTRONICS ENGINEERING (EEE) — **Semester: IV**

Sl. No	Course Category	Course Code	Course Title	Teaching Dept.	Teaching Hours /Week			Credits	Examination			
					L	T	P		Duration in Hours	CIE Marks	SEE Marks	Total Marks
1	BS	21MTA41	Numerical Methods, Complex Variable and Sampling Theory	MAT	3	1	1	4	3	50	50	100
2	HS	21CIP42	Constitution of India and Professional Ethics	HS	1	0	0	1	1	50	50	100
3	UHV	21UHV43	Universal Human Values-II	HS	1	0	0	1	1	50	50	100
4	HS	21HSS44	Environmental Studies	HS	2	0	0	2	2	50	50	100
5	PC	21EE45	Electrical Machines-II	EEE	2	2	0	3	3	50	50	100
6	PC	21EE46	Power Electronics	EEE	3	0	0	3	3	50	50	100
7	PC	21EE47	Digital System Design	EEE	3	0	0	3	3	50	50	100
8	PC	21EEL48A	Electrical Machines Laboratory-II	EEE	0	1	2	1	3	50	50	100
9	PC	21EEL48B	Power Electronics Laboratory	EEE	0	1	2	1	3	50	50	100
10	PC	21EEL48C	Digital System Design Laboratory	EEE	0	1	2	1	3	50	50	100
TOTAL					**15**	**6**	**7**	**20**		**500**	**500**	**1000**

Course prescribed to Lateral entry Diploma holders admitted to IV Semester B.E.												
2	NCMC	21DIP41A	Diploma Mathematics-II	MAT	3	0	0	0	3	100	--	100

- For Lateral entry students Assessment of Internship-I to be conducted during IV semester.
- The Assessment Pattern for 1/2/3 credit courses shall be done as per the VTU guidelines.
- BS-MTX (X-Variable) Eg: Core branches: ME, CV, EEE, ETE, ECE-**MTA**, Digital branches: CSE, ISE, AIML- **MTB**.
- Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
- Successful completion of the course Additional Mathematics-II shall be indicated as satisfactory in the grade card. Non completion of the same shall be indicated as unsatisfactory.

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

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SEMESTER – IV

Numerical Methods, Complex Variable and Sampling Theory (3:1:1) 4

(Common to ECE, ETE, EEE, MECH & CIVIL Branches)

(Effective from the academic year 2021-22)

Course Code	21MTA41	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:1:1	SEE Marks	50
Total Number of Contact Hours	50	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Apply the concept of Numerical Techniques, probability distribution and stochastic processes to analyze problems arising in the Science and Engineering field.
2. Analyze engineering problems by applying the concept of Complex Analysis, Curve fitting and Statistical Methods.
3. Apply the important analytical tools for solving partial differential equations arising in engineering applications.

Module – I

Introduction: Understanding the importance of the study of Complex Analysis, Transformations, Numerical techniques, Statistics, Probability and Sampling Distributions and their applications in the field of Science, Engineering, Business & Research.

Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula Falsi method and Newton Raphson method.

Numerical solution of ordinary differential equations of first order and first degree, Taylor's series method, Modified Euler's method, 4^{th} order Runge -Kutta method, Milne's predictor and corrector methods.

Self-Learning Component: Picard's method

Lab Session 1:

1. Solution of differential equation using Euler Method, 4^{th} order Runge- Kutta method.
2. Determination of roots of a polynomial by Newton Raphson method, Regula Falsi method.

(10 Hours)

Module – II

Complex Variables: Analytic functions - Cauchy-Riemann equations in Cartesian and Polar forms, Construction of analytic functions by Milne's method. Complex line integrals - Cauchy's theorem and Cauchy's integral formula.

Transformation: Conformal transformation, discussion of transformations: $w = z^2, w = e^z$, $w = z + \frac{1}{z}$ $(z \neq 0)$. Bilinear transformation-problems.

Self-Learning Component: Residue, poles, Cauchy's Residue theorem (without proof) and problems.

Lab Session 2:

1. Conformal mapping using Matlab for $W = e^z, W = z^2$, $W = z + \frac{1}{z}$ $(z \neq 0)$, complex valued functions.
2. Compute residues and poles for complex functions. (10 Hours)

Module – III

Partial Differential Equations: Formation of PDEs by elimination of arbitrary constants / functions, Solution of non-homogeneous PDE by direct integration, Homogeneous PDEs involving derivative with respect to one independent variable only, Solution of Lagrange's linear PDE. Solution of One-dimensional heat and wave equations by method of separation of variables.

Self-Learning Component: Derivation of One-dimensional heat and wave equations by method of separation of variables.

Lab Session 3:

1. Formation of PDE by eliminating arbitrary constant and function.
2. Solution of Heat equation. (10 Hours)

Module – IV

Vector Integration: Line integrals – problems, Surface and Volume integrals - definition, Green's theorem in a plane, Stoke's theorem and Gauss Divergence theorem (without proof) - problems.
Self-Learning Component: Proof of Green's theorem in a plane.

Lab Session 4:

1. Evaluation of line integral.
2. Evaluate Green's Theorem in a plane. (10 Hours)

Module – V

Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution & Chi-square distribution as a test of goodness of fit.
Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, problems.
Self-Learning Component: Test of hypothesis for difference of means and difference of Proportions.

Lab Session 5:

1. Testing of hypothesis using Chi-square distribution.
2. Testing of hypothesis using t – distribution.

Recap/Summary of the Course. (10 Hours)

Course Outcomes:

The students will be able to:

CO1: Solve order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
CO2: Explain the concepts of analytic functions, describe conformal and Bilinear transformation arising in field theory and signal processing.
CO3: Analyze a variety of partial differential equations and solution by exact methods/method of separation of variables.
CO4: Apply Green's Theorem, Divergence Theorem and Stoke's theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems.
CO5: Demonstrate testing of hypothesis of sampling distributions and illustrate examples of Markov chains related to discrete parameter stochastic process.

Question paper pattern:

SEE will be conducted for 100 marks.

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

CIE will be conducted for 100 marks.

- Three Unit Tests each of **20 Marks** (Duration 01 hour).
- Two assignments each of 10 Marks.
- Two alternate assessment tools (AATs) from the list shall be planned to attain the COs and POs for **20 Marks** (duration 01 hours).

- The sum of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks.

Textbooks:

1. B.S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, 2015.
2. E. Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2015.
3. B.V. Ramana, "Higher Engineering Mathematics", 6th Edition, Tata McGraw-Hill, 2010.

References:

1. N.P. Bali, Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publishers, 2014.
2. H.K. Dass, Er. RajnishVerma, "Higher Engineering Mathematics", 3rd Edition, S. Chand publishers, 2014.
3. P. Kandasamy, K. Thilagavathi, K. Gunavathi, "Engineering Mathematics", Vol. III, 2001.
4. S.S. Sastry, "Introductory Methods of Numerical Analysis", 4th Edition, Prentice Hall of India, 2010.

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Constitution of India and Professional Ethics (1:0:0) 1

(Common to all Branches)

(Effective from the academic year 2021-2022)

Course Code	21CIP32/42	CIE Marks	50
Teaching Hours/Week (L: T:P)	1-0-0	SEE Marks	50
Total Number of Lecture Hours	13	Exam Hours	01

Course objectives:

This course will enable students to

1. Familiarise with the Indian Constitution and have legal knowledge enabling them to take competitive exams and understand complex political issues.
2. Understand engineering ethics and responsibility and raise awareness and consciousness of the issues related to the profession, liability, risk and safety at work place.

Module – 1

Preamble: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation.

Introduction and Basic information about the Indian Constitution:

Introduction, Definition and significance of the Indian Constitution, Historical Background of the Indian Constitution. Framing of the Indian constitution: Role of the Constituent Assembly, Preamble and Salient features of the Constitution of India. **2 Hours**

Module – 2

Fundamental Rights, Directive Principles of State Policy and Fundamental Duties:

Fundamental Rights and its limitations, Directive Principles of State Policy: Importance and its relevance. Fundamental Duties and their significance. Case Studies **3 Hours**

Module – 3

Union and State Administration:

The Union Executive-The President and The Vice President, The Prime Minister and The Council of Ministers, The Union Legislature -Lok Sabha & Rajya Sabha, The Union Judiciary- The Supreme Court of India and its jurisdiction.

The State Executive-The Governors, The Chief Ministers and The Council of Ministers, The State Legislature- Legislative Assembly and Legislative Council, The State Judiciary- The State High Courts and its jurisdiction. **4 Hours**

Module – 4

Elections, Constitutional Amendments, Emergency Provisions and Special Constitutional Provisions:

Elections-Electoral Process in India, Election Commission of India: Powers & Functions, Constitutional Amendments- methods and Important Constitutional Amendments ie 42^{nd}, 44^{th}, 61^{st},74^{th}, 76^{th}, 77^{th}, 86^{th} ,91^{st}, 100, 101^{st}, 118^{th}, Emergency Provisions-types and its effect,

Special Constitutional Provisions for Schedule Castes, Schedule Tribes & Other Backward Classes Women & Children. **2 Hours**

Module – 5

Professional Ethics:

Definition of Ethics, Scope and Aim of Professional and Engineering Ethics, Code of ethics as defined in the Institution of Engineers (India), Responsibilities of Engineers and impediments to

responsibilities, Honesty, Integrity and Reliability of Engineers, Risk, Safety and Liability in Engineering, Case Studies. **2 Hours**

Course outcomes: The students will be able to:
CO1. Understand and have constitutional knowledge and legal literacy
CO2. Understand Engineering and Professional ethics and responsibilities of Engineers.

Assessment Details (both CIE and SEE): Kannada, Constitution of India and Professional Ethics and Universal Human Values

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum mark which is 20 marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE and SEE taken together

Continuous Internal Evaluation:

Three Tests each of **20 Marks.** (duration 01 hour)
1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**
4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Two alternate assessment tools (AATs) from the list shall be planned to attain the COs and POs for **20 Marks**
6. At the end of the 13th week of the semester

The sum of three tests, two assignments and AATs will be out of 100 marks and will be scaled down to 50 marks.

CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination (SEE):

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

The question paper will have 50 questions. Each question is set for 01 mark.

SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 50 marks. The duration of the examination is 01 Hour.

Textbooks

1. Durga Das Basu, Introduction to the Constitution of India, Lexis Nexis, 20th Edn, 2011.
2. Shubham Singles, Charles E. Haries and Et al, Constitution of India and Professional Ethics, Cengage Learning India Private Limited, Latest Edition, 2018.

References

1. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, Engineering Ethics, Prentice –Hall of India Pvt. Ltd. New Delhi, 2004.
2. M.V.Pylee, An Introduction to Constitution of India, Vikas Publishing,2002.

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Universal Human Values- II (1:0:0) 1

(Effective from the academic year 2021-2022)

Course Code	21UHV43	CIE Marks	50
Teaching Hours/Week (L: T:P)	1-0-0	SEE Marks	50
Total Number of Lecture Hours	13	Exam Hours	01

Course objectives:

This introductory course is intended to

1. Develop a holistic perspective based on self-exploration about family, society and nature/existence.
2. Understand harmony in the family, society and nature/existence
3. Strengthening of self-reflection.
4. Develop commitment and courage to act.

Module – 1

Preamble: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation.

Harmony in the Family: Understanding values in human relationships; Family as basic unit; Harmony in family, Recognizing feelings in relationships-trust, respect, affection, care, guidance, reverence, glory, gratitude and love.

Case study and Group Discussion **3 Hours**

Module – 2

Harmony in Society: Extending relationship from family to society; Comprehensive human goal, Five dimensions of human endeavor; Harmony from family order to World family order.

Case study and Group Discussion **2 Hours**

Module – 3

Harmony in the Nature: Understanding the harmony in the Nature; Interconnectedness, self- regulation and mutual fulfillment; four orders of nature; Recyclability, Natural characteristics.

Case study and Group Discussion **3 Hours**

Module – 4

Harmony in Existence: Understanding existence as co-existence; Space; Co-existence of units in space, various attributes of units and space, Role of a human being in existence.

Case study and Group Discussion **2 Hours**

Module – 5

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics, Holistic Technologies.

Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Case study and Group Discussion **3 Hours**

Course outcomes: The students will be able to:

1. Understand the role of a human being in ensuring harmony in family, society and nature, significance of value inputs in a classroom and start applying them in their life and profession

2. Distinguish between values and skills, ethical and unethical practices, happiness and accumulation of physical facilities, Intention and Competence of an individual etc and start working out the strategy to actualize a harmonious environment wherever they work

Assessment Details (both CIE and SEE): Kannada, Constitution of India and Professional Ethics and Universal Human Values

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum mark which is 20 marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE and SEE taken together

Continuous Internal Evaluation:

Three Tests each of **20 Marks.** (duration 01 hour)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Two alternate assessment tools (AATs) from the list shall be planned to attain the COs and POs for **20 Marks**

6. At the end of the 13th week of the semester

The sum of three tests, two assignments and AATs will be out of 100 marks and will be scaled down to 50 marks.

CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination (SEE):

SEE will be conducted as per the scheduled timetable, with common question papers for the subject.

The question paper will have 50 questions. Each question is set for 01 mark.

SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 50 marks. The duration of the examination is 01 Hour.

Textbooks

The Textbook *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN978-93-87034-47-1

The Teacher's Manual for *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, NewDelhi, 2019. ISBN 978-93-87034-53-2

References

Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
Small Is Beautiful: A Study of Economics as if People Mattered, E. F. Schumacher, 1973, Blond & Briggs, UK
Vivekananda - Romain Rolland (English)

Relevant websites, documentaries

Value Education websites, http://uhv.ac.in,
Story of Stuff, *http://www.storyofstuff.com*

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Environmental Studies (2:0:0) 2

(Common to all Branches)

(Effective from the academic year 2021-22)

Course Code	21HSS44	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:0	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	02

Course Objectives:

This course will enable students to:

1. Recognize the ecological basis for regional and global Environmental issues, and lead by example as an environmental steward.
2. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
3. Analyze the trans-national character of environmental problems and ways of addressing them, including interactions across local to global scales.
4. Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, and written and oral communication needed to conduct high-level work as environmentalists.

Module – 1

Introduction: Relevance of the Subject to Historical and real-time Global, Economic and Societal Scenario. Internship and Job Opportunities in the current scenario.

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.
Biodiversity: Types, Value; Hot-spots; Threats to Biodiversity.

(5 Hours)

***Field work:** Visit to a local area to document environmental assets: river / forest / grassland / hill

Module – 2

Environmental Pollution & Abatement (with Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.

(5 Hours)

***Field work:** Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural, so as to observe and document environmental pollution and recommend remedial measures.

Module – 3

Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

(5 Hours)

***Field work:** Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural, so as to observe and document environmental impacts and recommend remedial measures.

Module – 4

Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Fluoride problem in drinking

water; Cloud Seeding, and Carbon Trading.

(5 Hours)

***Field work:** Visit to a Green Building, followed by understanding of process and its brief documentation.

Module – 5

Latest Developments in Environmental Pollution Mitigation (Concept and Applications): G.I.S. and Remote Sensing, Environment Impact Assessment (E.I.A.), Environmental Management Systems (E.M.S.), ISO14001.

Case Studies: Environmental Stewardship, Environmental NGOs.

***Field work:** Visit to an Environmental Engineering Laboratory / Water Treatment Plant/Wastewater treatment Plant, followed by understanding of process and its brief documentation

Summary of the Course

(6 Hours)

(*Note: Any 1 among the 5 Field works is mandatory from the Exercises discussed in across the 5 modules, and Students have to submit a report)

Course outcomes:
The students will be able to:

CO 1:	Appraise the significance of ecological systems under the ambit of environment.
CO 2:	Analyze for the consequences owing from anthropogenic interactions on the environmental processes.
CO 3:	Recommend solutions in the Anthropocene Epoch, with an in-depth understanding of the interdisciplinary facets of environmental issues.
CO 4:	Elucidate the trans-national character of environmental problems and ways of addressing them.
CO 5:	Appraise latest developments, concerns and ethical challenges associated with Environmental Protection.

Teaching Practice:

- Classroom teaching (Chalk and Talk)
- ICT – Power Point Presentation
- Audio & Video Visualization Tools
- Case Studies: Real-life Article Inferential Discussion
- Site-visit and Reporting

Question paper pattern:

- SEE will be conducted for 50 marks, and will comprise of 50 MCQs. The duration of exam is 2 hours.
- CIE will be conducted for 40 marks. It will be for 1-hour duration; it shall consist of 40 MCQs, each carrying 1 mark.
- CIE will be announced prior to the commencement of the course.
- Two assignments ought to be submitted each of 10 Marks

- One alternate assessment tools (AATs) from the list shall be planned to attain the COs and POs for 20 Marks (duration 01 hours)
- The average of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks.

Text Books

1. Rajesh Gopinath and N. Balasubramanya, "Environmental science and Engineering", 1st Edition, City of Publisher, Cengage Learning India Private Limited, 2018.
2. J. S. Singh, S. P. Singh and S. R. Gupta, "Ecology, Environmental Science and Conservation", India, S. Chand Publishing, 2017.

References:

1. M. Gadgil and R. Guha, "This Fissured Land: An Ecological History of India", Univ. of California Press, 1993.
2. E. P. Odum and H. T. Odum, "Fundamentals of Ecology", Philadelphia: Saunders Publisher, 1971.
3. M. L. Mckinney, "Environmental Science systems & Solutions", Web enhanced Edition, City of Publisher, R. M. Publisher, 1996.

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Electrical Machines - II (2:1:0) 3

(Effective from the academic year 2021-22)

Course Code	21EE45	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Understand the constructional features, classification of DC and AC rotating machines with its performance for different loading conditions
2. Analyse the operational behaviour of machines and its applications
3. Explain the concept of synchronisation of alternators with infinite bus and parallel operation of alternators

Module – 1

Introduction: Role of electrical machines in nation's power generation, its performance analysis and synchronization methods adopted in practical applications.

DC GENERATOR- Types of armature winding, EMF equation, no-load characteristic, armature reaction, load characteristics. Commutation, types of Commutation, commutation difficulties, interpoles.

(8hours)

Module – 2

DC Motors- Back EMF and its significance, Torque equation, Application of motors. DC motor starters, Special DC motors- permanent magnet motor, brushless DC motors.

Testing of DC machines - Direct and indirect methods, predetermination of losses and efficiency by Swinburne's, Hopkinson's and Field Tests. Speed control of DC shunt and DC series motors.

(8hours)

Module – 3

Synchronous Machines:

Synchronous generators: Generated EMF, effect of distribution and chording of winding, harmonics-causes, reduction and elimination. Armature reaction, synchronous reactance, leakage reactance.

Synchronous Motor

Principle of operation, methods of starting, V and inverted V curves, applications of synchronous machines.

(8hours)

Module – 4

Voltage regulation and methods of synchronization:

OC and SC tests, Voltage regulation, determination of voltage regulation by EMF, MMF and ZPF methods. Slip test on salient pole alternator, voltage regulation of salient pole alternator using X_d and X_q.

(8 hours)

Module – 5

Synchronization of alternators:

Need and conditions for parallel operation of alternators, Methods of synchronizing a three phase alternator to bus bars. Load sharing between two alternators in parallel.

Power angle characteristics, Effect of change in excitation and effect of change in load for both generating and motoring modes. Hunting and Damping,

Recap: Concepts of basic principles of energy conversion in generators, construction, its characteristics and various testing methods adopted in performance analysis.

(8 hours)

Course Outcomes: The students will be able to:

CO1: **Describe** the operating principles and characteristics of DC and Synchronous machines.
CO2: **Describe** the methods of testing and Synchronizing methods of synchronous machines.
CO3: **Analyse** the performance of various machines.

Question paper pattern:

SEE will be conducted for 100 marks.

- The question paper will be set for 100 marks and marks scored will be proportionally scaled down to 50 marks
- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

CIE will be conducted for 100 marks.

- Three Unit Tests each of **20 Marks** (Duration 01 hour).
- Two assignments **each of 10 Marks.**
- Two alternate assessment tools (AATs) from the list shall be planned to attain the COs and POs for **20 Marks** (duration 01 hour).
- The sum of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks.

Text Books:

1. D. P Kothari," Electrical Machines", et al McGraw Hill, 4th edition 2011
2. Dr. P.S. Bhimbra, "Electrical Machinery", Khanna Publications, 7th Edition, 2007
3. Abhijit Chakraborthy, "Electric Machines", McGraw Hill Education, 2015

References:

1. Ashfaq Husain, "Electric Machines", DhanpatRai and Co, Second Edition,2014
2. M. G. Say, "Performance and Design of Alternating Current Machines", John Wiley and Sons Publications, 3rdEdition,2002
3. A S Langsdorf, "Alternating current Machines", McGraw Hill Education, 1984.

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

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SEMESTER – IV

Power Electronics (3:0:0) 3

(Effective from the academic year 2021 -2022)

Course Code	21EE46	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course objectives:

This course will enable students to:

1. Give an overview of applications of power electronics, different types of power semiconductor devices, their switching characteristics.
2. Explain the techniques for design and analysis of single phase diode rectifier circuits
3. Explain different power transistors, their steady state and switching characteristics.
4. Explain different types of Thyristors, their gate characteristics and gate control requirements.
5. Explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, Voltage controllers, DC- DC and DC -AC converters.

Module – 1

Introduction: Significance and Scope of the course, Impact of the course on Societal Problems - Sustainable Solutions, Career Prospective, Latest research trends and innovations.

Power semiconductor devices: Application of power electronics, Types of power electronic circuits, Peripheral effects, Characteristics and specifications of switches. Power semiconductor devices, Control characteristics of power devices, Device choices.

Power Diodes: Introduction, Diode characteristics, Reverse recovery characteristics, Diode types, Diode circuits with DC source connected to R and RL load, Single-phase Full-Wave Rectifiers with R load , Single-phase Full-Wave Rectifier with RL Load.

(8 hours)

Module – 2

Power Transistors: Introduction, Bipolar Junction Transistors: Steady State Characteristics, Switching Characteristics, Switching Limits. Power MOSFET: Steady state characteristics, Switching characteristics. IGBTs: Steady state characteristics, Switching characteristics.

Gate Drive Circuits: MOSFET Gate Drive, Isolation of Gate Drives

(8 hours)

Module – 3

Thyristors: Introduction, Thyristor characteristics, Two- transistor model, Thyristor turn-on and turn-off, Series and Parallel operation of thyristors, di/dt and dv/dt protection, DIACs, TRIACs, Thyristor Firing Circuits, Unijunction Transistor, Pulse transformers and Opto-couplers.

(8 hours)

Module – 4

Controlled Rectifiers: Introduction, Single-Phase Half Wave converter with R Load, Single-Phase Half Wave converter with RL Load, Single-Phase Half Wave converter with RL Load and Freewheeling Diode, Single-Phase Full Wave converter with RLE Load, Single-Phase Dual converters, Three-Phase Full Wave converter.

AC Voltage Controllers: Introduction, Principle of Phase control & Integral cycle control, Single-Phase Full Wave Controllers with Resistive Loads, Single-Phase Full-Wave Controllers with Inductive Loads.

(8 hours)

Module – 5

DC-DC Converters: Introduction, Performance parameters, Principle of step-down operation, Step down converter with RL load, Principle of step up operation, Step-up converter with R load, Converter classification.

DC-AC Converters: Introduction, Principle of operation, Performance parameters, Single phase half and full- bridge inverter with R and RL load, Three-phase inverters, Voltage control of single-phase inverter.

Recap: Summary of various power semiconductor devices and their applications in different converters.

(8hours)

Course outcomes:

The students will be able to:

CO1: Explain different types of power semiconductor devices and circuits.
CO2: Analyze the operation, characteristics, gate control circuits of power transistors and thyristors.
CO3: Analyze the operation of different power converters**.**
CO4: Evaluate the performance parameters of power converters.

Question paper pattern:

SEE will be conducted for 100 marks.

- The question paper will be set for 100 marks and marks scored will be proportionally scaled down to 50 marks
- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

CIE will be conducted for 100 marks.

- Three Unit Tests each of **20 Marks** (Duration 01 hour).
- Two assignments **each of 10 Marks.**
- Two alternate assessment tools (AATs) from the list shall be planned to attain the COs and POs for **20 Marks** (duration 01 hour).
- The sum of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks.

Textbooks

1. M. H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson, 4th Edition, 2014.
2. P. S. Bimbhra, "Power Electronics", Khanna Publishers, 5th Edition, 2012.
3. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics converters, applications and design", Wiley, 3rd edition, 2014.

References

1. VedamSubramanyam, "Power Electronics", Revised Second Edition, New Age International Publishers, 2006.
2. Daniel W Hart, "Power Electronics", McGraw Hill, 1st Edition, 2011.

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Digital System Design (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21EE47	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course objectives:

This course will enable students to:

1. Design combinational circuits.
2. Design Sequential circuits.
3. Gain knowledge on Memories & its use

Module – 1

Introduction: Significance and Scope of the Digital Electronics, Importance of the Course in Economic growth of Nation, Impact of the course on Societal Problems/ Sustainable Solutions/ National Economy, Career Perspective, Innovations (Current), Research status/trends.

Principles of Combinational Logic :Introduction, Review of Boolean algebra and basic gates, Definition of combinational logic, Canonical forms, Generation of switching equations from truth table, Karnaugh maps - 3, 4 variables, Map entered variables, Incompletely specified functions, Simplifying max term equations, Quine - McCluskey minimization technique. Design with Basic gates, NAND gates and NOR gates

(8 hours)

Module – 2

Combinational Logic Circuits:

Introduction to combinational circuits, General approach, Decoders- NAND gate implementation, types, using decoders as Boolean function generators, BCD decoders, encoders. Parallel Adders (Carry Look Ahead Adder and Ripple carry adder), subtractors, Binary comparators, Multiplexers and DeMultiplexers.

(8 hours)

Module – 3

Flip Flops

Introduction, Basic bistable elements, SR latch, applications, Gated SR latch, D, T, JK flip flops, Characteristics equations, Master/Slave JK flip-flop, Edge triggered flip flop, conversion of one flip flop to another.

(8 hours)

Module – 4

Registers: Introduction on registers, Shift registers: SISO, SIPO, PISO, PIPO and Universal Register. Applications of shift registers (serial adder, ring counter, Johnson counter).

Counters: Introduction on counters, Up counter, down counter, up/down counter using flip flops, design of Mod N counter, Design of synchronous counters, Universal Counter

(8 hours)

Module – 5

Sequential Circuit Design:

Introduction, Mealy and Moore Models, State Machine Notation, State diagram, Synchronous Sequential Circuit Analysis, Sequence detector, Construction of state Diagrams, Counters Design.

Memories:

Read only and Read/Write Memories, Programmable ROM, EPROM, EEPROM, Flash memory, SRAM, DRAM.

Self- Study Topics:

1. Logic Gates, Universal gates and the truth tables.
2. Different Number systems

Summary: The student will be able to explore about Combinational & sequential circuits, design aspects, their applications and gain knowledge on Memories and their use.

(8 hours)

Course outcomes:

The students will be able to:

CO1: Analyze the Boolean equations and simplify the switching equations by applying Karnaugh Maps and Quine McClusky techniques.

CO-2: Design Adders, Subtractors, Multiplexer, Encoder, Decoder and Comparator as digital combinational control circuits.

CO-3: Design flip flops, counters, shift registers as sequential control circuits.

CO-4: Analyze and Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits.

CO-5: Design and develop finite state machines.

CO-6: Analyze the functioning of Read only and Read/Write Memories, Programmable ROM, EPROM and Flash memory.

Question paper pattern:

SEE will be conducted for 100 marks.

- The question paper will be set for 100 marks and marks scored will be proportionally scaled down to 50 marks
- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

CIE will be conducted for 100 marks.

- Three Unit Tests each of **20 Marks** (Duration 01 hour).
- Two assignments **each of 10 Marks.**
- Two alternate assessment tools (AATs) from the list shall be planned to attain the COs and POs for **20 Marks** (duration 01 hour).

The sum of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks.

Textbooks:

1. M. Morris Mano, "Digital Logic and Computer Design", Pearson India Education services Pvt Ltd, 1st edition, March 2017.
2. Donald Givone, "Digital Principles and Design", Tata Mc Graw Hill, 7th edition, July 2017

References:

1. Charles Roth Jr. Larry L. Kinney, Raghunandan G.H, " Fundamental of Logic Design", Cengage Learning ,1st edition, January 2019.
2. John Yarbrough, "Digital Logic Applications and Design", Cengage Learning, 1st Edition, 2006.

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SEMESTER – IV

Electrical Machines Laboratory-II(0:0:1) 1

(Effective from the academic year 2021-22)

Course Code	21EEL48A	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:1:2	SEE Marks	50
Total Number of Contact Hours	30	Exam Hours	3

Course objectives:

This course enables students to:

1. To conduct Load, Swinburne's, Hopkinsons and field tests DC Motors and to find the performance characteristics
2. To conduct retardation test to find losses in DC machine
3. To conduct speed control tests on DC motor
4. To conduct a slip test and to connect synchronous generators to infinite bus to find performance characteristics.

List of Experiments

PART A

1. Load test on a DC motor- determination of speed-torque and HP-efficiency characteristics.
2. Swinburne's Test.
3. Hopkinson's Test.
4. Field's test on series motors.
5. Retardation test- electrical braking method.
6. Speed control of DC motor by armature voltage control and flux control.
7. Slip test and determination of regulation.
8. Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa.

PART B

Open Ended Experiments:

1. Load characteristics of a D.C. compound generator - i) Short shunt-Cumulative and Differential (ii) Long shunt-Cumulative and Differential.
2. Load characteristics of a D.C. shunt generator

Course outcomes:

The students will be able to:

CO1: Analyze the no load and load characteristics of DC generators

CO2: Analyze the performance of DC motors by direct and indirect methods

CO3: Analyze and compare the regulation of alternator by various methods

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SEMESTER – IV

Power Electronics Laboratory (0:0:1) 1

(Effective from the academic year 2021 -2022)

Course Code	21EEL48B	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:1:2	SEE Marks	50
Total Number of Contact Hours	30	Exam Hours	3

Course objectives:

This course will enable students to:

1. Conduct test to find the static characteristics of SCR, TRIAC, MOSFET and IGBT
2. Generate firing signal to trigger the SCR by different methods
3. Conduct test on single phase controlled rectifier and ac voltage regulator
4. Control the speed of various motors

PART A

1. Static Characteristics of SCR.
2. Static Characteristics of MOSFET and IGBT
3. Static Characteristics of TRIAC
4. SCR turns on circuit using synchronized UJT relaxation oscillator
5. SCR digital triggering circuit for a single phase controlled rectifier and ac voltage regulator
6. Single phase controlled full wave rectifier with R load, R-L load with and without freewheeling diode
7. AC voltage controller using TRIAC and DIAC combination connected to R and R-L loads

PART B

8. Speed control of DC motor using single phase semi converter
9. Speed control of stepper motor
10. Speed control of universal motor using ac voltage regulator
11. Speed control of a separately excited D.C. Motor using an IGBT/MOSFET chopper
12. Single phase MOSFET/IGBT based PWM inverter

Open ended Experiment

1. Step up and Step down Chopper with R load

Course outcomes:

The students will be able to:

CO1: Obtain static characteristics of semiconductor devices and find their performance
CO2: Trigger the SCR by different methods to be used in power converter
CO3: Verify the performance of different power electronic converters with R and RL loads
CO4: Control the speed of a dc motor, universal motor and stepper motors

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Digital System Design Laboratory (0:0:1) 1

(Effective from the academic year 2021-22)

Course Code	21EEL48C	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:1:2	SEE Marks	50
Total Number of Contact Hours	30	Exam Hours	3

Course objectives:

This course will enable students toDesign, realization and verification of

1. Demorgan‟s Theorem, SOP, POS forms
2. Full/Parallel Adders, Subtractors and Magnitude Comparator
3. Multiplexers using logic gates
4. Demultiplexers and Decoders
5. Flip-Flops, Shift registers and Counters.

List of Experiments

1. Simplification, realisation of Boolean expressions using logic gates/universal gates
2. Realisation of half/full adder and half/full Subtractors using logic gates
3. i. Realisation of parallel adder/Subtractors using 7483 IC
   ii. BCD to excess-3 code conversion and vice versa
4. Realisation of binary to gray code conversion and vice versa
5. MUS/DEMUX – use of 74153, 74139 for arithmetic circuits and code converter
6. Realisation of one/two bit comparator and study of 7485 magnitude comparator.
7. Use of i) Decoder IC to drive LED display and b) Priority encoder
8. Truth table verification of flip-flops of i. JK master slave ii. T type and iii. D type
9. Realization of 3 bit counters as a sequential circuit and MOD-N counter design (IC 7476, IC7490, IC 74192 and IC 74193).
10. Shift left, shift right, SIPO, SISO, PISO and PIPO operations using 74S95.

Open Ended Experiments

1. Wiring and testing Ring counter/Johnson Counter
2. Writing and testing of Sequence Generator.
3. Simulate Full Adder using any simulation tool
4. Simulate Mod-8 Synchronous UP/DOWN Counter using Simulation tool.

Course outcomes:

The students will be able to:

CO1:Design the truth table of various expressions and combinational circuits using logic gates.
CO2: Design, test and evaluate various combinational circuits such as adders, subtractors, comparators, multiplexers and demultiplexers
CO3:Analyze and design flips-flops, counters and shift registers

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Diploma Mathematics- II (0:0:0) NIL

COMMON TO ALL BRANCHES

(Effective from the academic year 2021-22)

Course Code	21DIP41A	CIE Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	-
Total Number of Contact Hours	3	Exam Hours	3

Course Objectives:

This course will enable students to:

1. To provide an insight into linear & higher order ODE's and elementary probability theory.
2. To familiarize the important tools of Laplace transformations required to analyse the engineering problems.

Module – I

Introduction: Understanding the importance of Vector Differentiation, Differential equations, Laplace Transforms and Probability in the field of Science, Engineering, Business and Research.

Differential equations–I: Introduction-solutions of first order and first-degree differential equations: exact, Equations reducible to exact, linear differential equations and Bernoulli's equation. (6 hours)

Module – II

Differential equations–II: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous/non-homogeneous equations. Inverse differential operators. [Particular Integral restricted to $R(x)= e^{ax}$, sin ax, cos ax, polynomial for $f(D)y = R(x)$]. (6 hours)

Module – III

Probability: Introduction to Probability, Sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes' theorem, problems. (6 hours)

Module – IV

Laplace Transforms: Definition and Laplace transforms of elementary functions, Laplace Transforms of e^{at} f(t), t^nf(t), n is a positive integer & (f(t))/t (without proof), Periodic function (statement only) and Unit-step function – problems. (6 hours)

Module – V

Inverse Laplace Transforms: Inverse Laplace Transform- Definition and problems, Convolution theorem (No Proof), Evaluation of Inverse Laplace Transform using Convolution theorem. Solution of linear differential equations using Laplace transforms technique.

Recap/Summary of the course. (6 hours)

Course outcomes: The students will be able to:

CO1: Solve first and higher order ordinary differential equations.

CO2: Use Laplace transform and inverse Laplace transform in solving differential equation.

CO3: Apply elementary probability theory for related problems.

Question paper pattern:

CIE will be conducted for 100 marks.

- Three Unit Tests each of **20 Marks** (Duration 01 hour).
- Two assignments each of 10 Marks.
- Course Seminar suitably planned to attain the COs and POs for 20 Marks (duration 01 hours).
- The sum of three tests, two assignments, and a seminar will be out of 100 marks. The student shall secure a minimum of 40% of marks of the course to qualify and become eligible for the award of a degree.

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2015.
2. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2015.
3. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2010.

References:

1. N. P. Bali, Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publishers, 2014.
2. C. Pandurangappa, Advanced Mathematics II (Lateral entry bridge course text book)", 3rd Edition. Sanguine Publishers, 2015.
3. S. Pal, S. C. Bhunia, Engineering Mathematics, 3rd Edition, Oxford University Press, 2011.
4. H. K. Dass, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Private Ltd, 2014.