

Bachelor of Technology (Electrical Engineering)  
(Credit Based)  
Modified Scheme of Studies/Examination Semester III  
(Modified & w.e.f. Session 2019-20)

Sr. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	*EE-201A	Electric Circuit Theory	3:1:0	4	4	75	25	0	100	3
2	EE-203A	Analog Electronics	3:0:0	3	3	75	25	0	100	3
3	*EE-205A	Electrical Machines - I	3:1:0	4	4	75	25	0	100	3
4	BS-207A	Applied and Computational Mathematics	3:0:0	3	3	75	25	0	100	3
5	HM-903A	Soft Skills & Interpersonal Communication	3:0:0	3	3	75	25	0	100	3
6	*EE-211A	Electrical Machines – I Lab	0:0:2	2	1	-	40	60	100	3
7	EE-207A	Analog Electronics Lab	0:0:2	2	1	-	40	60	100	3
8	**EE-209A	Industrial Training-I	2:0:0	2	-	-	100	0	100	3
9	***MC-901A	Environmental Sciences	3:0:0	3	-	75	25	0	100	3
		<b>Total</b>		<b>26</b>	<b>19</b>	<b>375</b>	<b>205</b>	<b>120</b>	<b>700</b>	

\* Subjects Common with IIIrd Semester. B.Tech. [Electrical & Electronics Engg.] Scheme, K.U.K.

\*\*EE-209A is a mandatory credit-less course in which the students will be evaluated for the industrial training undergone after 2<sup>nd</sup> semester and students will be required to get passing marks to qualify.

\*\*\*MC-901A is a mandatory credit-less course in which the students will be required to get passing marks in the major test.

Bachelor of Technology (Electrical Engineering)  
(Credit Based)  
Scheme of Studies/Examination Semester-IV (Modified & w.e.f. Session 2019-20)

S. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	EE-202A	Digital Electronics	3:1:0	4	4	75	25	0	100	3
2	EE-204A	Signals and Systems	3:1:0	4	4	75	25	0	100	3
3	*EE-206A	Electrical Machines – II	3:1:0	4	4	75	25	0	100	3
4	*EE-208A	Power Electronics	3:1:0	4	4	75	25	0	100	3
5	EE-216A	Electromagnetic Fields	3:0:0	3	3	75	25	0	100	3
7	*EE-210A	Electrical Machines- II Lab	0:0:2	2	1	-	40	60	100	3
8	*EE-212A	Power Electronics Lab	0:0:2	2	1	-	40	60	100	3
9	EE-214A	Digital Electronics Laboratory	0:0:2	2	1	-	40	60	100	3
10	**MC-902A	Constitution of India	3:0:0	3	-	75	25	0	100	3
		<b>Total</b>		<b>28</b>	<b>22</b>	<b>375</b>	<b>245</b>	<b>180</b>	<b>800</b>	

\* Subjects Common with IV Semester. B.Tech. [Electrical & Electronics Engg.] Scheme, K.U.K.

\*\*MC-902A is a mandatory credit-less course in which the students will be required to get passing marks in the major test.

**Note: All the students have to undergo 4 to 6 weeks Industrial Training after 4<sup>th</sup> semester which will be evaluated in 5<sup>th</sup> semester.**

EE-201A	Electric Circuit Theory						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	1	-	4	75	25	100	3h
<b>Purpose</b>	<b>To familiarize the students with electric network function and network synthesis.</b>						
<b>Course Outcomes</b>							
CO1	Apply network theorems for the analysis of electrical circuits.						
CO 2	Obtain the transient and steady-state response of electrical circuits.						
CO 3	Analyse circuits in the sinusoidal steady-state (single-phase and three-phase).						
CO 4	Analyse two port circuit behavior.						

### Unit-I

#### Solution of First and Second order networks:

Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

### Unit-II

#### Electrical Circuit Analysis Using Laplace Transforms

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros, series and parallel resonances.

### Unit-III

#### Two Port Network and Network Functions:

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

### UNIT-IV

#### Network Synthesis:

Hurwitz polynomials, Properties of Hurwitz polynomials, Positive real functions, procedure of testing of PR functions, concept and procedure of network synthesis, properties of expressions of driving point immittances of LC networks. LC Network synthesis: Foster's I & II Form, Cauer's I & II form, RC & RL Network.

#### Suggested Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.

**Note:** The paper setter will set the paper as per the question paper templates provided.

EE-203A	Analog Electronics	3L:0T:0P	3 credits	3 h Time
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### Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the characteristics of transistors.
- Design and analyze various rectifier and amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- Understand the functioning of OP-AMP and design OP-AMP based circuits.

### UNIT 1: Diode circuits

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

### UNIT 2: BJT circuits

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

### UNIT 3: MOSFET circuits

MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, transconductance, high frequency equivalent circuit.

### UNIT 4: Differential, multi-stage and operational amplifiers (8 Hours)

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

### Text/References:

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989

Note: The paper setter will set the paper as per the question paper templates provided.

EE-205A		Electrical Machine-I					
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	1	-	4	75	25	100	3h
<b>Purpose</b>	To familiarize the students with electric machines and transformer.						
<b>Course Outcomes</b>							
CO1	To understand concept ,working, operation, maintenance of single phase transformer						
CO 2	To understand concept ,working, operation, maintenance of three phase transformer & conversion from three phase to multiple phases						
CO 3	To understand construction ,working, operation of D.C. Generator						
CO 4	To understand concept ,working, operation, testing of D.C. Motor						

#### UNIT – I

##### TRANSFORMERS:

Principle, construction of core, e.m.f. equation, winding & tank, cooling, operation, testing of single phase transformer, equivalent circuit, phasor diagram, parameters determination, P.U representation of parameters, regulation, losses & efficiency, separation of iron losses, parallel operation, all-day efficiency, Sumpner's test, specifications of transformer, maintenance of transformer, difference between power transformer and distribution transformer.

#### UNIT – II

**Three phase transformer:** Types and their comparative features, Zig-zag connection.

**Auto-Transformer:** Principle, construction, comparison with two winding transformers, applications.

**Nature of magnetizing current:** plotting of magnetizing current from B-H curve, inrush current.

**Phase-Conversion:** Three to two phase, three to six phase and three to twelve phase conversions. Introduction to three windings transformer, tap-changing & phase- shifting transformers.

#### UNIT – III

**D.C. Generator-**Principle & construction of D.C. generator, simplex lap, wave winding, E.M.F. equation, types, voltage build up, armature reaction, compensating winding, function of commutator, methods of improving commutation, load characteristics, parallel operation.

**Excitation System**—Purpose and requirements of excitation system, brushless excitation system.

#### UNIT- IV

##### D.C. Motor-

Principle of DC motors, function of commutator in DC motors, torque and output power equations, load characteristics, losses, starting, starters, speed control, braking, testing , Swinburne test, Hopkinson test, Ward Leonard Method, efficiency & applications.

##### Suggested Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. J. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

**Note:** The paper setter will set the paper as per the question paper templates provided.

BS-207A	APPLIED AND COMPUTATIONAL MATHEMATICS						
LECTURE	TUTORIAL	PRACTICAL	CREDIT	MAJOR TEST	MINOR TEST	TOTAL	TIME
3	-	-	3	75	25	100	3 H
Purpose	The objective of this course is to familiarize the prospective Engineers with ordinary and partial differential equations, Laplace Transform which allow deterministic mathematical formulations of phenomena in engineering processes and to study numerical methods for the approximation of their solution. More precisely, the objectives are as under:						
Course Outcomes							
CO 1	To introduce the Ordinary & Partial Differential Equations, its formation and solutions for multivariable differential equations originated from real world problems.						
CO 2	To study some extended topics in calculus essential for computations w.r.t. parameter variations, vectors and field theory.						
CO 3	Introduction about the concept of Laplace transform and how it is useful in solving the definite integrals and initial value problems.						
CO 4	To introduce the tools of numerical methods in a comprehensive manner those are used in approximating the solutions of various engineering problems.						

#### UNIT-1

##### ORDINARY & PARTIAL DIFFERENTIAL EQUATIONS

**ODE:** First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Second order linear differential equations with constant coefficients.

**PDE:** Formation of Partial Differential Equations, Solutions of first order linear and non-linear PDEs, Charpit's method, Solution to homogenous linear partial differential equations (with constant coefficients) by complimentary function and particular integral method.

#### UNIT-2

##### ADVANCE CALCULUS

Multivariable Calculus: Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar and ) Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere .

Vector Calculus: Gradient, divergence and Curl and their properties, Directional derivative. Line integrals, surface integrals, volume integrals, Theorems of Green, Gauss and Stokes (without proof).

#### UNIT-3

##### LAPLACE TRANSFORM

Laplace Transform, Laplace Transform of Elementary Functions, Basic properties of Laplace Transform, Laplace transform of periodic functions, finding inverse Laplace transform by different methods, Convolution theorem, solving ODEs by Laplace Transform method.

#### UNIT-4

##### NUMERICAL TECHNIQUES

Solution of polynomial and transcendental equations: Bisection method, Newton-Raphson method and Regula-Falsi method, Lagrange's formulae.

Numerical Differentiation using Newton's forward and backward difference formulae, Numerical integration: Trapezoidal rule and Simpson's 1/3<sup>rd</sup> rule, Taylor's series, Runge-Kutta method for solving first and second order equations.

##### Textbooks/References:

1. Erwin Kreyszig and Sanjeev Ahuja, Applied Mathematics-II, Wiley India Publication, Reprint, 2015.
2. W.E. Boyce and R. C. Di Prima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India,
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.
6. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall.
7. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
8. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
9. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
10. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
11. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
12. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
13. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
14. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

**Note:** The Examiner will be given the question paper template to set the questions.

HM- 903A	Soft Skills & Interpersonal Communication						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
CO1	Develop basic understanding of Communication						
CO2	Understand the process of communication and speaking						
CO3	Develop the Personality concepts and its implementation						
CO4	Develop the basic of Group Discussion and interviews						

#### UNIT-I

Communication: Introduction Verbal, Non-Verbal, kinesics, proxemics, chronemics, Types of communication, extrapersonal communication, intrapersonal communication, intrapersonal communication, mass communication, Creativity in communication, Role of communication, flow of Communication and its need, Persuasive communication and negotiation; Time management in Persuasive communication, Importance of Persuasive Communication

#### UNIT-II

Barriers in the way of communication, noise, intrapersonal barriers, interpersonal barriers, organizational barriers, Extrapersonal barriers, Basics of communication: importance of communication, process of communication, objectives and characteristics of communication, Communication skills: Accent, Intonation, Phonetics, Speaking skills, Confidence, clarity, Fluency, Quality, pronunciation

#### UNIT-III

Personality Development; what is personality? Role of personality, Heredity, Environment, situation, Basics of personality, Soft skills; Needs and training, Activity in soft skills, Organizational skill; Introduction and its need, basics principles for Organization skills, Stress management; Introduction, Stress at home and office, Stress prevention, analyze the model of stress.

#### UNIT-IV

Group discussion, form of Group discussion, strategy for Group discussion, discussing problems and solution, Oral presentation, introduction, planning, Occasion, Purpose, Modes of delivery, Resume making; Purpose of Resume, Resume design and structure, contents in Resume, types of resume, Job interview, introduction, objective of Interview, types of interview, stages of interview, Face to face interview and campus interview

#### Text Books:

1. Technical Communication Principles and Practice by Meenakshi Raman and Sangeeta Sharma by Oxford Publication

#### Reference Books:

1. Personality Development and soft skills by Barun K. Mitra, Oxford Publication
2. Communication Skills For Engineers by C. Muralikrishna and Sunita Mishra, Pearson Pub.

Note: The paper setter will set the paper as per the question paper templates provided.

EE -211A	Electrical Machines Lab-I						
L	T	P	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3h

**LIST OF EXPERIMENTS:**

1. To find turns ratio, polarity & mark dot convention of a 1-phase transformer.
2. To perform open & short circuit tests on a 1-phase transformer & find parameters.
3. To perform Sumpner's Back to Back test on 1-phase transformer & find parameters.
4. Parallel operation of two 1-phase transformers and observe load sharing.
5. To convert three phase supply to 2-phase by Scott-connection, compare line currents theoretically & practically for unbalanced load.
6. To perform load test on DC shunt generator & find efficiency & observe speed at different load.
7. Speed control of DC shunt motor by armature & field control method, draw graph between speed & field current.
8. To perform Swinburne's test of DC shunts motor and find efficiency.
9. To perform Hopkinson's test of DC shunts M/Cs.
10. To perform Ward Leonard method for speed control DC shunts motor.
11. To make various types of three phase connections , using three single phase transformers, study relevant features
12. Characteristics for compound, series shunt generators.

**Note: At least eight experiments should be performed from above list.**

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EE-207A	Analog Electronics Lab						
L	T	P	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3h

**List of Experiments:**

1. To Design a simple common emitter (CE) amplifier Circuit and find its gain and frequency response.
2. To Design a differential amplifier and calculate its gain and frequency response
3. To design RC coupled Single stage amplifier and determination of the gain , frequency response.
4. To design a Emitter follower and determination of the gain, input and output impedances.
5. To design and test the performance of RC Phase shift Oscillator.
6. To design and test the performance of Hartley Oscillators.
7. To design and test the performance of Colpitt Oscillators.
8. To design an astable multivibrator using 555 timer.
9. To design a monostable multivibrator using 555 timer.
10. To design Schmitt trigger using op-amp and verify its operational characteristics.

**Note: At least eight experiments should be performed from above list.**

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EE-209A		INDUSTRIAL TRAINING-I						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Practical	Total	Time (Hrs.)
2	0	0	--	--	100	--	100	3 h
<b>Purpose</b>	To provide comprehensive learning platform to students where they can enhance their employability skills and exposure to the industrial environment.							
<b>Course Outcomes</b>								
CO1	Capability to acquire and apply fundamental principles of engineering.							
CO 2	Become updated with all the latest changes in technological world.							
CO 3	Capability and enthusiasm for self-improvement through continuous professional development and life-long learning							
CO 4	Awareness of the social, cultural, global and environmental responsibility as an engineer.							

**Note:** EE-209A is a mandatory non-credit course in which the students will be evaluated for the industrial training undergone after 2<sup>nd</sup> semester and students will be required to get passing marks to qualify.

The candidate has to submit a training report of his/her work/project/assignment completed in the industry during the training period. The evaluation will be made on the basis of submitted training report and viva-voce/presentation.

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MC-901A	Environmental Sciences						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	0	75	25	100	3 Hrs.
<b>Purpose</b>	To learn the multidisciplinary nature, scope and importance of Environmental sciences.						
<b>Course Outcomes (CO)</b>							
CO1	The students will be able to learn the importance of natural resources.						
CO2	To learn the theoretical and practical aspects of eco system.						
CO3	Will be able to learn the basic concepts of conservation of biodiversity.						
CO4	The students will be able to understand the basic concept of sustainable development.						

#### UNIT 1

The multidisciplinary nature of environmental studies, Definition, Scope and Importance, Need for public awareness, Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

- Forest Resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water Resources: Use & over-utilization of surface & ground water, floods, drought, conflicts over water, dams-benefits and problems.
- Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- Food Resources: World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- Energy Resources: Growing energy needs, renewable & non-renewable energy sources, use of alternate energy sources. Case studies.
- Land Resources: Land as a resource, land, degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyle.

#### UNIT II

**Ecosystem-Concept of an ecosystem.** Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological Succession, Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest Ecosystem, (b) Grassland Ecosystem, (c) Desert Ecosystem and (d) Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)  
Field Work: Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban /Rural Industrial/Agricultural, Study of common plants, insects and birds, Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

#### UNIT III

**Biodiversity and its conservation:** Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity of global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity, Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts, Endangered and endemic species of India, Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

**Environmental Pollution Definition:** Cause, effects and control measures of (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

#### UNIT IV

**Social Issues and the Environment.** From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns, Case Studies: Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies: Wasteland Reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public Awareness, Human population and the Environment, Population growth, variation among nations, Population explosion-Family Welfare Programme, Environment and human health. Human rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies, Drugs and their effects; Useful and harmful drugs, Use and abuse of drugs, Stimulant and depressant drugs, Concept of drug de-addiction, Legal position on drugs and laws related to drugs.

#### Suggested Books

- Environmental Studies- Deswal and Deswal. Dhanpat Rai and Co.
- Environmental Science and Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India.
- Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
- Environmental Science- Botkin and Keller. 2012. Wiley, India

**Note:** The Examiner will be given the question paper template to set the question paper.

EE-202A	Digital Electronics	3L:1T:0P	4 credits
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### Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Be able to use PLDs to implement the given logical problem.

#### Unit-I

#### Fundamentals of Digital Techniques:

Digital signal, review of number systems, binary codes, BCD, Excess-3, Gray, EBCDIC, ASCII, logic gates- AND, OR, NOT, NAND, NOR, EX-OR, Boolean algebra, Error detection and correction, hamming code.

#### Unit-II

#### Combination Design using Gates:

Design using gates, K-map and Quine-Mccluskey methods of simplification.

#### Combinational design using MSI Devices

Multiplexers and Demultiplexers and their uses as logic elements, Decoders, Adders/Subtractors, BCD arithmetic circuits, Encoders, Decoders/Drivers for display devices.

#### Unit-III

#### Design of Sequential circuits:

Flip flops: S-R, J-K, T, D, master slave, edge triggered, shift registers, sequence generators, counters- asynchronous and synchronous, ring counters and Johnson Counter.

#### D/A & A/D Converters:

D/A converters- weighted resistor and R-2 R ladder, specifications for D/A converters, A/D converters: Sample and hold circuits, Quantization, Parallel-comparator, successive approximation, counting type, dual slope ADC.

#### Unit-IV

#### Digital logic families:

Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families. Tristate logic, interfacing of CMOS and TTL families.

#### Programmable logic devices:

ROM, PLA, PAL, FPGA and CPLDS.

#### REFERENCES:

1. Modern Digital Electronics (Edition III) : R.P. Jain, TMH.
2. Digital Integrated Electronics: Taub & Schilling, MGH
3. Digital Principles and Applications: Malvino & Leach, MGH
4. Digital Fundamentals, Floyd, 11th Ed., Pearson.

**Note:** The paper setter will set the paper as per the question paper templates provided.

EE-204A	Signals and Systems	3L:1T:0P	4 credits
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*Course Outcomes:*

At the end of this course, students will demonstrate the ability to

- Understand the concepts of continuous time and discrete timesystems.
- Analyse systems in complex frequencydomain.
- Understand sampling theorem and itsimplications.

Unit-I

**Introduction to Signals:** Continuous and discrete time signals, deterministic and stochastic signals, periodic and aperiodic signals, even and odd signals, energy and power signals, exponential and sinusoidal signals and singular functions. Signal representation in terms of singular functions,

**Introduction to Systems:** Linear and non-linear systems, time invariant and time varying systems ,lumped and distributed systems, deterministic and stochastic systems, casual and non-causal systems, analog and discrete/digital memory and memory less systems.

Unit-II

**Random Variables:** Introduction to Random Variables, PDF, CDF

**Linear Time Invariant Systems:** Introduction to linear time invariant (LTI) systems, properties of LTI systems, convolution integral, convolution sum, causal LTI systems described by differential and difference equations. Concept of impulse response.

Unit-III

**Discretization of Analog Signals:** Introduction to sampling, sampling theorem and its proof. Effect of under sampling, reconstruction of a signal from sampled signal.

**Fourier Series :**Continuous time Fourier series (CTFS), Properties of CTFS, Convergence of Fourier series.

Unit-IV

**Fourier Transform:** Continuous Time Fourier Transform (CTFT), Properties of CTFT, Systems characterized by linear constant- coefficient differential equations.

Discrete time Fourier transform (DTFT), Properties of DTFT, Duality, Systems characterized by linear constant coefficient difference equations.

**Laplace Transform:** Introduction to Laplace transform, Region of convergence for laplace transform, Inverse Laplace transform, Properties of Laplace transform, Analysis and characterization of LTI systems using LaplaceTransform.

**REFERENCES :**

1. Oppenheim, Willsky, Nawab, Signals and Systems, Prentice Hall India, 2<sup>nd</sup> Edition, 2009
2. Simon Haykins – "Signal & Systems", Wiley Eastern
3. Tarun Kumar Rawat, Signals and Systems, Oxford University Press.

**Note:** The paper setter will set the paper as per the question paper templates provided.

EE-206A		Electrical Machines-II					
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	1	-	4	75	25	100	3h
Purpose	To familiarize the students with the basics of Electrical Machines						
Course Outcomes							
CO1	Understand the concepts of rotating magnetic fields.						
CO 2	Understand the operation of ac machines.						
CO 3	Analyse performance characteristics of ac machines.						
CO 4	Analyse synchronous machine						

#### UNIT-I

##### Induction Machines:

Basic concept of Induction machines: winding factors, generated e.m.f. and m.m.f distribution, a.c. winding, rotating magnetic field.

**3-phase Induction Motor:** Construction, features, production of torque, phasor diagram, equivalent circuit, performance analysis, torque –slip characteristics, running, light and blocked rotor test, load test on 3-ph I.M.

#### UNIT-II

##### Single phase induction motors:-

Constructional features & double revolving field theory, equivalent circuit, determination of parameters. Split phase, starting methods, types& applications.

**Starting of 3-ph I.M.** Starting methods of squirrel cage and wound rotor induction motor.

**Induction Generator**-Operation, applications, advantages.

#### UNIT-III

##### Three Phase Synchronous Generators:

Principle, construction, EMF equation, armature winding, armature reaction, equivalent circuit, voltage regulation – synchronous reactance method, Rothert's m.m.f method, Potier triangle method, Output power equation, power angle curve, two reactance theory, slip test, Transient and subtransient reactance, synchronization, parallel operation.

#### UNIT-IV

**Three Phase Synchronous Motor:** Construction, Principle of operation, Equivalent circuit, torque, power developed, starting, V-curve, Hunting-causes , effects & reduction , synchronous condenser applications. Comparison between induction motor and synchronous motor, high starting torque motors.

##### Suggested Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
4. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
5. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.

**Note:** The paper setter will set the paper as per the question paper templates provided.

EE-208A	Power Electronics						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	1	-	4	75	25	100	3h
<b>Purpose</b>	<b>To familiarize the students with the Converter and Power switching device</b>						
<b>Course Outcomes</b>							
CO1	Understand the differences between signal level and power level devices.						
CO 2	Analyse controlled rectifier circuits.						
CO 3	Analyse the operation of DC-DC choppers.						
CO 4	Analyse the operation of voltage source inverters.						

#### UNIT-I

##### Power switching devices :

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.

#### UNIT-II

##### Thyristor rectifiers

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with Rload and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

#### UNIT-III

##### DC-DC buck converter:

Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage.

##### DC-DC boost converter:

Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

#### UNIT-IV

##### Single-phase voltage source:

Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage.

##### Suggested Books:

1. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
4. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

**Note: The paper setter will set the paper as per the question paper templates provided.**

EE-216A	Electromagnetic Fields	3L:0T:0P	3 credits	Time 3 h
Course Outcomes	<p>At the end of the course, students will demonstrate the ability</p> <ul style="list-style-type: none"> <li>• To understand the basic laws of electromagnetism.</li> <li>• To obtain the electric and magnetic fields for simple configurations under static conditions.</li> <li>• To analyse time varying electric and magnetic fields.</li> <li>• To understand Maxwell's equation in different forms and different media.</li> <li>• To understand the propagation of EM waves.</li> </ul> <p>This course shall have Lectures and Tutorials. Most of the students find difficult to visualize electric and magnetic fields. Instructors may demonstrate various simulation tools to visualize electric and magnetic fields in practical devices like transformers, transmission lines and machines.</p>			

#### Unit-I

##### Review of Vector Calculus

Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus- differentiation, partial differentiation, integration, vector operator, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

#### Unit-II

##### Static Electric Field

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

#### Unit-III

##### Conductors, Dielectrics and Capacitance

Current and current density, Ohm's Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

#### Unit-IV

##### Static Magnetic Fields and Maxwell's Equations:

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions.

Maxwell's equations in differential and integral forms and their physical significances in circuit and field theory.

##### Text / References:

1. M.N.O.Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A.Pramanik, "Electromagnetism-Theory and applications", PHI Learning Pvt.Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
5. W.J.Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
6. W.J.Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
7. E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
8. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
9. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

Note: The paper setter will set the paper as per the question paper templates provided.

EE -210A	Electrical Machines Lab-II						
L	T	P	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3h

#### LIST OF EXPERIMENTS:

- 1) To perform load test on a 3-phase induction motor & DC generator set and to determine the efficiency of induction motor.
- 2) Determine mechanical losses by light running of a 3-phase induction motor.
- 3) Study and starting of 1-phase induction motor. To perform light running and block rotor test and to determine the parameters of the equivalent circuit.
- 4) To perform the open circuit test and block rotor test on 3-phase induction motor and draw the circle diagram.
- 5) To perform & study effect of rotor resistance on a poly phase slip ring induction motor.
- 6) To calculate regulation by synchronous impedance method:-
  - a) Conduct open and short circuit test on a three phase alternator.
  - b) Determine and plot variation of synchronous impedance with  $I_f$
  - c) Determine SCR
- d) Determine regulations for 0.8 lagging power factor, 0.8 leading power factor and unity PF.
- 7) To plot V curves of a synchronous machine.
  - a) Determination of  $X_o$  of a synchronous machine.
  - b) Measurement  $X_d$  &  $X_q$  (Direct axis and Quadrature axis reactance) by slip test
- 8) To measure  $X_q$  of synchronous machine (negative sequence reactance).
- 9) To calculate regulation by ZPF method.
- 10) To perform and study parallel operation of synchronous generators.

**Note: At least eight experiments should be performed from above list.**

EE -212A	Power Electronics Lab						
L	T	P	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3h

#### LIST OF EXPERIMENTS:

1. To Plot the firing characteristics of given silicon control rectifier.
  - a. By varying the gate current  $I_g$  keeping forward voltage  $V_{ak}$  fixed.
  - b. By varying forward voltage  $V_{ak}$  keeping gate current fixed.
2. To study the V-I characteristics of given UJT. To plot graph between  $V_e$  and  $I_e$ . To find negative resistance from the graph.
3. To plot V-I characteristics of given Triac in I and III quadrant.
4. To plot the drain characteristics of given F.E.T & to evaluate the parameter  $r_d$ ,  $I_{dss}$ .
5. To study the UJT based relaxation oscillator & to evaluate the dynamic resistance.
6. To study & draw the characteristics of DC-DC chopper power circuit
7. To study the characteristics of single phase fully controlled converter circuit.
8. To study the characteristics of 3-phase fully controlled converter power circuit.
9. To study single phase Mc Murray Inverter power circuit.
10. To study single phase cyclo-converter circuit.

**Note:** At least eight experiments should be performed from above list.

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EEN -214A	Digital Electronics Lab						
L	T	P	Credit	Practical	Minor Test	Total	Time
-	-	2	1	60	40	100	3h

LIST OF EXPERIMENTS:

- 1) Study of TTL gates- AND, OR, NOR, NAND, NOT, EX-OR, EX-NOR.
  - 2) Design & realize a given function using K-Map and verify its performance.
  - 3) To verify the operation of multiplexer & Demultiplexers.
  - 4) To verify the operation of comparator.
  - 5) To verify the truth tables of S-R, J-K, T& D type flip flops
  - 6) To verify the operation of bi-directional shift register.
  - 7) To design & verify the operation of 3-bit synchronous counter.
  - 8) To design and verify the operation of synchronous UP/DOWN decade counter using JK flip flop & drive a seven segment display using the same.
  - 9) To design and verify the operation of asynchronous UP/DOWN decade counter using JK flip flop & drive a seven segment display using the same.
  - 10) To design and realize sequence generator for a given sequence using JK Flip flop.
  - 11) Study of CMOS NAND & NOR gates and interfacing between TTL and CMOS gates.
  - 12) Design a 4-bit shift register and verify its operation of a ring counter and a Johnson counter.
- Note: At least ten experiments should be performed from above list.**

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MC-902A	Constitution of India					
Lecture	Tutorial	Practical	Major Test	Minor Test	Total	Time
3	-	-	75	25	100	3 Hrs.
Purpose	To know the basic features of Constitution of India					
Course Outcomes						
CO1	The students will be able to know about salient features of the Constitution of India.					
CO2	To know about fundamental duties and federal structure of Constitution of India.					
CO3	To know about emergency provisions in Constitution of India.					
CO4	To know about fundamental rights under constitution of India.					

### UNIT-I

Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India. Scheme of the fundamental rights

### UNIT -II

The scheme of the Fundamental Duties and its legal status. The Directive Principles of State Policy – Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and the States. Parliamentary Form of Government in India – The constitution powers and status of the President of India

### UNIT - III

Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India. Emergency Provisions: National Emergency, President Rule, Financial Emergency. Local Self Government – Constitutional Scheme in India.

### UNIT-IV

Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19. Scope of the Right to Life and Personal Liberty under Article 21.

### Text Books

1. Constitution of India. Prof. Narender Kumar (2008) 8<sup>th</sup> edition. Allahabad Law Agency.

### Reference Books:

1. The constitution of India. P.M. Bakshi (2016) 15<sup>th</sup> Edition. Universal law Publishing.

**Note:** The paper setter will set the paper as per the question paper templates provided.