E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai
Accredited by NAAC with 'A' Grade | Accredited by NBA
(NAGAPATTINAM – 611 002)

B.E ELECTRICAL AND ELECTRONICS ENGINEERING

Full Time Curriculum and Syllabus

Fourth Year – Seventh Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1701MGX01	Professional Ethics	3	0	0	3	40	60	100
1702EE701	Protection and Switchgear	3	0	0	3	40	60	100
1702EE702	Power System Operation and Control	3	0	0	3	40	60	100
1702EE703	High Voltage Engineering	3	0	0	3	40	60	100
	Elective-V	3	0	0	3	40	60	100
	Elective-VI (Open Elective)	3	0	0	3	40	60	100
Laboratory Course								
1702EE751	Power System Simulation Laboratory	0	0	2	1	50	50	100
1702EE752	Computer Aided Electrical Drawing Laboratory	0	0	2	1	50	50	100
1704EE753	Mini Project-III	0	0	2	1	100	0	100
1704GE751	Life Skills: Competitive Exams Preparation	2	0	0	2	100	0	100
1704EE754	Implant / Internship Training Presentation	0	0	0	1	100	0	100

L – Lecture | T – Tutorial | P – Practical | CA – Continuous Assessment | ES – End Semester

1701MGX01	PROFESSIONAL ETHICS	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Basic understanding of business management
2. Basic understanding of human values

COURSE OBJECTIVES:

1. To provide basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues
2. To provide basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards, Exposure to Safety and Risk, Risk Benefit Analysis
3. To have an idea about the Collegiality and Loyalty, Collective Bargaining, Confidentiality, Occupational Crime, Professional, Employee, Intellectual Property Rights
4. TohaveanadequateknowledgeaboutMNC"s,Business,Environmental,ComputerEthics, Honesty, Moral Leadership, sample Code of Conduct.
5. To use the engineering principles to update and maintain the technical skills.

Course Outcomes:

After completion of the course, Student will be able to

CO1 – Discuss about Engineering ethics by using various theorems(K2)
CO2 – Describe the role of engineering as social experimentation(K2)
CO3 – Explain the role of engineers for safety(K2)
CO4 –Discuss various responsibility and rights in professional ethics(K2)
CO5 – Discuss about various global issues and its impact in society(K2)

UNIT I ENGINEERING ETHICS **9 Hours**

Senses of „Engineering Ethics"– Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg"s theory – Gilligan"s theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION **9 Hours**

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study.

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY **9 Hours**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Case Studies on Chernobyl, Bhopal MIC and Sterlite copper.

UNIT IV RESPONSIBILITIES AND RIGHTS **9 Hours**

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES **9 Hours**

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Case study on Hiroshima and Nagasaki

REFERENCES:

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi 2004
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003)
6. Nptel link: https://nptel.ac.in/courses/109/106/109106117/

1702EE701	PROTECTION AND SWITCHGEAR	L	T	P	C
		3	0	0	3

PREREQUISITE :

1.Power system Analysis
2.Transmission and Distribution

COURSE OBJECTIVES:

1. Remember the fundamental protection schemes and the need of implying protection schemes.
2. Understand protection of different power system components such as transmission line,
3. Study the different relay characteristics and their functionalities.
4. Understand and recognize circuit breakers: types, construction, performance and ratings.

Course Outcomes:

After completion of the course, Student will be able to
CO1 Explain the principle and operation of various protection schemes (K2)
CO2 Describe the function and characteristics of different types of relay(K2)
CO3 Describe the causes of abnormal operating condition of power system components(K2)
CO4 Outline the arc phenomenon and switching behavior of circuit breakers (K2)
CO5 Explain the classification of circuit breakers with testing standards(K2)

UNIT I INTRODUCTION TO PROTECTION SCHEMES. 9 Hours

Need for protection schemes; Fault conditions &calculations- Fault clearing process; Neutral grounding; Zones of protection; Digital protection schemes &applications.

UNIT II PROTECTIVE RELAYS AND RELAY CHARACTERISTICS 9 Hours

Importance of protective relaying; Electromagnetic relays- Over current, Differential, Distance, and Directional relays; R-X diagram; Digital relays, Microprocessor based relays.

UNIT III APPARATUS AND TRANSMISSION LINE PROTECTION 9 Hours

Protection of current transformer and potential transformer; Protection of generators and motors; Protection of transmission line; Bus bar protection schemes.

UNIT IV THEORY OF SWITCHING AND ARCING PHENOMENON 9 Hours

Current interruption ; Transient recovery voltage; Rate of rise of recovery voltage; Resistance switching; Current chopping; Interruption of capacitive current; Electric arc; Modes of arc extinction; Arc interruption theories.

UNIT V CIRCUIT BREAKERS 9 Hours

Air blast circuit breaker; Oil circuit breaker ;SF_6 circuit breaker; Vacuum circuit breaker; HVDC circuit breaker; Solid state circuit breaker; Rating and selection of circuit breakers; Testing of circuit breakers.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Voltage stability of electrical network
2. Digital computer aided protection and automation

REFERENCES:

1. BadriRam, Vishwakarma, "Power System Protection and Switchgear",Tata McGraw Hill, 2nd edition 2017.
2. Ravindra P.Singh, "Switchgear and Power system protection " PHI Learning Pvt. Ltd,2009
3. Bhuvanesh A Oza, Nirmal-Kumar C Nair, "Power system protection & switchgear", Tata McGraw-Hill Education,2010
4. B.Rabindranath andN.Chander, „PowerSystemProtection and Switchgear",NewAge International (P) Ltd., First Edition 2011.
5. Sunil S. Rao, "Switchgear and Protection", Khanna publishers, New Delhi, 13th Edition, Reprint 2012.

1702EE702 **POWER SYSTEM OPERATION AND CONTROL** **L T P C**
3 0 0 3

PREREQUISITE :

1. Transmission &Distribution.
2. Power system analysis.

COURSE OBJECTIVES:

1. To realize the basic operation of power system components.
2. To infer the economic operation of power system.
3. To summarize the various control methods & security schemes in power systems.

Course Outcomes:

After completion of the course, Student will be able to
CO1 Explain the principle and operation of various protection schemes(K2)
CO2 Make use of the importance of real power & frequency control in power system(K3)
CO3 Apply various methods of reactive power & voltage control in power system(K3)
CO4 Calculate the solution for unit commitment and least cost methodology for power generation(K3)
CO5 Describe the SCADA, EMS and various security schemes in power system(K2)

UNIT I LOAD CHARACTERISTICS 9 Hours

Load and load duration curves; load forecasting; components of system load; classification of base load; forecasting of the base load by method of least square fit; necessity for regulation of system frequency and voltage; P-F and Q-V control structure.

UNIT II REAL POWER - FREQUENCY CONTROL 9 Hours

Basics of speed governing mechanism and modeling; speed-load characteristics; load sharing between two synchronous machines in parallel; control area concept; LFC control of a single-area system- static and dynamic analysis; LFC control of two-area system.

UNIT III REACTIVE POWER–VOLTAGE CONTROL 9 Hours

Fundamental characteristics of excitation system; types of excitation system; block diagram model of exciter system; analysis of AVR; generation and absorption of reactive power; methods of voltage control; application of FACTS Devices in Q-V control.

UNIT IV UNIT COMMITMENT & ECONOMIC DISPATCH 9 Hours

Incremental cost curve; co-ordination equations with and without losses; solution by Lambda iteration; introduction to unit commitments; constraints on unit commitment; unit commitment methods.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9 Hours

Need for computer control of power systems; concept of energy control centre; functions ;system monitoring; data Acquisition and control; system hardware configuration; SCADA and EMS functions; state transition diagram showing various state transitions and control strategies.

Total: 45 Hours

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Implementation of PLC in automation Systems
2. Case studies of major international power blackouts and list out the cause and Effect of it.

REFERENCES:

1.Abhijit Chakrabarti, Sunita Halder, “Power System Analysis Operation and Control”, PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.
2. Olle.I.Elgerd, “Electric Energy Systems theory - An introduction”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 34th Reprint, 2010.
3. Nagrath I.J. and Kothari D.P., „Modern Power System Analysis“, Tata McGraw-Hill, 4tn Edition, 2011.
4.HadiSaadat, “Power System Analysis”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
5. Allen. J. Wood and Bruce F. Wallenberg, “Power Generation, Operation and Control”, John Wiley & Sons, Inc., 2003.
6. http://nptel.ac.in/courses/108101040.

1702EE703	HIGH VOLTAGE ENGINEERING	L	T	P	C
		3	0	0	3

PREREQUISITE :

1. Power system analysis
2. Transmission and Distribution

COURSE OBJECTIVES:

1. Understand transient overvoltage and the protection of high voltage apparatus
2. Understand high voltage generation and measurement techniques in high voltage engineering
3. Specify testing methods and standards in high voltage equipment testing

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO 1 Describe the fundamentals of over voltages, causes of over voltages and protection against over voltages(K2)
CO2 Explain the breakdown mechanism in gaseous, liquid, and vacuum dielectrics(K2)
CO3 Review the methods of generation of high voltages and high currents(K2)
CO4 Summarize the measurement techniques of high voltages and high currents (K2)
CO5 Infer the high voltage testing of electrical power apparatus like insulator, bushing, circuit breaker, isolater and transformer(K2)

UNIT I OVERVOLTAGE PHENOMENON 9 Hours

Electric field stresses; Estimation and control of electric stress; Natural causes of overvoltage; Lightning phenomenon; Mathematical modeling of lightning; Overvoltage due to switching surges; Surge voltage distribution and control.

UNIT II DIELECTRIC BREAKDOWN IN LIQUID, SOLID AND GASEOUS DIELECTRICS 9 Hours

Breakdown mechanisms in liquid dielectric-Liquid dielectrics used in practice; Various processes of breakdown in solid dielectrics -Solid dielectrics used in practice; Ionization process; Corona discharge; Gaseous breakdown in uniform, Non uniform fields; selection of gases as insulating materials.

UNIT III GENERATION OF HIGH VOLTAGE AND CURRENT 9 Hours

Generation of high DC voltage; Van de graff generator; Cascaded transformer ;Standard impulse wave shapes; Marx circuit generation of switching surges; Impulse current generation; Impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGE AND CURRENT 9 Hours

Measurement of HVDC current and voltage; Measurement of high AC and impulse voltages; Measurement of high current: Direct, alternating and impulse current; Cathode Ray Oscilloscope measurement technique for impulse voltage and current.

UNIT V HIGH VOLTAGE TESTING AND INSULATION COORDINATION 9 Hours

Principles of Insulation coordination; Testing of electrical apparatus- Insulators, Bushings, Circuit breakers , Cables ,Transformer ;Test standards ; Ratings of high voltage laboratories.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Power system transients
2. Indian testing standards of high voltage apparatus

REFERENCES:

1. S. Naidu and V. Kamaraju, “High Voltage Engineering”, Tata McGraw Hill, Fifth Edition, 2013.
2. E. Kuffel and W.S. Zaengl, J. Kuffel, “High voltage Engineering fundamentals”, Newness Second Edition Elsevier, New Delhi, 2005.
3. Subir Ray, “An Introduction to High Voltage Engineering”, PHI Learning Private Limited, New Delhi, Second Edition, 2013.
4. C.L. Wadhwa, “High Voltage Engineering “New Age International, 2007.
5. Dieter Kind, Kurt Feser, “High Voltage test techniques”, Newness, 2001.

1703EE010 ELECTRIC AND HYBRID VEHICLES L T P C
3 0 0 3

PREREQUISITE :

1. Applied Chemistry
2. Electrical Machinery-I

COURSE OBJECTIVES:

1. To realize the importance of electric transportation systems
2. To understand the basics of electric vehicle components and configuration
3. To understand the various charging types, comfort and safety methods and application of electric vehicle in Smart grid

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 – Describe the importance and challenges of electric vehicles (K2)

CO2 – Discuss the energy storage system and battery technology in electric vehicles (K2)

CO3 – Infer about various charging system and starting system (K2)

CO4 – Explain the role of hybrid electric vehicle with its safety (K2)

CO5 – Discuss the emerging technologies and its benefits (K2)

UNIT I ELECTRIC VEHICLES 9 Hours

History of modern transportation; importance of different transportation development strategies to future oil supply; introduction to electric vehicles; history of hybrid and electric vehicles, social, environmental importance and key challenges of hybrid and electric vehicles; specifications of PHEVS, BEVS, EVS; plug-in hybrid vehicle characteristics; the future of electric vehicles.

UNIT II ENERGY STORAGE AND BATTERY TECHNOLOGY 9 Hours

Introduction to Energy Storage system; Battery Requirements for HEVs, PHEVs, and EVs; Types of batteries; Properties of batteries; Working principle and construction of lead-acid, nickel cadmium, nickel metal hydride, lithium ion Batteries; Maintenance and charging of batteries; Diagnosing lead-acid battery faults; Advanced battery technology; Developments in electrical storage; Case studies.

UNIT III CHARGING AND STARTING SYSTEMS 9 Hours

Requirements of the charging system; Charging system principles; Alternators and charging circuits; Diagnosing charging system faults; Advanced charging system technology; New developments in charging systems; Requirements of the starting system; Starter motors and circuits; Types of starter motor; Diagnosing starting system faults; Advanced starting system technology; New developments in starting systems; Case studies.

UNIT IV HYBRID ELECTRIC VEHICLE DRIVE TRAIN AND SAFETY 9 Hours

Requirement of drive train; Architecture of hybrid drive train; Sizing of components- Series configuration, Parallel configuration, parallel and series configuration; Security-Airbags and belt tensioners, Diagnosing comfort and safety system faults, Advanced comfort and safety systems technology; New developments in comfort and safety systems.

UNIT V EMERGING TECHNOLOGIES 9 Hours

Introduction-Electric Vehicle Supply Equipment, Smart vehicles in smart grid; Vehicle-to-grid technologies-Unidirectional and Bidirectional; Need of Charging Station Selection (CSS) server, Smart grid technologies-Applications / Benefits, Smart meter, Smart charger; Purpose and benefits; Ethics in road safety.

Total: 45 Hours

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Wireless charging of electric vehicles.
2. Monitoring and control of driverless electric vehicle.

REFERENCES:

1. M. Ehsani, Y. Gao, and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, Second Edition, 2009.
2. Tom Denton, “Automobile Electrical and Electronic Systems”, Elsevier Butterworth-Heinemann, Fourth Edition, 2011.
3. Ali Emadi, “Advanced Electric Drive Vehicles”, CRC Press, First Edition, 2014.
4. Iqbal Hussain, “Electric & Hybrid Vehicles – Design Fundamentals”, Second Edition, CRC Press, 2011.
5. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, Second Edition, 2015.
6. NPTEL Course, “Historical Journey of Hybrids and Electric Vehicle”, by Dr. Praveen Kumar and Prof. S. Majhi, IIT-Guwahati.

1702EE751

POWER SYSTEM SIMULATION LABORATORY

L	T	P	C
0	0	2	1

PRE REQUISITE:

1. Power system analysis
2. Measurement and control laboratory

COURSE OBJECTIVES:

1. To develop simple C programs for the following basic requirements:
   a. Formation of bus admittance and impedance matrices and network solution.
   b. Power flow solution of small systems using simple method, Gauss-Seidel NR method.
   c. Economic Dispatch.
   d. Symmetrical and unsymmetrical faults
2. To acquire experience in the usage of standard packages for the following analysis / simulation / control functions.
   a. Simulation of Load-Frequency Dynamics and control of power system
   b. Transient stability simulation of single machine power system

Course Outcomes:

After completion of the course, Student will be able to
CO1 Understand and to solve the basic problems in power systems(K2)
CO2 Compute and model the transmission line parameters(K3)
CO3 Analyse the load flow in power systems(K3)
CO4 Model the power system dynamics components(K3)
CO5 Analyse the stability of the power systems (K3)

LIST OF EXPERIMENTS:

1. Calculation of per unit quantities
2. Formation of Y-bus and Z-bus matrices
3. Computation and modeling of transmission line parameters
4. Formation of reduced y_{bus} matrix by node elimination method
5. Load Flow Analysis - I : Solution of Load Flow And Related Problems Using Gauss-Seidel Method
6. Load Flow Analysis - II: Solution of Load Flow and Related Problems Using Newton Raphson Methods
7. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
8. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System
9. Computation of line currents by symmetrical components
10. Economic Dispatch in Power Systems.
11. Symmetrical and unsymmetrical fault analysis
12. Study of EMTP, ETAP and MIPOWER software

Total: 30Hours

ADDITIONAL EXPERIMENTS:

1. Stability analysis of a power system using swing equation
2. Determination of load curve

REFERENCES:

1. J.P.Barret, P.Bornard and B.Meyer, “Power System Simulation”, Hapman and Hall publishers, 1996.
2. M.A.Pai, “Computer techniques in power system analysis”, New Delhi McGraw Hill Education (India) Private Limited,2014.
3. Harrold Klee and Randal Allen, “Simulation of dynamic systems with MATLAB”, CRC press, Third edition, 2017
4. https://onlinecourses.nptel.ac.in/

1702EE752	COMPUTER AIDED ELECTRICAL DRAWING LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE :
1. Electrical Machinery -II
2. Transmission and Distribution

COURSE OBJECTIVES:
1. To gain basic knowledge of electrical drawings.
2. To learn about single line diagram of panels and switch boards.
3. To study about winding diagrams of dc motor and induction motor.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 Draw the various symbols, notations and single line electrical drawings using software (K3)

CO2 Sketch the electrical machine assembly and winding diagram of induction motor(K3)

CO3 Draw the single line diagram of different panel boards and substation layout(K3)

CO4 Sketch the control and main circuit of motor starters(K3)

CO5 Draw the circuit diagram and simulate/test simple electrical and electronics circuits using simulation software(K3)

LIST OF EXPERIMENTS:

1. Draw the symbols used in electrical wiring.
2. Draw the single line diagram of single phase/three phase MCB distribution board.
3. Draw the single line diagram of typical MV panel.
4. Draw the single line diagram of lighting distribution board (LDB).
5. Draw the single line diagram of motor control center (MCC) panel.
6. Draw the electrical machine assembly drawing.
7. Draw the single line diagram of 110 KV/11KV receiving substation.
8. Draw the single line diagram of intercom arrangement in a multistoried building.
9. Draw the control and main circuit of motor starters.
10. Draw the winding diagram of single phase/three phase induction motor.
11. Draw the circuit diagram and simulate/test simple electrical/electronic circuits using simulation software.
12. Draw the layout diagram of any one power plant.

Total: 30 Hours

ADDITIONAL EXPERIMENTS:
1. Computer aided drawing of Heating Ventilation and Air Conditioning (HVAC) systems.
2. Computer aided simulation of simple electrical and electronics circuits using simulation software.

REFERENCES:

1. Sham Tickoo and Anurag, “AutoCAD 2013 for Engineers and Designers”, Dream tech press, New Delhi, 2013.
2. George Omura, “Mastering AutoCAD 2016 and AutoCAD LT 2016”, Sybex, New Delhi, 2016.
3. Muhammad H Rashid, “Introduction to PSpice using OrCAD for Circuits and Electronics”, PHI Learning, 3rd Edition, New Delhi, 2011.
4. K.M. Vishnu Murthy, “Computer-Aided Design of Electrical Machines”, BS Publications, Hyderabad, 2008.
5. M. Yogesh, B. S. Nagaraja, N. Nandan, “Computer Aided Electrical Drawing”, PHI Learning, First Edition, 2014.
6. https://thestylingbook.com/mastering-autocad-2013-and-autocad-lt-2013-free-related-books.html
7. Dr. T. Suresh Padmanabhan and Dr. V. Mohan, “Computer Aided Electrical Drawing Laboratory Manual”, 2018.

		L	T	P	C
1704EE753	**MINI PROJECT-III**	**0**	**0**	**2**	**1**

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device / system / component(s) to be designed and developed using modeling software, may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the soft copy of the model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report examined by the internal examiner constituted by the Head ofthe Department.

TOTAL:45 HOURS

1704GE751	LIFE SKILLS: COMPETITIVE EXAM PREPARATION	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

1. To recollect the fundamentals of electrical and electronic systems.
2. To remember the analysis of electrical and electromagnetic theories, electrical circuits, electrical machines and other systems in electrical and electronics engineering.
3. To test the analytical skills of students in the field of electrical circuits, electronics, electrical machines and power systems.

Electric Circuit Analysis: DC Circuits and AC Circuits - Theorems, Transient Analysis of circuits, and Resonance circuits.

Analog and Digital Electronics: Diode, BJT, FET - Device Structures, Circuits and Applications; Logic Gates, Code Converters, Flip Flops, Counters, Analysis and Design of Sequential Circuits, Memory Logic Devices.

Electromagnetic Theory: Divergence Theorem, Stroke's Theorem, Coulombs Law, Gauss Law, Electric and Magnetic Field Intensity, Electric and Magnetic Flux Density, Magnetization and Permeability, Self-Inductance and Mutual Inductances, Maxwell's Equation.

Linear Integrated Circuits: Operational Amplifier – Characteristics, Applications – Inverting & Non-Inverting Amplifier, Summing & Differential Amplifier, Integrator, Differentiator, Oscillators and Signal Converters; Special Function ICs.

Electrical Machines: Generator, Motor and Transformer - Construction, Principle of Operation, Working, Characteristics and Classifications of, testing of electrical machines. Starting of electrical machines.

Electrical Drives and Control: Rectifier, Inverter, Chopper, AC Voltage Controller, Cycloconverter – Modes of Operation, V-I Characteristics, Power Converter Fed Electrical Drives, Closed Loop Operation of Electrical Drives with Speed and Current Controller. Quadrant of Operation of Electrical Drives, Microprocessor / Microcontroller – Instruction Set, Addressing Modes, Interfacing, and Applications in Drives. Linear Control Systems - Stability Analysis, Time and Frequency Response

Power Generation, Transmission and Distribution: Power Generation from Thermal Plants, Hydro Power Plants, Diesel/Gas Plants, Nuclear Plants, Renewable Energy Sources, HVDC and HVAC Transmission Systems, Types of Conductors, Skin and Proximity effects, Classification of Lines, Ferranti Effect, Types and Testing of Insulators, Underground Cables.

Power System Analysis: Load Flow Analysis, Symmetrical Components, Symmetrical and Unsymmetrical Faults, Power System Stability.

TOTAL: 30 HOURS

REFERENCES:

1. A. Sudhakar and S.P. Shyammohan, "Circuits and Networks: Analysis and Synthesis", TMH, 4th Edition, 2010.
2. M.Nahvi and Joseph A.Edminister, "Electric Circuits", Schaum's Outline series, Tata McGraw Hill, New Delhi, 6 th Edition,2014.
3. Milman, Halkias and satyabrata Jit, ―Electronic Devices and Circuits 4th Edition, McGraw Hill Education (India) Private Ltd., 2015.
4. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, PHI Ltd., 2015.
5. M.Morris Mano, ―Digital Logic and Computer Design, Prentice Hall of India, 4th edition, 2013.
6. William H.Hayt, „Engineering ElectromagneticsTata McGraw Hill, 2005.
7. D Roy Choudhury and Sheil B.Jani, "Linear Integrated Circuits" 4th Edition, New Age International, New Delhi, 2014.
8. Kothari D.P and I.J. Nagrath, "Electric Machines", Published by Tata McGraw -Hill Education Pvt. Ltd,2010, 5 th Edition.
9. Rashid M H, "Power Electronics-Circuits, Devices and Applications", Prentice Hall of India, New Delhi, 2011.

10. N. K. De, P. K. Sen, “Electric Drives”, 16th, PHI Learning PVT. LTD.,2014
11. R S.Gaonkar, “Microprocessor Architecture Programming and Application”, Prentice hall, New Delhi, fifth edition,2002.
12. Sunil Mathur, “Microprocessor 8085 and its Interfacing” Prentice hall India learning private limited, New Delhi, second edition,2011.
13. M. Gopal, “Control Systems, Principles and Design”, 4th Edition, Tata McGraw Hill, New Delhi,2012.
14. P.K.Nag, PowerPlantEngineering,TataMcGraw-HillPublishingCompanyLtd.,ThirdEdition, 2014.
15. J.Brian, Hardy and Colin R.Bayliss „Transmission and Distribution in Electrical Engineering“, Newnes; Fourth Edition, 2012.
16. C.L.Wadhwa, “Electrical Power Systems”, New Academic Science Ltd, seventh edition2017.
17. J. D. Glover, M. Sarma and T. Overbye, “Power System Analysis and Design”, Fourth Edition,CENGAGE – Engineering, 2007.
18. HadiSaadat, “Power System Analysis”, Second Edition, McGraw Hill Publishers, 2002.

1704EE754	IMPLANT / INTERNSHIP TRAINING PRESENTATION	L	T	P	C
		0	0	0	1

In order to provide the experiential learning to the students, the students undergo in-plant training or internship during summer / winter vacation between III and VII semesters. A presentation based on in-plant training / internship shall be made in this semester and suitable credit may be awarded.

Internal Assessment Only	
Test	40
Presentation / Quiz /Group Discussion	40
Report	20