Course curriculum for Electrical Engineering for 2021 Batch

Semester IV (2021 batch)				
Serial no.	**Course code**	**Course name**	**Credits**	**Course Instructor**
1	EE 206	Introduction to Electrical Machines	3	Prof. Abhijit K
2	EE 209	Introduction to Power Electronics	3	Prof. Abhijit K
3	EE 208	Engineering Electromagnetics	3	Prof. Naveen K
4	EE 223	Introduction to Power Systems	3	Prof. Pratyasa B
5	EE 216	Communications Lab	2	Prof. Bharath B N
6	EE 309	Introduction to communication Systems	3	Prof. Rajshekhar Bhat
7	EE 226	Control System and lab	6	Prof. Sangamesh Deepak R
8	EE 224	Digital systems	6	Prof. Nagaveni S
9	EE 214	Digital Circuits Lab	3	Prof. Nagaveni S
10	EE 212	Devices and Circuits Lab	3	Prof. Ruma Ghosh
Total credits			**35**	

SYLLABUS

Name of Academic Unit: Electrical Engineering
Level: B. Tech.
Programme: B.Tech.

i	**Title of the course**	Introduction to Electrical Machines
ii	**Credit Structure (L-T-P-C)**	2-1-0-3
iii	**Type of Course**	Core
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Half
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	Network Theory
vii	**Course Content**	Transformer: Magnetic Circuits, principle of transformer action, equivalent circuits, phasor diagram, efficiency, basics of three phase transformer. Synchronous Machines: induced emf and torque in a rotating coil, rotating magnetic field, construction of synchronous Machines, induced emf, phasor diagram, equivalent circuit, OCC-SCC, power angle characteristics, V-curve and inverted V curve. Other topics: introduction to Induction Motor, introduction to DC Machine, Application of Electrical Machines and special electrical motors.
viii	**Texts/References**	1. P. S. Bimbhra, "Electrical machinery," Khanna Publishers, 7th edition, 1977. 2. M. G. Say, "The Performance and Design of Alternating Current Machines," CBS, 3rd edition, 2002. 3. Stephen Chapman, "Electric Machinery Fundamentals," McGraw Hill, 4th edition, 2017. 4. D.P. Kothari, I.J. Nagrath, "Electric Machines," McGraw Hill, 5th edition, 2017. 5. A Fitzgerald, Charles Kingsley, and Stephen Umans, "Electric Machinery," McGraw Hill, 6th edition, 2017.
ix	**Name(s) of Instructor(s)**	Pratyasa Bhui
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Mechanical Engineering
xi	**Is/Are there any course(s) in the same/**	No

	other academic unit(s) which is/ are equivalent to this course? If so, pleasegive details.	
xii	**Justification/ Need for introducing thecourse**	Electrical Machines play a vital role in almost everyfield of Electrical Engineering, e.g. different motorused in industrial drives, robots and electric cars, generators and transformers used in power and energy system, transformers in electronic circuits etc. This course deals some of the important aspects of transformers, synchronous generators and introduction to DC machines and induction motors.

Name of Academic Unit: Electrical Engineering
Level: B. Tech.
Programme: B.Tech.

i	**Title of the course**	Introduction to Power Electronics
ii	**Credit Structure (L-T-P-C)**	2-1-0-3
iii	**Type of Course**	Core
iv	**Semester in which normally to beoffered**	Spring
v	**Whether Full or Half Semester Course**	Half
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	Electric circuits, Devices
vii	**Course Content**	Introduction to power semiconductor devices, drivecircuits, Rectifiers - single and three phase; basics of inverters - single and three phase; PWM generation, DC/DC converters - Buck, Boost and Buck Boost. Basics of magnetic circuits.
viii	**Texts/References**	*1.* L. Umanand, ``Power Electronics – essentialsand applications," Wiley 2009. *2.* M. H. Rashid " Power Electronics," Pearson.4th edition, 2017. *3.* Cyril W Lander, "Power Electronics" TheMcGraw-Hill Companies, 3rd ed, 1993.
ix	**Name(s) of Instructor(s)**	Satish Naik
x	**Name(s) of other Departments/ Academic Units to whom the course isrelevant**	None
xi	**Is/Are there any course(s) in the same/other academic unit(s) which is/ are equivalent to this course? If so, pleasegive details.**	No
xii	**Justification/ Need for introducing thecourse**	Power electronics play an important role in all the industrial systems such as automation, electricalgrid, integration of renewable energy sources. Thiscourse deals with some of the important aspects of power electronics devices, converters and its applications.

Name of Academic Unit: Electrical Engineering
Level: B.Tech.
Programme: B.Tech.

i	Title of the course	**Engineering Electromagnetics**
ii	Credit Structure (L-T-P-C)	(3 0 0 3)
iii	Type of Course	Core course
iv	Semester in which normally to be offered	Spring
v	Whether Full or Half Semester Course	Half
vi	Pre-requisite(s), if any (For the students) – *specify course number(s)*	Exposure to Basic calculus and first year physics course (PH102).
vii	Course Content*	Overview of Static Electric and Magnetic Fields, Steady Electric Currents. Time Varying Electromagnetic Fields, Maxwell's Equations, Boundary Conditions. Plane Electromagnetic Waves, Propagation in Free Space and in Matter. Reflection and Refraction of Waves at Conducting and Dielectric Boundary. Transmission Lines: TEM waves, Transmission Line Equations, Wave Propagation along Finite Transmission Lines, Transients on Lines, The Smith Chart. Waveguides, Waves in Guided Media, Parallel Plate Waveguide, Rectangular Waveguide, Cavity Resonators. Basic Theory of Antennas and Radiation Characteristics, Elementary Types of Antennas.
Viii	Texts/References	1. D K Cheng, "Fundamentals of Electromagnetics", Addison Wesley, MA 1993. 2. R K Shevgaonkar, "Electromagnetic Waves", McGraw-Hill Education (India) Pvt Limited, 2005 3. Hayt, William H., Jr., and John A. Buck, "Engineering Electromagnetics", 7th ed. McGraw-Hill, 2006.

ix	Name(s) of Instructor(s) ***	Rajshekhar Bhat
x	Name(s) of other Departments/ Academic Units to whom the course is relevant	None
xi	Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to thiscourse? If so, please give details.	No
xii	Justification/ Need for introducing thecourse	This is a core course which introduces the engineering electromagnetics. This course will lay a foundation for moreadvanced courses such as antenna design. Moreover, a basic understanding of the electromagnetic theory is useful for a course on wireless communications.

Name of Academic Unit: Electrical Engineering
Level: B. Tech.
Programme: B.Tech.

i	**Title of the course**	Introductions to Power Systems
ii	**Credit Structure (L-T-P-C)**	3-0-0-3
iii	**Type of Course**	Core
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Half
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	Network Theory, Introduction to Electrical Machines
vii	**Course Content**	Introduction: Evolution of Power Systems, Energy Sources Structure of Bulk Power Systems, Power generation concepts, ac and dc transmission concepts, Basic three phase system concepts Transmission lines: Models and performance of transmission lines and cables Insulators: different types, Electric field distribution and insulators Power Flow: modelling of generators, transformers, lines and loads, per Unit Systems, Bus admittance matrix, Gauss Seidel and Newton-Raphson load flow methods Introduction to next course: introduction to faults, power system protection, stability, operation, blackout
viii	**Texts/References**	1. Grainger and Stevenson , "Power System Analysis," 1st edition, McGraw Hill, 2017. 2. Bergen and Vittal, "Power System Analysis," 2nd Edison, Pearson 2002. 3. O E. Elgerd,"Electrical Energy Systems Theory," 2nd edition, McGraw Hill, 2017. 4. Stagg and el-abiad, "Computer methods in Power System Analysis," MedTech, 2019. 5. Glover, Sarma and Overbye, "Power System Analysis and design," CLIPL, 5th edition, 2012. 6. Hadi Saadat, "Power System Analysis," PSA Publishing LLC, 2011. 7. B. F. Wollenberg, "Power Generation, operation and control," 2nd edition, Wiley, 2006. 8. Nagrath and Kothari, "Power System Engineering," 2nd edition, McGraw Hill, 2012.
ix	**Name(s) of Instructor(s)**	Pratyasa Bhui

x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Electrical Engineering
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	Power and energy systems is one of the interdisciplinary and important topics for research today. Basic understanding of the structure of bulk power systems, operation, protection and control is necessary to work with modern technologies. This is an introductory course on electrical power systems which covers introduction to power system structures, modelling of different components, faults and a brief overview of next course topics- power system, protections, stability and operation.

Name of Academic Unit: Electrical Engineering
Level: B. Tech.
Programme: B.Tech.

i	**Title of the course**	Communications Lab
ii	**Credit Structure (L-T-P-C)**	0-0-4-2
iii	**Type of Course**	Core (Lab)
iv	**Semester in which normally to beoffered**	Spring
v	**Whether Full or Half Semester Course**	Half
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	Introduction to Communication Systems
vii	**Course Content**	Practical experiments in-line with the content of "Introduction to Communication Systems" coursecovering transmission and reception mechanisms corresponding to analog and digital communication. ● Introduction to the usage of software defined radios and MATLAB ● Analog modulation and demodulation ● Digital modulation and demodulation – BPSK and QPSK only
viii	**Texts/References**	*1)* Upamanyu Madhow, ``Introduction to Communication Systems," Cambridgeuniversity press, 2008 edition. *2)* Simon Haykin, "An Introduction to Analogand Digital Communication," Wiley India Pvt. Ltd., 2006. *3)* B. P. Lathi and Zhi Ding, ``Modern Digitaland Analog Communication Systems," Oxford higher education, 2017.
ix	**Name(s) of Instructor(s)**	Naveen M. B. and Bharath B. N.
x	**Name(s) of other Departments/ Academic Units to whom the course isrelevant**	Electrical Engineering
xi	**Is/Are there any course(s) in the same/other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing thecourse**	This course provides a hands-on experience ofvarious topics discussed in the "Introduction to Communication Systems" course. The aforementioned theory course and this lab course will enable the student to have a strong background on the basics of analog and digital communication.

Name of Academic Unit: Electrical Engineering
Level: B. Tech.
Programme: B.Tech.

i	**Title of the course**	Introduction to Communication Systems
ii	**Credit Structure (L-T-P-C)**	3-0-0-3
iii	**Type of Course**	Core
iv	**Semester in which normally to beoffered**	Spring
v	**Whether Full or Half Semester Course**	Half
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	Exposure to probability, signals and systems
vii	**Course Content**	Motivation towards designing Analog and Digital Communication Systems Baseband and passband signals Analog modulation techniques – Amplitude Modulation and Angle Modulation Overview of digital modulation – Signal Constellations, Hypothesis Testing, ML and MAP detection rules, performance analysis of selected digital modulation schemes.
viii	**Texts/References**	*1.* Upamanyu Madhow, ``Introduction to Communication Systems," Cambridgeuniversity press, 2008 edition. *2.* Simon Haykin, "An Introduction to Analog and Digital Communication," Wiley India Pvt.Ltd., 2006. *3.* B. P. Lathi and Zhi Ding, ``Modern Digital andAnalog Communication Systems," Oxford higher education, 2017.
ix	**Name(s) of Instructor(s)**	Naveen M B
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	None
xi	**Is/Are there any course(s) in the same/other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing thecourse**	Analog and digital communication systems are vitalcomponents of many real world systems, such as RADAR (analog) and current/next generation wireless communication systems (digital). This is a fundamental course, which enables the student to understand the basic principles behind the working of such systems.

Name of Academic Unit: Electrical Engineering
Level: B. Tech.
Programme: B. Tech.

i	Title of the course	**Control Systems**
ii	Credit Structure (L-T-P-C)	(2 0 2 6)
iii	Type of Course	Core
iv	Semester in which normally to be offered	Autumn
v	Whether Full or Half Semester Course	Full
vi	Pre-requisite(s), if any	Undergraduate Linear Algebra
vii	Course Content*	● **Basic concepts:** Notion of feedback, open- and closed-loop systems. ● **Modeling and representations of control systems:** Transfer function models of suitable mechanical, electrical, thermal and pneumatic systems, Ordinary differential equations, Transfer functions, Block diagrams, Signal flow graphs, State-space representations, ● **Performance and stability:** Time-domain analysis, Second-order systems, Characteristic-equation and roots, Routh-Hurwitz criteria, ● **Basic modes of feedback control:** Proportional, Integral, Derivative. ● **Root locus** method of design ● **Frequency-domain techniques:** Root-locus methods, Frequency responses, Bode-plots, Gain-margin and phase-margin, Nyquist plots, ● **Compensator design:** Proportional, PI and PID controllers, Lead-lag compensator. ● **State-space concepts:** Controllability, Observability, pole placement result, Minimal representations. ● Laboratory involves set of experiments following the theory component covered in the class
Viii	Texts/References	1. Norman Nise, Control System Engineering, Wiley, 5th edition 2. Gene Franklin et. al., "Feedback Control of Dynamic Systems", 7th Edition, Pearson. 3. K. Ogata, Modern Control Engineering, Pearson, latest edition 4. B. Kuo, Automatic Control System, Wiley
ix	Name(s) of Instructor(s) ***	AM

x	Name(s) of other Departments/ Academic Units to whom the course is relevant	Mechanical Engineering
xi	Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.	No
xii	Justification/ Need for introducing the course	Control Systems are ubiquitous. Each discipline of engineering need to understand the concept of control systems in one form or the other. This course introduces mathematical modeling of systems, stability analysis, stabilization and techniques of making systems work as desired. This course makes the students appreciate the inherent similarities in the working principles of electrical and mechanical systems. The concepts of control systems are widely used in numerous field like industrial automation, robotics, automobiles, space exploration, military applications, cyber-physical systems and so on.

Name of Academic Unit: Electrical Engineering
Level: UG
Programme: B.Tech.

i	**Title of the course**	EE 224 Digital Systems
ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) specify course number(s)**	None
vii	**Course Contents:**	**Introduction to Digital Systems** **Number systems and Logic:** Number Systems, Different Codes, Boolean logic, basic gates, truth tables **Introduction to Logic families:** TTL, CMOS etc. **Boolean Algebra:** Laws of Boolean Algebra, logic minimization using K maps **Combinational Logic Circuits:** Adders, Subtractors, Multipliers, MSI components like Comparators, Decoders, Encoders, MUXs, DEMUXs **Sequential circuits:** Latches, Flipflops, Analysis of clocked sequential circuits, Registers and Counters (Synchronous and Asynchronous), State Machines **Introduction to Hardware Description Languages** **Array based logic elements:** Memory, PLA, PLD, FPGA **Special Topics:** Asynchronous State machines, Testing and Verification of Digital Systems

viii	**Texts/References**	1. J. F. Wakerly: Digital Design, Principles and Practices, 4th Edition,Pearson Education, 2005 2. M. Moris Mano; Digital Design, 4th Edition, Pearson,2009 3. Ronald J. Tocci; Digital System, Principles and Applications, 10th Edition, Pearson, 2009 4. H.Taub and D. Schilling; Digital Integrated Electronics, McGraw Hill, 1977 5. Charles H Roth; Digital Systems Design usingVHDL, Thomson Learning, 1998
ix	**Name(s) of Instructor(s)**	RG
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Computer Science Engineering
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course?If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This course introduces students to the world of Digital Systems by introducing concept of Boolean Algebra andLogic Functions. This course is a beginning of the spinerelated to Digital Design, Microprocessor, Embedded Systems etc,

Name of Academic Unit: Electrical Engineering
Level: UG
Programme: B.Tech.

i	**Title of the course**	**EE 214: Digital Circuits Laboratory**
ii	**Credit Structure (L-T-P-C)**	(0 0 3 3)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Digital Systems Theory (EE224)
Vii	**Course Content***	This purpose of this lab is to complement the Digital Systems Theory Course. The following is the tentative list of experiments for this lab: Experiments with discrete ICs 1. Introduction of digital ICs 2. Realizing Boolean expressions 3. Adder/Subtractor 4. Shift registers 5. Synchronous Counters 6. Asynchronous Counters + 7-segment display 7. Finite State Machines (2 weeks) Experiments with CPLDs 1. Arithmetic and Logic Unit 2. LCD, Buzzer Interfacing 3. Pipelining
Viii	**Texts/References**	1. M. Moris Mano; Digital Design, 5th Edition, Pearson, 2009 2. J.F.Wakerly: Digital Design, Principles and Practices,4th Edition,Pearson Education, 2005 3. Ronald J. Tocci; Digital System, Principles and Applications, 10th Edition, Pearson, 2009
Ix	**Name(s) of Instructor(s) *** **	RG

x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Computer Science
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	The lab deals with fundamental digital circuits which are extensively used in electronic gadgets.

Name of Academic Unit: Electrical Engineering
Level: B.Tech.
Programme: B.Tech.

i	**Title of the course**	Devices and circuits Lab
ii	**Credit Structure (L-T-P-C)**	0-0-3-3
iii	**Type of Course**	Core (Lab)
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	Electronic Devices, Analog circuits
vii	**Course Content**	This lab will reinforce concepts thought in Electronic devices and analog circuits. It will have experiments on Device characterization and circuits design and characterization. The following is the tentative list of experiments for this lab: 1. LED and Photodiode characterization 2. BJT biasing and CE amplifier 3. Solar cell characterization 4. Diode Temperature characteristics 5. NMOS characterization and CS amplifier 6. MOS differential amplifier 7. basic opamp circuits 8. Active filters 9. Multivibrators 10. Audio amplifiers
viii	**Texts/References**	1. J.V.Wait, L.P.Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, 2nd edition, McGraw Hill, New York, 1992. 2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988. 3. Behzad Razavi, Fundamentals of microelectronics, Wiley Publications 4. A.S.Sedra and K.C. Smith,Microelectronic Circuits, Saunder's College Publishing, Edition IV, 2017. 5. Ramakant Gayakwad, Op-amps and Linear Integrated Circuit, 4th edition, Pearson, 2000.

ix	**Name(s) of Instructor(s)**	NK
x	**Name(s) of other Departments/**	Electrical Engineering
	Academic Units to whom the course is relevant	
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	The lab trains students in design and debug of analog electronic circuits and improves understanding of electronic devices. The lab is required for the reinforcement of the concepts taught in Electronic devices, Analog circuits and network theory courses.