UNIVERSITY OF MUMBAI
No. UG/72 of 2016-17

CIRCULAR:-

A reference is invited to the syllabi relating to the Bachelor of Engineering (B.E) degree course **vide** this office Circular No.UG/253 of 2009, dated 7th July, 2009 and the Principals of affiliated Colleges in Engineering are hereby informed that the recommendation made by Ad-hoc Board of Studies in Electrical Engineering at its meeting held on 23rd May, 2016 has been accepted by the Academic Council at its meeting held on 24th June, 2016 **vide** item No. 4.56 and that in accordance therewith, the revised syllabus as per Choice Based Credit System for Bachelor of Electronics and Electrical Engineering (Sem. V &VI), which is available on the University's web site (www.mu.ac.in) and that the same has been brought into force with effect from the academic year 2016-17.

19/9/16.

MUMBAI – 400 032
21st September, 2016

(Dr.M.A.Khan)
REGISTRAR

To,

The Principals of affiliated Colleges in Engineering.

A.C/ 4.56/24/06/2016.

****

No. UG/72-A of 2016 MUMBAI-400 032 21st September, 2016

Copy forwarded with compliments for information to:-

1. The Dean, Faculty of Technology,
2. The Chairmen, Board of the Studies in Electrical Engineering .
3. The Director, Board of College and University Development,
4. The Controller of Examinations,
5. The Co-Ordinator, University Computerization Centre.

19/9/16

(Dr.M.A.Khan)
REGISTRAR

... PTO

AC 24/06/2016

Item No. 4.56

UNIVERSITY OF MUMBAI

(As per Credit Based Semester and Grading System with effect from the academic year 2012–2013)

From Dean's Desk:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development. Faculty of Technology, University of Mumbai, in one of its meeting unanimously resolved that, each Board of Studies shall prepare some Program Educational Objectives (PEO "s) and giv to affiliated Institutes to add few (PEO "s) and cou for each course, so that all faculty members in affiliated institutes understand the depth and approach of course to be taught, which will enhance learner "s learning process. It was also resolved that, maximum senior faculty from colleges and experts from industry to be involved while revising the curriculum. I am happy to state that, each Board of studies has adhered to the resolutions passed by Faculty of Technology, and developed curriculum accordingly. In addition to outcome based education, semester based credit and grading system is also introduced to ensure quality of engineering education. Semester based Credit and Grading system enables a much-required shift in focus from teacher-centric to learner-centric education since the workload estimated is based on the investment of time in learning and not in teaching. It also focuses on continuous evaluation which will enhance the quality of education. University of Mumbai has taken a lead in implementing the system through its affiliated Institutes and Faculty of Technology has devised a transparent credit assignment policy and adopted ten points scale to grade learner "s performa courses is based on 15 weeks teaching learning process, however content of courses is to be taught in 12-13 weeks and remaining 3-2 weeks to be utilized for revision, guest lectures, coverage of content beyond syllabus etc. Credit and grading based system was implemented for First Year of Engineering from the academic year 2012-2013. Subsequently this system will be carried forward for Second Year Engineering in the academic year 2013-2014, for Third Year and Final Year Engineering in the academic years 2014-2015 and 2015-2016 respectively.

Dr. S. K. Ukarande

Dean, Faculty of Technology,

Member - Management Council, Senate, Academic Council

University of Mumbai, Mumbai

Preamble:
To be added

Teaching Scheme Semester V

Course Code	Course Name	Teaching Scheme (Hrs)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ELC501	Microprocessors and Peripherals	04	--	--	04	--	--	04
ELC502	Electrical Machines-II	04	--	--	04	--	--	04
ELC503	Electromagnetic Fields and Waves	03	--	01	03	--	01	04
ELC504	Design with Linear Integrated Circuits	04	--	--	04	--	--	04
ELC505	Signals and Systems	04	--	01	04	--	01	05
ELS506	Business Communication and Ethics	--	04*	--	--	02	--	02
ELL501	Microprocessors and Peripherals Laboratory	--	02	--	--	01	--	01
ELL502	Electrical Machines-II Laboratory	--	02	--	--	01	--	01
ELL503	Design with Linear Integrated Circuits Laboratory	--	02	--	--	01	--	01
ELL504	Mini Project I	--	02	--	--	02	--	02
	Total	19	10+2*	02	19	07	02	28

*2 hours to be conducted class wise and remaining 2 hours to be conducted batch wise

Examination Scheme Semester V

Course Code	Course Name	Examination Scheme							Total
		Theory Marks				Term Work	Practical and Oral	Oral	
		Internal Assessments			End Semester Examination 3 Hrs Duration				
		Test 1	Test 2	Avg. of Test 1 & Test 2					
ELC501	Microprocessors and Peripherals	20	20	20	80	--	--	--	**100**
ELC502	Electrical Machines-II	20	20	20	80	--	--	--	**100**
ELC503	Electromagnetic Fields and Waves	20	20	20	80	25	--	--	**125**
ELC504	Design with Linear Integrated Circuits	20	20	20	80	--	--	--	**100**
ELC505	Signals and Systems	20	20	20	80	25	--	--	**125**
ELS506	Business Communication and Ethics	--	--	--	--	50	--	--	**50**
ELL501	Microprocessors and Peripherals Laboratory	--	--	--	--	25	--	--	**25**
ELL502	Electrical Machines-II Laboratory	--	--	--	--	25	25	--	**50**
ELL503	Design with Linear Integrated Circuits Laboratory	--	--	--	--	25	25	--	**50**
ELL504	Mini Project I	--	--	--	--	25	25	--	**50**
	Total	--	--	**100**	**400**	**200**	**75**	--	**775**

Teaching Scheme Semester VI

Course Code	Course Name	Teaching Scheme (Hrs)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ELC601	Microcontrollers and its Applications	04	--	--	04	--	--	04
ELC602	Electrical Machines-III	04	--	--	04	--	--	04
ELC603	Power Electronics	04	--	--	04	--	--	04
ELC604	Power System Analysis	04	--	--	04	--	--	04
ELC505	Digital Signal Processing and Processors	04	--	--	04	--	--	04
ELC606	Project Management	03	--	--	03	--	--	03
ELL601	Microcontrollers and its Application Laboratory	--	02	--	--	01	--	01
ELL602	Electrical Machines-III Laboratory	--	02	--	--	01	--	01
ELL603	Power Electronics and Power Analysis Laboratory	--	02	--	--	01	--	01
ELL604	Digital Signal Processing and Processor Laboratory	--	02	--	--	01	--	01
ELL605	Mini Project II	--	02	--	--	02	--	02
	Total	22	10	--	23	06	--	29

Examination Scheme Semester VI

Course Code	Course Name	Examination Scheme							Total
		Theory Marks				Term Work	Practical and Oral	Oral	
		Internal Assessments			End Semester Examination 3 Hrs Duration				
		Test 1	Test 2	Avg. of Test 1 & Test 2					
ELC601	Microcontrollers and its Application	20	20	20	80	--	--	--	**100**
ELC602	Electrical Machines-III	20	20	20	80	--	--	--	**100**
ELC603	Power Electronics	20	20	20	80	--	--	--	**100**
ELC604	Power System Analysis	20	20	20	80	--	--	--	**100**
ELC605	Digital Signal Processing and Processors	20	20	20	80	--	--	--	**100**
ELC606	Project Management	20	20	20	80	--	--	--	**100**
EL6501	Microcontrollers and its Application Laboratory	--	--	--	--	25	25	--	**50**
ELL602	Electrical Machines-III Laboratory	--	--	--	--	25	25	--	**50**
ELL603	Power Electronics and Power System Analysis Laboratory	--	--	--	--	25	25	--	**50**
ELL604	Digital Signal Processing and Processor Laboratory	--	--	--	--	25	--	--	**25**
ELL605	Mini Project II	--	--	--	--	25	25	--	**50**
Total		--	--	**120**	**480**	**125**	**100**	**--**	**825**

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELC501	Microprocessors and Peripherals	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		04	--	--	04	---	---	04

Course Code	Course Name	Examination Scheme							
ELC501	Microprocessors and Peripherals	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		20	**20**	**20**	**80**	**--**	**--**	**---**	**100**

Course Pre-requisite:
ELC402: Digital Circuit and Design

Course Objectives:

- To create a strong foundation by studying the basics of Microprocessors and interfacing to various peripherals which will lead to a well-designed Microprocessor based System. requisite

Course Outcomes:

- Students will be able to understand and design Microprocessor based systems.
- Students will be able to understand assembly language programming
- Students will be able to learn and understand concept of interfacing of peripheral devices and their applications

ELC501: Microprocessors and Peripherals

Module No	Topics	Hours
1	**Introduction to Intel 8085 Microprocessor:** Basic functions of the microprocessor, System bus, Architecture, Pin Configuration and Programmer's model of Intel 8085 Microprocessor	06
2	**Intel 8086 Architecture:** Major features of 8086 processor, 8086/88 CPU Architecture and the pipelined operation, Programmer's Model and Memory Segmentation	06
3	**Instruction Set of 8086 and Programming:** Instruction Set of8086 microprocessor in details, Addressing modes of 8086/88, Programming the 8086 in assembly language, Mixed mode Programming with C-language and assembly language. Assembler Directives Procedures and Macros.	10
4	**8086 Interrupts:** Interrupt types in 8086, Dedicated interrupts, Software interrupts	04
5	**Designing the 8086 CPU module:** 8086 pin description in details, Generating the 8086 System Clock and Reset Signals, 8086 Minimum and Maximum Mode CPU Modules, Memory interfacing with timing consideration, Minimum and Maximum Mode Timing Diagrams	10
6	**Peripheral Controllers for 8086 family and System Design:** Functional Block Diagram and description, Control Word Formats, Operating Modes and Applications of the Peripheral Controller namely 8255-PPI, , 8259- PIC and 8237-DMAC. Interfacing of the above Peripheral Controllers. Keyword and Display Interface using 8255.	08
7	**Multiprocessor Systems:** Study of Multiprocessor Configurations namely Closely Coupled System (CCS) and Loosely Coupled System (LCS), CCS with the case study of the Maths Coprocessor, Various System Bus Arbitration Schemes in LCS, and Role of the Bus Arbiter (Intel 8289) in the LCS.	08
	TOTAL	52

ELC501: Microprocessors and Peripherals

Recommended Books:

1) Microprocessor architecture and applications with 8085: By Ramesh Gaonkar (Penram International Publication).
2) 8086/8088 family: Design Programming and Interfacing: By John Uffenbeck (Pearson Education).
3) 8086 Microprocessor Programming and Interfacing the PC: By Kenneth Ayala
4) Microcomputer Systems: 8086/8088 family Architecture, Programming and Design: ByLiu& Gibson (PHI Publication).
5) Microprocessor and Interfacing: By Douglas Hall (TMH Publication).

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELC502	Electrical Machines-II	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		04	--	--	04	---	---	04

Course Code	Course Name	Examination Scheme							
ELC501	Electrical Machines-II	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		20	**20**	**20**	**80**	**--**	**--**	**---**	**100**

Course Objectives:

- To impart the knowledge of working principle, operations, performance and applications of Induction Motors and 3φ Transformers.

Course Outcomes:

- Students will be able to understand the engineering fundamentals of induction motor and transformers.
- Gain an ability to design and conduct performance experiments, as well as to identify, formulate and solve machine related problems.

ELC502: Electrical Machines-II

Module No	Topics	Hours
1	**Three Phase Transformers- Construction & Phasor groups:** Construction, Three phase transformer connections and phasor groups.	05
2	**Three Phase Transformers- Operation:** Parallel operation, Excitation Phenomenon in transformers, Harmonics in three phase transformers, Disadvantages of harmonics in transformers, Suppression of harmonics, Oscillating neutral phenomenon, Switching in transient phenomenon, Open delta or V-connection, Three phase to two phase conversion (Scott connection).	12
3	**Three Phase Induction Motors-Introduction:** Construction, Principle of operation, Rotor frequency, Rotor emf, Current and Power, Induction motor phasor diagram, Analysis of Equivalent circuit, Torque-speed characteristics in braking, motoring and generating regions, Effect of voltage and frequency variations on Induction motor performance, Losses and efficiency, Power stages, No load and block rotor test, Circle diagram, Applications of 3Φ IM	13
4	**Three Phase Induction Motors- Speed Control and Starting:** Speed control methods including V/f method (excluding Slip power recovery scheme), Starting methods, High torque motors, Cogging and crawling, Basic principle of Induction Generator.	10
5	**Single phase Induction Motor-Introduction:** Principle of operation, Double field revolving theory, Equivalent circuit of single phase induction motor, Determination of equivalent circuit parameters from no load and block rotor test.	06
6	**Single phase Induction Motor- Starting Methods:** Staring methods, Split phase starting- Resistance spilt phase, capacitor split phase, capacitor start and run, shaded pole starting, Reluctance starting. Calculation of capacitor at starting. Applications of 1ϕ IM	06
	TOTAL	52

ELC502: Electrical Machines-II

Recommended Books:

1. Electrical Machinery", by Dr. P.S.Bhimhra, VII Edition, Khanna Publication
2. Generalized Theory of Electrical Machines", by Dr. P.S.Bhimhra, V Edition,Khanna Publication
3. Electrical Machines", by Nagrath and Kothari.TMH Publication.
4. Electrical Machines", by Charles I. Hubert, Pearson Education
5. Performance and Design of AC Machines", by M.G.Say, CBS Publication

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELC503	Electromagnetic Fields and Waves	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		03	--	01	03	---	01	04

Course Code	Course Name	Examination Scheme							
ELC503	Eletromagnetic Fields and Waves	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		20	**20**	**20**	**80**	**25**	**--**	**---**	**125**

Course Objectives:

- Expose students Electric and magnetic field and their application in electrical engineering

Course Outcomes:

- Students will be familiar with the various concepts Electric and magnetic field and their practical application in electrical engineering

ELC503: Electromagnetic Fields and Waves

	ELC503: Electromagnetic Fields and Waves	**Hours**
1	**Vector Basics**: Introduction to Co-ordinate System – Rectangular – Cylindrical and Spherical Co-ordinate System – Introduction to line, Surface and Volume Integrals – Definition of Curl, Divergence and Gradient .	04
2	**Static Electric Fields:** Coulomb's Law in Vector Form – Definition of Electric Field Intensity – Principle of Superposition – Electric Field due to discrete charges, Electric field due to continuous charge distribution - Electric Field due to line charge– Electric Field on the axis of a uniformly charged circular disc – Electric Field due to an infinite uniformly charged sheet. Electric Scalar Potential – Relationship between potential and electric field - Potential due to infinite uniformly charged line – Potential due to electrical dipole - Electric Flux Density – Gauss Law Introduce applications of electrostatic fields – electrostatic discharge, high dielectric constant material.	08
3	**Static Magnetic Fields:** The Biot-Savart's Law in vector form – Magnetic Field intensity due to a finite and infinite wire carrying a current I – Magnetic field intensity on the axis of a circular and rectangular loop carrying a current I – Ampere,s circuital law and simple applications. Magnetic flux density – The Lorentz force equation for a moving charge and applications – Force on a wire carrying a current I placed in a magnetic field – Torque on a loop carrying a current I – Magnetic moment – Magnetic Vector Potential.	08
4	**Electric and Magnetic Fields in Materials**: Poisson's and Laplace's equation – Electric Polarization-Nature of dielectric materials-Definition of Capacitance – Capacitance of various geometries using Laplace's equation – Electrostatic energy and energy density – Boundary conditions for electric fields – Electric current – Current density – point form of ohm's law – continuity equation for current. Definition of Inductance – Inductance of loops and solenoids – Definition of mutual inductance – simple examples. Energy density in magnetic fields –magnetic boundary conditions. Estimation and control of electric stress- control of stress at an electrode edge.	08
5	**Time varying Electric and Magnetic Fields:** Faraday's law – Maxwell's Second Equation in integral form from Faraday's Law – Equation expressed in point form. Displacement current – Ampere's circuital law in integral form – Modified form of Ampere's circuital law as Maxwell's first equation in integral form – Equation expressed in point form. Maxwell's four equations in integral form and differential form.	04
6	**Wave theory:** Derivation of Wave Equation – Uniform Plane Waves – Maxwell's equation in phasor form, Wave equation in Phasor form – Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, plane waves in lossy dielectrics, propagation in good conductors.	04
	TOTAL	36

Books Recommended:

1. W. Hayt., “Engineering electromagnetic”, McGraw Hill, 4th edition, 1987.

2. Edminister, “Schaum "s series in electroma

3. N. Narayan Rao, “ Elements of Electromagnetic”, PHI publication, 4th edition, 2001.

4. E.C. Jordan & K.G. Balmain “Electromagnetic Waves and Radiating Systems.” Prentice Hall of India 2nd edition 2003. (Unit IV, V). McGraw-Hill, 9th reprint

5. G.S.N. Raju, “ Electromagnetic Field Theory and Transmission Lines” Pearson publications, fifteenth impression,2013.

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELC504	Design with Linear Integrated Circuits	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		04	--	--	04	---	---	04

Course Code	Course Name	Examination Scheme							
ELC504	Design with Linear Integrated Circuits	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		20	**0**	**20**	**80**	**--**	**--**	**---**	**100**

Course Objectives:

- To teach fundamental principles of standard linear integrated circuits.
- To develop a overall approach for students from selection of integrated circuit, study its specification, the functionality, design and practical applications

Course Outcomes:

After successful completion of the course student will be able to

- Demonstrate an understanding of fundamentals of integrated circuits.
- Analyze the various applications and circuits based on particular linear integrated circuit.
- Select and use an appropriate integrated circuit to build a given application.
- Design an application with the use of integrated circuit

ELC504: Design with Linear Integrated Circuits

Module No	Topics	No. of Hours
1	**Fundamentals of Operational Amplifiers:** Ideal Op Amp, characteristics of op-amp, op-amp parameters, high frequency effects on op-amp gain and phase, slew rate limitation, practical determination of op-amp parameters, single supply versus dual supply op-amp . Operational amplifier open loop and closed loop configurations, Inverting and non-inverting amplifier	06
2	**Applications of Operational Amplifier :** Adder, subtractor, integrator, differentiator, current amplifier, difference amplifier, instrumentation amplifier and application of Op-Amp in transducer measurement system with detail design procedure, single supply DC biasing techniques for inverting, non-inverting and differential amplifiers, Current to voltage and voltage to current converters, generalized impedance converter , First order filters, second order active finite and infinite gain low pass, high pass, band pass and band reject filters, RC phase shift oscillator, Wien bridge oscillator, Quadrature oscillator	12
3	**Non-Linear Applications of Operational Amplifier:** Inverting comparator, non-inverting comparator, zero crossing detector, window detector and level detector , Inverting Schmitt trigger, non-inverting Schmitt trigger with adjustable threshold levels, Square wave and triangular wave generator with duty cycle modulation, Half and full wave precision rectifiers and their applications ,Peak detectors, sample and hold circuits, voltage to frequency converter, frequency to voltage converter, logarithmic converters and antilog converters.	12
4	**Data Converters:** Performance parameters of ADC, single ramp ADC, ADC using DAC, dual slope ADC, successive approximation ADC, flash ADC, ADC0808/0809 and its interfacing , Performance parameters of DAC, binary weighted register DAC, R/2R ladder DAC, inverted R/2R ladder DAC, DAC0808 and its interfacing	06
5	**Special Purpose Integrated Circuits :** Functional block diagram, working, design and applications of Timer 555. Functional block diagram, working and applications of VCO 566, PLL 565, multiplier 534, waveform generator XR 2206, power amplifier LM380	08
6	**Voltage Regulators** Functional block diagram, working and design of three terminal fixed (78XX, 79XX series) and three terminal adjustable (LM 317, LM 337) voltage regulators , Functional block diagram, working and design of general purpose 723 (LVLC, LVHC, HVLC and HVHC) with current limit and current fold-back protection, Switching regulator topologies, functional block diagram and working of LT1070 monolithic switching regulator	08
	TOTAL	52

ELC504: Design with Linear Integrated Circuits

Recommended Books:

1. Sergio Franco, "*Design with operational amplifiers and analog integrated circuits*", Tata McGraw Hill, 3rd Edition.
2. William D. Stanley, "*Operational Amplifiers with Linear Integrated Circuits* ", Pearson, 4th Edition
3. D. Roy Choudhury and S. B. Jain, "*Linear Integrated Circuits*", New Age International Publishers, 4th Edition.
4. David A. Bell, "*Operation Amplifiers and Linear Integrated Circuits*", Oxford University Press, Indian Edition.
5. Ramakant A. Gayakwad, "*Op-Amps and Linear Integrated Circuits*", Pearson Prentice Hall, 4th Edition.
6. R. P. Jain, "*Modern Digital Electronics*," Tata McGraw Hill, 3rd Edition.
7. J. Millman and A. Grabel, "*Microelectronics*", Tata McGraw Hill, 2nd Edition.

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELC505	Signals and Systems	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		04	--	01	04	---	01	05

Course Code	Course Name	Examination Scheme							
ELC505	Signals and Systems	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		20	**20**	**20**	**80**	**25**	**--**	**---**	**125**

Course Objectives:

- To provide a comprehensive coverage of continuous time and discrete time of Signals and Systems.
- To introduce various time domain and frequency domain methods for analysis of Signals and systems.

Course Outcomes:

- Student will be able to differentiate between continuous time and discrete time of Signals and Systems.
- Student will be able to do time domain and frequency domain analysis of Signals and systems**.**

ELC505: Signals and Systems

Module No.	Topics	Hours
1	**Continuous And Discrete Time Signals And Systems:** Mathematical representation and classification of CT and DT signals, arithmetic operations on the signals, transformation of independent variable, Mathematical representation and classification of CT and DT systems ,Sampling and reconstruction, aliasing effect	08
2	**Time Domain Analysis Of Continuous and Discrete Signals And Systems:** Properties of LTI systems, impulse and step response, Use of convolution integral and convolution sum for analysis of LTI systems, Properties of convolution integral/sum.	06
3	**Frequency Domain Analysis of Continuous Time System Using Laplace Transform :** Need of Laplace transform, review of Laplace transform, properties, inverse of Laplace transform, concept of ROC, poles and zeros, Unilateral Laplace transform, Analysis and characterization of LTI system using Laplace transform: impulse and step response, causality, stability, stability of causal system , Block diagram representation	08
4	**Frequency Domain Analysis of Discrete Time System Using Z Transform:** Need of Z transform, definition, properties of unilateral and bilateral Z Transform, mapping with s plane, relationship with Laplace transform, Z transform of standard signals, ROC, poles and zeros of transfer function, inverse Z transform, Analysis and characterization of LTI system using Z transform: impulse and step response, causality, stability, stability of causal system , Block diagram representation, system realization	14
5	**Frequency Domain Analysis of Continuous and Discrete Signals:** Review of Fourier series, Discrete time Fourier series, its properties , Fourier transform, properties of Fourier transform, relationship with Laplace and Z transform, Discrete time Fourier transform, properties, frequency sampling, Discrete Fourier transform, properties	12
6	**Correlation and Spectral Density:** Comparison of convolution and correlation, Auto and cross correlation, energy/power spectral density , Relation of ESD, PSD with auto-correlation, Relationship between ESD/PSD of input and output of LTI system.	04
	TOTAL	52

ELC505: Signals and Systems

Recommended Books:

1. Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab, "*Signals and Systems*", 2nd Edition, PHI learning, 2010.

2. Tarun Kumar Rawat, "*Signals and Systems*", Oxford University *Press 2010.*

3. John Proakis and Dimitris Monolakis, "*Digital Signal Processing*", Pearson Publication, 4th Edition.

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELS506	Business Communication and Ethics	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		--	04*	--	--	02	--	02

*02 Hours Theory Class wise and 02 Hours Practical Batch wise

Course Code	Course Name	Examination Scheme							
ELS505	Business Communication and Ethics	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		--	--	--	--	**50**	--	--	**50**

Course Pre-requisite

- FEC206 Communication Skills

Course Objective

- To inculcate in students professional and ethical attitude, effective communication skills, teamwork, skills, multidisciplinary approach and an ability to understand engineer "s so
- To provide students with an academic environment where they will be aware of the excellence, leadership and lifelong learning needed for a successful professional career.
- To inculcate professional ethics and codes of professional practice
- To prepare students for successful careers that meets the global Industrial and Corporate requirement " p
  different teams to enhance their team building capabilities like leadership, motivation, teamwork etc.

Course Outcomes: A learner will be able to …..

- communicate effectively in both verbal and written form and demonstrate knowledge of professional and ethical responsibilities
- Participate and succeed in Campus placements and competitive examinations like GATE, CET.
- Possess entrepreneurial approach and ability for life-long learning.
- Have education necessary for understanding the impact of engineering solutions on Society and demonstrate awareness of contemporary issues.

ELS506: Communication Skills

Module No	Topics	Hours
1	**Report Writing :** Objectives of report writing, Language and Style in a report, Types of reports, Formats of reports: Memo, letter, project and survey based	06
2	**Technical Proposals:** Objective of technical proposals, Parts of proposal	02
3	**Introduction to Interpersonal Skills:** Emotional Intelligence, Leadership, Team Building ,Assertiveness, Conflict Resolution, Negotiation Skills, Motivation, Time Management	08
4	**Meetings and Documentation:** Strategies for conducting effective meetings ,Notice ,Agenda, Minutes of the meeting	02
5	**Introduction to Corporate Ethics and etiquettes:** Business Meeting etiquettes, Interview etiquettes, Professional and work etiquettes, Social skills ,Greetings and Art of Conversation, Dressing and Grooming ,Dinning etiquette Ethical codes of conduct in business and corporate activities (Personal ethics, conflicting values, choosing a moral response, the process of making ethical decisions)	02
6	**Employment Skills:** Cover letter, Resume, Group Discussion, Presentation Skills, Interview Skills	06
	TOTAL	26

ELS506: Communication Skills

Recommended Books:

1. Fred Luthans, "*Organizational Behavior"* , Mc Graw Hill, edition
2. Huckin and Olsen, "*Technical Writing and Professional Communication"*, Mc Graw Hill
3. Wallace and Masters, "*Personal Development for Life and Work"* , Thomson Learning, 12th edition
4. Heta Murphy, "*Effective Business Communication"* , Mc Graw Hill, edition
5. B N Ghosh, "*Managing Soft Skills for Personality Development*", Tata McGraw
6. Bell . Smith, "*Management Communication*" Wiley India Edition,3rd edition.
7. Dr.K.Alex , "*Soft Skills*",S Chand and Company

Internal Assessment (IA): There will be no IA written examination
End Semester Examination: There will be no ESE written examination

List of Assignments Term Work:

Term work shall consist of assignments as listed below
1. Report Writing (Synopsis or the first draft of the Report)
2. Technical Proposal (Group activity, document of the proposal)
3. Interpersonal Skills (Group activity and Role play)
4. Interpersonal Skills (Documentation in the form of soft copy or hard copy)
5. Meetings and Documentation (Notice, Agenda, Minutes of Mock Meetings)
6. Corporate ethics and etiquettes (Case study, Role play)
7. Cover Letter and Resume
8. Printout of the PowerPoint presentation

The distribution of marks for term work shall be as follows,
1. Assignments : 20 marks
2. Project Report Presentation: 15 marks
3. Group Discussion: 15 marks

At least total 08 assignments, project report presentation and group discussion covering entire syllabus must be given during the batch wise practical. The assignments and project work should be students " centric ar an attempt should be made to make assignments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every assignment / project / group discussion graded from time to time. The average of grades converted in to marks should be taken into account for term work assessment.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELL501	Microprocessors and Peripherals Laboratory	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		--	02	--	--	01	---	01

Course Code	Course Name	Examination Scheme							
ELL501	Microprocessors and Peripherals Laboratory	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		--	--	--	--	**25**	--	--	**25**

Term Work:

At least 10 experiments based on the entire syllabus of **ELC501: Microprocessor and Peripherals** should be set to have well predefined inference and conclusion. Computation/simulation based experiments are also encouraged. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time.** The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

Suggested Experiments

1. Write a program to arrange block of data in i) Ascending and (ii) Descending order.
2. Write a program to find out any power of a number
3. Write a programmable delay
4. Write a program to find out largest number in an array.
5. Experiment on String instructions (e.g Reversing of string & palindrome)
6. Write a programme to multiply 32 bit numbers
7. Menu driven programming
8. Write a program for code conversion
9. Programming the 8255 to read or write to port (any one application)
10. Programming the 8259 to demonstrate rotating priority, Specific priority, etc

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELL502	Electrical Machines –II Laboratory	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		--	02	--	--	01	---	01

Course Code	Course Name	Examination Scheme							
ELL502	Electrical Machines –II Laboratory	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		--	--	--	--	**25**	**25**	--	**25**

Term Work:
At least 10 experiments based on the entire syllabus of **ELC502: Electrical Machines-II** should be set to have well predefined inference and conclusion. Computation/simulation based experiments are also encouraged. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time.** The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. **Practical and Oral exam** will be based on the entire syllabus.

List of Experiments Recommended:

1.Load test on three phase squirrel cage IM
2. Load test on three phase slip ring IM
3. No load and Blocked rotor test on three phase IM
4. Circle diagram of three phase IM
5. Load test on Single phase IM
6. No load and Blocked rotor test on Single phase IM
7. Study of starting methods of 1Φ Induction motors.
8. Open circuit & Short circuit test on three phase transformer
9. Parallel operation of transformers
10. Scott connection of transformer
11. Open Delta connection of transformer.
12. Making various 3 Φ transformer connections using identical 1Φ transformers.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELL503	Design with Integrated Circuits Laboratory	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		--	02	--	--	01	---	01

Course Code	Course Name	Examination Scheme							
ELL503	Design with Integrated Circuit Laboratory	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		--	--	--	--	**25**	**25**	--	**50**

Term Work:

At least 10 experiments based on the entire syllabus of **ELC504: Design with Linear Integrated Circuits** should be set to have well predefined inference and conclusion. Computation/simulation based experiments are also encouraged. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time.** The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. **Practical and Oral** exam will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELL504	Mini Project-I	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme							
ELL504	Mini Project-I	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		--	**--**	**--**	**--**	**25**	**25**	**--**	**50**

Term Work:

The main intention of Mini Project is to make student enable to apply the knowledge and skills learned out of courses studied to solve/implement predefined practical problem. The students undergo various laboratory/tutorial/simulation laboratory/work shop courses in which they do experimentation based on the curriculum requirement. The Mini Project may be beyond the scope of curriculum of courses taken or may be based on the courses but thrust should be on

- Learning additional skills
- Development of ability to define and design the problem and lead to its accomplishment with proper planning
- Learn the behavioral science by working in a group

The group may be maximum **four** (04) students. Each group will be assigned one faculty as a supervisor. The college should keep proper assessment record of progress of the project and at the end of the semester it should be assessed for awarding TW marks. The TW may be examined by approved internal faculty appointed by the head of the institute. The final examination will be based on demonstration in front of internal and external examiner. In the examination each individual student should be assessed for his/her contribution, understanding and knowledge gained about the task completed. The students may use this opportunity to learn different computational techniques as well as some model development. This they can achieve by making proper selection of Mini Projects.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELC601	Microcontrollers and its Applications	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		04	--	--	--	--	--	04

Course Code	Course Name	Examination Scheme							
ELC601	Microcontollers and its Applications	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		20	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Course Objectives:

- To impart knowledge of PIC microcontrollers along with the programming using assembly language and C language.
- To make the students aware of recent microcontroller based design.

Course Outcomes:

- Students will understand the basic programming used in microcontroller based systems.
- Students will be able to implement any system using microcontrollers

ELC601: Microcontrollers and its Applications

Module No.	Topics	Hours
1	**Introduction to microcontroller**: Block diagram of generic microcontroller, Microcontroller versus microprocessor, Overview of the PIC 18 family, A brief history of PIC microcontroller, PIC 18 features and family, Internal bus structure of PIC microcontroller.	04
2	**PIC Controller : PIC 18** Block diagram PIC 18 microprocessor, PIC microcontroller program memory and data (File) memory organization, Special Function Register (SFR), General purpose Register (GPR), CPU registers, WREG register, Status register, BSR register, Instruction register, Program counter and program ROM, Stack pointer and Stack RAM, PIC 18 internal architecture (ALU, EEPROM, RAM, I/O port, Timer, CCP, DAC), Pipelining.	10
3	**PIC 18 Assembly language programming:** Instruction format, Addressing modes, Assembler directives, Assembly language programming structure, Instruction set, Reading writing data in programme memory, Arithmetic and logical instructions: Writing programs to perform arithmetic and logical computations, Rotate instructions: Writing program to perform divide and multiplication operations, Branch instruction, Subroutine and instructions associated with it, Stack and instruction associated with it, Time delays and delay calculations.	10
4	**PIC Programming in assembly and C:** Timer programming for generation of time delay : Timer register, control registers, interrupt register, 16 bit and 8 bit programming, Counter programming to count events: Serial port programming, Basics of serial communication, Synchronous and asynchronous communication, SPBRG, TXREG, RCREG, TXSTA,RCSTA,PIR1, Interrupt programming:, Interrupt versus polling, Interrupt structure, Enabling and disabling interrupt, Programming Timer, interrupt, LCD and Keyboard interfacing.	16
5	**Parallel Ports I**/O Addressing, Synchronization. Overview of the PIC18 parallel ports, Interfacing with simple output devices.	06
6	**Input/ Output (I/O) port Interfacing** Interfacing matrix keyboard and 7- segment LED display, ADC Interface, Stepper Motor Interface, Dc Motor interface, Interfacing an LCD (Liquid Crystal Display).	06
	TOTAL	52

ELC601: Microcontrollers and its Applications

Books Recommended:

1. Fundamentals of Microcontrollers and applications in Embedded System (PIC 18 Microcontroller familiy), Ramesh Gaonkar, Penram International publishing (Ind) pvt. Ltd.

2. PIC Microcontroller and Embedded systems, Mazidi, Muhmmad A. Pearson Education

3. Han Way Huang, PIC Microcontroller, Cengage learning

4. Microprocessor from assembly language to C using PIC 18FXX2, Robert B. Reese, Davinci Engineering press

5. Microcontrollers (Theory and Applications), Ajay Deshmukh, Tata McGraw Hill Edu. Pvt. Ltd

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELC602	Electrical Machines-III	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		04	--	--	--	--	--	04

Course Code	Course Name	Examination Scheme							
ELC602	Electrical Machines-III	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		20	**20**	**20**	**80**	**--**	**--**	**---**	**100**

Course Objectives:

- To impart the knowledge of working principle, operations, performance and applications of 3φ Synchronous Generators and Synchronous Motors
- To develop the d-q model of 3φ Synchronous Machines and Induction Machines

Course Outcomes:

- Students will be able to understand the engineering fundamentals of synchronous machines.
- Gain an ability to design and conduct performance experiments, as well as to identify, formulate and solve machine related problems.

ELC602: Electrical Machines-III

Module No.	Topics	Hours
1	**Synchronous Generator:** Construction, Emf induced in ac winding, winding factors, armature reaction, phasor diagram, OC and SC test, voltage regulation by EMF, MMF, ZPF, ASA, Saturated synchronous reactance method, power flow and maximum power conditions, parallel operation, effect of changing mechanical torque, effect of changing excitation, effect of excitation on alternator connected to infinite bus.	20
2	**Salient Pole Synchronous Generators**: Blondel's two reaction theory, power angle characteristics, synchronizing power and torque.	06
3	**Synchronous Motor:** Principle of operation, phasor diagram, power flow and maximum power conditions, excitation circles, power circles, V curves and O curves, power factor control (Effect of change in excitation on power factor), Hunting, Dampers, Starting methods, Starting against high torques, Measurement of X_d and X_q.	12
4	**Theory of Synchronous Machine:** The ideal synchronous machine, synchronous machine Inductances, Transformation to Direct and Quadrature axis variables, Basic machine relations in dq0 variables, Steady state Analysis.	05
5	**Theory of Induction Machine:** The ideal Induction machine, Transformation to d-q variables, Basic machine relations in d-q variables, Steady state Analysis.	05
6	**Sequence Reactance of Synchronous Generator (Only for practical)** Measurement of positive, negative and zero sequence reactance of Synchronous generator.	04
	TOTAL	52

Books Recommended:

1. Electrical Machinery by P.S.Bimhhra, VII Edition, Khanna Publisher
2. Electrical Machines by Nagrath and Kothari.TMH Publication.
3. Electrical Machinery by Fitzgerald and Kingsley, Second Edition, Mc Graw Hill Book Company
4. Generalized Theory of Electrical Machines by Dr. P.S.Bimhhra, V Edition, Khanna Publishers
5. Electrical Machines by Smarajit Ghosh, Pearson Education

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELC603	Power Electronics	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		04	--	--	04	---	---	04

Course Code	Course Name	Examination Scheme							
ELC603	Power Electronics	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		20	**20**	**20**	**80**	**--**	**--**	**---**	**100**

Course Objectives:

- To impart knowledge of basic operation of power semiconductor devices, converters and their applications

Course Outcome:

- Solid background in fundamentals of power electronics and exposure to state of the art technologies and its control aspects which is used in practice

ELC603: Power Electronics

Module No.	Topics	Hours
1	**Thyristors :** Basic operation of silicon controlled rectifier, two transistor analogy, Static and Dynamic characteristics, Gate characteristics, Firing circuits - R, RC, ramp triggering of UJT, Commutation circuits, Protection circuit of SCR, Basic operation and characteristic of Triac, GTO, Diac.	08
2	**Other power semiconductor devices:** Basic operation and characteristics of power diodes, power BJTs, power MOSFETs, IGBTs, Comparison of devices, applications, need for driver circuits and snubber circuits, heat sinks.	06
3	**Controlled Rectifiers:** Single phase half wave rectifiers, full wave rectifiers (mid-point and bridge configuration) for R and R-L load, freewheel diode, harmonic analysis of input current and input power factor for single phase fully controlled rectifier, effect of source inductance (concept only), single phase dual converter, Three phase semi converter and full converter with R load, Applications, Numerical for calculation of output voltage, single phase PWM rectifier, basic working principle and applications	12
4	**Inverter:** Principle of operation, Performance parameters, Single phase voltage source bridge Inverters, Three phase VSI (120◦ and 180◦ conduction mode), control of inverter output voltage , PWM techniques-Single PWM, Multiple PWM, Sinusoidal PWM, Introduction to Space vector modulation, Current source inverters, comparison of VSI and CSI, Applications.	12
5	**DC to DC Converter**: Basic principle of dc to dc conversion, switching mode regulators – Buck, Boost, Buck-Boost, Cuk regulators, concept of bidirectional dc to dc converters, all with resistive load and only CCM mode, Applications, Numerical included.	08
6	**AC voltage controllers:** On-Off and phase control, Single phase AC voltage controllers with R and RL loads. **Cyclo converters, Matrix converter:** Basic working principle.	06
	TOTAL	52

ELC603: Power Electronics

Books Recommended:

1. “Power Electronics” M.H.Rashid, Prentice-Hall of India
2. “Power Electronics”, Ned Mohan, Undeland, Robbins, John Wiley Publication
3. “Power Electronics”, P.C Sen, Tata McGrawhill
4. “Power Electronics: Devices, Circuits and Matlab Simulations” by Alok Jain, Penram International publishing Pvt Ltd
5. “Power Electronics”, V.R Moorthi, Oxford University press
6. “Thyristors & their applications”, Ramamurthy
7. “Power Electronics”, M.D Singh and Khanchandani, Tata McGrawhill

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELC604	Power System Analysis	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		04	--	--	04	---	---	04

Course Code	Course Name	Examination Scheme							
ELC604	Power System Analysis	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		20	**20**	**20**	**80**	**--**	**--**	**---**	**100**

Course Objectives:

- To give the students basic knowledge of the various faults and it "s analysis
- To give the students basic knowledge of transients occurring in power system

Course Outcomes:

- Students will be able to analyze various types of faults occurring in power system
- Engineering knowledge in effects of faults and mitigation of transients

ELC604: Power System Analysis

ELC604: Power System Analysis

Module No.	Topics	Hours
1	**Symmetrical Fault Analysis:** Introduction to synchronous machine, basic construction and operation and equivalent circuit diagram , short circuit of synchronous machine: no load and loaded machine, transient on a transmission line, selection of Circuit breaker, short circuit MVA, algorithm for SC studies, Z Bus formulation, symmetrical fault analysis using Z bus **(numerical on Z bus formulation upto 3x3 matrix).**	14
2	**Unsymmetrical Fault Analysis:** Symmetrical component transformation, phase shift in star-delta transformers, sequence impedances and sequence network of transmission line, synchronous machine and transformer, power invariance, construction of sequence network of a power system. Fault analysis of unsymmetrical faults, single line to ground (SLG) fault, line to line (L-L) fault, double line to ground (LLG) fault, open conductor faults, bus impedance matrix method for analysis of unsymmetrical shunt faults.	14
3	**Power System Transients**: Review of transients in simple circuits, recovery transient due to removal of short circuit, arcing grounds, capacitance switching, current chopping phenomenon. Travelling waves on transmission lines, wave equation, reflection and refraction of waves, typical cases of line terminations, attenuation, Bewely lattice diagram. Lightning phenomenon, mechanism of Lightning stroke, shape of Lightning voltage wave, over voltages due to Lightning, Lightning protection problem, significance of tower footing resistance in relation to Lightning, insulator flashover and withstand voltages, protection against surges, surge arresters, surge capacitor, surge reactor and surge absorber, Lightning arrestors and protective characteristics, dynamic voltage rise and arrester rating.	10
4	**Insulation Coordination:** Volt time curve, over voltage protection, ground wires, insulation coordination based on lightning, surge protection of rotating machines and transformers	02
5	**Corona:** Phenomenon of corona, Disruptive critical voltage, Visual critical voltage, corona loss, factors affecting corona loss, Radio interference due to corona, practical considerations of corona loss, corona in bundled conductor lines, corona ring, corona pulses- their generation and properties in EHV lines, charge voltage (q-V) diagram and corona loss.	06
6	**Uncompensated Transmission Line**: Electrical Parameters, Fundamental Transmission Line equation, Surge Impedance and Natural Loading, the uncompensated line on Open circuit, the uncompensated line under load- Effect of line length, load power and power factor on voltage and reactive power, Maximum power and stability considerations.	06
	TOTAL	52

Books Recommended: *Text Books:*

1. Wadhwa C.L. *Electrical power system*, New Age International,4th edition,2005

2. Hadi Saadat, Power System Analysis, TMH publications,2002

3. D. P. Kothari, I. J. Nagrath, Modern *Power System Analysis*, Mc Graw Hill,3rd edition,2006

4. B.R. Gupta, *Power System Analysis And Design*, S.Chand,4th edition,2007

5. Begamudre R.D. "Extra High Voltage AC Transmission Engineering", New Age International, 2nd edition

6. Soni M.L., Bhatanagar U.S, Gupta P.V, A *course in electrical power*, Dhnapat Rai sons

7. Timothy J.E.Miller, "Reactive Power Control in Electric Systems" Wiley India Pvt Ltd. 2010.

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELC605	Digital Signal Processing and Processors	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		04	--	--	04	---	---	04

Course Code	Course Name	Examination Scheme							
ELC605	Digital Signal Processing and Processors	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		20	**20**	**20**	**80**	**--**	**--**	**---**	**100**

Course Objectives:

- To study DFT and its computation
- To study the design techniques for digital filters
- To study the finite word length effects in signal processing
- To study the fundamentals of digital signal processors
- To get acquainted with the DSP applications

Course Outcomes:

- Students will be able to understand concept of digital filters
- Students will be able to decide the selection and design of digital filters
- Students will understand the effect of hardware limitation
- Students will be understand need of DSP processors
- Students will be able to understand the use and application of DSP processors

ELC605: Digital Signal Processing and Processors

Module No.	Unit No.	Topics	Hours
1		**Discrete Fourier Transform and Fast Fourier Transform**	10
	1.1	**Discrete Fourier Series**: Properties of discrete Fourier series, DFS representation of periodic sequences.	
	1.2	**Discrete Fourier transforms**: Properties of DFT, linear convolution of sequences using DFT, computation of DFT, relation between Z-transform and DFS	
	1.3	**Fast Fourier Transforms**: Fast Fourier transforms (FFT), Radix-2 decimation in time and decimation in frequency FFT algorithms, inverse FFT, and composite FFT	
2		**IIR Digital Filters**	10
	2.1	Mapping of S-plane to Z-plane, impulse invariance method, bilinear Z transformation (BLT) method, frequency warping, pre-warping	
	2.2	**Analog filter approximations**: Butter worth and Chebyshev, design of IIR digital filters from analog filters, design examples	
	2.3	Analog and digital frequency transformations	
3		**FIR Digital Filters**	10
	3.1	Characteristics of FIR digital filters, frequency response, location of the zeros of linear phase FIR filters	
	3.2	Design of FIR digital filters using window techniques, Gibbs phenomenon, frequency sampling technique, comparison of IIR and FIR filters	
4		**Finite Word Length Effects in Digital Filters**	08
	4.1	Number representation, fixed point, sign-magnitude, one's complement, two's complement forms, floating point numbers	
	4.2	Quantization, truncation, rounding, effects due to truncation and rounding, Input quantization error, Product quantization error, co-efficient quantization error, zero-input limit cycle oscillations, overflow limit cycle oscillations, scaling	
	4.3	Quantization in Floating Point realization IIR digital filters, finite word length effects in FIR digital filters, quantization effects in the computation of the DFT- quantization errors in FFT algorithms	
5		**Introduction to DSP Processors**	08
	5.1	Introduction to fixed point and floating point DSP processor, multiplier and multiplier accumulator (MAC), modified bus structures and memory access schemes in DSPs, multiple access memory, multiport memory, VLIW architecture, pipelining, special addressing modes, on-chip peripherals	
	5.2	Features of TMS 320c67xx DSP processor, architecture of TMS 320c67xx DSP processor, architecture features: computational units, bus architecture memory, data addressing, address generation unit, program control, program sequencer, pipelining, interrupts, features of external interfacing, on-chip peripherals, hardware timers, host interface port, clock generators, SPORT	
6		**Applications of DSP Processors**	06
	6.1	Speech Processing: Speech analysis, speech coding, sub band coding, channel vocoder, homomorphic vocoder, digital processing of audio signals.	
	6.2	**Radar signal processing**: Radar principles, radar system and parameter considerations, signal design	
		TOTAL	52

ELC605: Digital Signal Processing and Processors

Recommended Books:

1. Proakis J., Manolakis D., "*Digital Signal Processing*", 4th Edition, Pearson Education
2. Oppenheim A., Schafer R., Buck J., "*Discrete Time Signal Processing*", 2nd Edition, Pearson Education.
3. Babu R., "*Digital Signal Processing*", 4th Edition, Scitech Publications.
4. B. Venkata Ramani and M. Bhaskar, "*Digital Signal Processors, Architecture, Programming and Applications*", Tata McGraw Hill, 2004.
5. L. R. Rabiner and B. Gold, "*Theory and Applications of Digital Signal Processi*ng", Prentice-Hall of India, 2006.
6. B. Kumar, "*Digital Signal Processing*", New Age International Publishers, 2014.

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELC606	Project Management	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		03	--	--	03	---	---	03

Course Code	Course Name	Examination Scheme							
ELC605	Project Management	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		20	**20**	**20**	**80**	**--**	**--**	**---**	**100**

Course Objectives:

- To Introduce the concept of Project Management to the students

Course Outcomes:

- Students will be able to handle the Industrial Projects effectively and efficiently.

Module No.	Topics	Hours
1	**Understanding Projects and Project management**: Difference between Project and Operation. Definition of Project & Project Management. Selection and Qualities of a Project Manager. Life cycle of Project. Project Management Methodologies & Growth	03
2	**Project Selection & Appraisal:** Project ideas generation, Pre-Feasibility Analysis (SWOT). Feasibility Analysis-Market& Demand appraisal, Technical appraisal, Financial appraisal (debt/equity ratio, different sources of finance, financial institution, Cash Flows, Profitability projections like PBP, NPV, IRR, Break–Even Analysis). Risk analysis (Sensitivity analysis & Scenario Analysis). Economic Feasibility (SCBA-UNIDO approach). Preparing a detailed Project Proposal (Executive Summary).	12
3	**Project Planning**: Attributes & Definition of planning. WBS. Time Planning (PERT/CPM/Trade off). Material Planning (Procurement logistics & storage). Machines & Technology planning. Human Resource Planning (Project Organization). Planning the cost (Budgeting). QAP. Planning of Risk Management. Statutory Clearances. Resource Allocation & Resource Leveling. Introduction & use of PM software.	12
4	**Project Execution, Monitoring & Controlling:** Motivation (Motivation Theories). Communication & Reporting (Types and Methods). Co-ordination. Management of scope. TQM. Stake Holder Management, Risk Management and Logistics Management.	04
5	**Project Closure & Termination:** Inspection. Testing. Transportation. Commissioning. Trial Run. Documentation required for Project Handover. Preparing a Project Report for Future Reference.	02
6	**Contracts Management:** Types of contracts, Tendering (techno commercial aspects). Negotiations and Awarding the contracts. Contract closure.	03
	TOTAL	36

ELC606: Project Management

Books Recommended:

1. Project Management & Appraisal, Sitangshu Khatua, Pub. Oxford University

2. Project Preparation , Appraisal, Budgeting & Implementation by Prasanna Chandra(TMH)

3. Project Management & Control by Narendra Singh, Himalaya Pub.

4. Project Management- a Managerial Approach to Planning, Scheduling, and Controlling Harold Kerzner, 10th edition John Wiley & Sons, Inc.

5. Project Management - a Managerial Approach : Jack R. Meredith & Samuel J Mantel, Jr., 7 th Edition John Wiley & Sonns, Inc.

6. Project Management Institute (PMBOK)â Guide, 5th Edition

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be set from all the modules.
5: Weightage of marks will be as per Blueprint.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELL601	Microcontrollers and its Applications Laboratory	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		--	02	--	--	01	---	01

Course Code	Course Name	Examination Scheme							
ELL601	Microcontrollers and its Applications Laboratory	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test1	**Test 2**	**Avg. of Test 1 and Test 2**					
		--	--	--	--	**25**	**25**	--	**50**

Term Work:

At least 10 experiments based on the entire syllabus of **ELC601: Microcontrollers and its Applications** should be set to have well predefined inference and conclusion. Computation/simulation based experiments are also encouraged. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time.** The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. **Practical and Oral** exam will be based on the entire syllabus.

Suggested Experiments

To design and test circuits

1. Addition , Subtraction
2. BCD Adder
3. Multiplication, Division
4. 4 bit LCD driver
5. Working of ADC/ DAC
6. Demonstration of Traffic light
7. Implement door bell
8. Working of calculator

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELL602	Electrical Machines-III Laboratory	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		--	02	--	--	01	---	01

Course Code	Course Name	Examination Scheme							
ELL602	Electrical Machines-III Laboratory	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test1	**Test 2**	**Avg. of Test 1 and Test 2**					
		--	--	--	--	**25**	**25**	--	**50**

Term Work:

At least 10 experiments based on the entire syllabus of **ELC602: Electrical Machines-III** should be set to have well predefined inference and conclusion. Computation/simulation based experiments are also encouraged. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time.** The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. **Practical and Oral** exam will be based on the entire syllabus.

List of Laboratory Experiments Recommended:

1. Construction details of Synchronous machine
2. Regulation of alternator by direct loading.
3. Regulation of alternator by EMF and MMF method
4. Regulation of alternator by ZPF, ASA and saturated synchronous reactance method.
5. To study the Excitation required to maintain terminal voltage of an alternator constant.
6. V and inverted V curves of synchronous motor
7. Determination of Xd and Xq by slip test. 8. Synchronization of Alternators.
9. Parallel operation of alternators.
10. Starting methods of synchronous motor.
11. Use of Synchronous motor as a synchronous condenser.
12. Performance curves of synchronous motor by conducting brake test with rated excitation.
13. To determine positive sequence, negative sequence and zero sequence reactance of an alternator

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELL603	Power Electronics and Power System Analysis Laboratory	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		--	02	--	--	01	---	01

Course Code	Course Name	Examination Scheme							
ELL603	Power Electronics and Power System Analysis Laboratory	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test1	**Test 2**	**Avg. of Test 1 and Test 2**					
		--	--	--	--	**25**	**25**	--	**50**

Term Work:

At least 6 experiments based on the entire syllabus of **ELC603:Power Electronics** at least 4 simulation/laboratory experiments based on entire syllabus of **ELC604:Power System Analysis** should be set to have well predefined inference and conclusion. Computation/simulation based experiments are also encouraged. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time.** The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. **Practical and Oral** exam will be based on the entire syllabus.

Suggested List of Experiments:

ELC603:Power Electronics

1. V-I Characteristics of SCR
2. Firing Circuit of SCR
3. MOSFET/IGBT characteristics
4. Single phase half / full controlled rectifier circuit
6. Three phase half /fully controlled rectifier circuit with R load
7. Single/Three phase Inverter
9. Triac-Diac circuit
10. Buck converter

ELC604:Power System Analysis

1) Symmetrical Fault Analysis
2) Bus Impedance formulation and symmetrical fault analysis using Z Bus
3) Symmetrical Component
4) Unsymmetrical Fault Analysis
5) Unsymmetrical Fault Analysis
6) Travelling Waves and Corona

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELL604	Digital Signal Processing and Processor Laboratory	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		--	02	--	--	01	---	01

Course Code	Course Name	Examination Scheme							
ELL604	Digital Signal Processing and Processor Laboratory	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test1	**Test 2**	**Avg. of Test 1 and Test 2**					
		--	--	--	--	**25**	--	--	**25**

Term Work:

At least 10 experiments based on the entire syllabus of **ELC605: Digital Signal Processing and Processors** should be set to have well predefined inference and conclusion. Computation/simulation based experiments are also encouraged. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time.** The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

Course Code	Course Name	Teaching Scheme in Hrs			Credit Assigned			
ELL605	Mini Project-II	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
		--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme							
ELL605	Mini Project-II	**Theory Marks**				**Term Work**	**Practical and Oral**	**Oral**	**Total**
		Internal Assessment			**End Sem Exam**				
		Test 1	**Test 2**	**Avg. of Test 1 and Test 2**					
		--	--	--	--	**25**	**25**	--	**25**

Term Work:

The main intention of Mini Project is to make student enable to apply the knowledge and skills learned out of courses studied to solve/implement predefined practical problem. The students undergo various laboratory/tutorial/simulation laboratory/work shop courses in which they do experimentation based on the curriculum requirement. The Mini Project may be beyond the scope of curriculum of courses taken or may be based on the courses but thrust should be on

- Learning additional skills
- Development of ability to define and design the problem and lead to its accomplishment with proper planning
- Learn the behavioral science by working in a group

The group may be maximum **four** (04) students. Each group will be assigned one faculty as a supervisor. The college should keep proper assessment record of progress of the project and at the end of the semester it should be assessed for awarding TW marks. The TW may be examined by approved internal faculty appointed by the head of the institute. The final examination will be based on demonstration in front of internal and external examiner. In the examination each individual student should be assessed for his/her contribution, understanding and knowledge gained about the task completed. The students may use this opportunity to learn different computational techniques as well as some model development. This they can achieve by making proper selection of Mini Projects.