

Course No.	Course Name	L-T-P - Credits	Year of Introduction
MA202	Probability distributions, Transforms and Numerical Methods	3-1-0-4	2016
Prerequisite: Nil			
Course Objectives			
<ul style="list-style-type: none"> To introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in various Engineering and social life situations. To know Laplace and Fourier transforms which has wide application in all Engineering courses. To enable the students to solve various engineering problems using numerical methods. 			
Syllabus			
Discrete random variables and Discrete Probability Distribution. Continuous Random variables and Continuous Probability Distribution. Fourier transforms. Laplace Transforms. Numerical methods-solution of Algebraic and transcendental Equations, Interpolation. Numerical solution of system of Equations. Numerical Integration, Numerical solution of ordinary differential equation of First order.			
Expected outcome .			
After the completion of the course student is expected to have concept of (i) Discrete and continuous probability density functions and special probability distributions. (ii) Laplace and Fourier transforms and apply them in their Engineering branch (iii) numerical methods and their applications in solving Engineering problems.			
Text Books:			
<ol style="list-style-type: none"> Miller and Freund's "Probability and statistics for Engineers"-Pearson-Eighth Edition. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th edition, Wiley, 2015. 			
References:			
<ol style="list-style-type: none"> V. Sundarapandian, "Probability, Statistics and Queuing theory", PHI Learning, 2009. C. Ray Wylie and Louis C. Barrett, "Advanced Engineering Mathematics"-Sixth Edition. Jay L. Devore, "Probability and Statistics for Engineering and Science"-Eight Edition. Steven C. Chapra and Raymond P. Canale, "Numerical Methods for Engineers"-Sixth Edition-Mc Graw Hill. 			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Discrete Probability Distributions. (Relevant topics in section 4.1,4,2,4.4,4.6 Text1)		
	Discrete Random Variables, Probability distribution function, Cumulative distribution function.	2	
	Mean and Variance of Discrete Probability Distribution.	2	
	Binomial Distribution-Mean and variance.	2	
	Poisson Approximation to the Binomial Distribution. Poisson distribution-Mean and variance.	2	
			15%

II	Continuous Probability Distributions. (Relevant topics in section 5.1,5.2,5.5,5.7 Text1)		
	Continuous Random Variable, Probability density function, Cumulative density function, Mean and variance.	2	
	Normal Distribution, Mean and variance (without proof).	4	
	Uniform Distribution.Mean and variance.	2	
	Exponential Distribution, Mean and variance.	2	
FIRST INTERNAL EXAMINATION			
III	Fourier Integrals and transforms. (Relevant topics in section 11.7, 11.8, 11.9 Text2)		15%
	Fourier Integrals. Fourier integral theorem (without proof).	3	
	Fourier Transform and inverse transform.	3	
	Fourier Sine & Cosine Transform, inverse transform.	3	
IV	Laplace transforms. (Relevant topics in section 6.1,6.2,6.3,6.5,6.6 Text2)		15%
	Laplace Transforms, linearity, first shifting Theorem.	3	
	Transform of derivative and Integral, Inverse Laplace transform, Solution of ordinary differential equation using Laplace transform.	4	
	Unit step function, second shifting theorem.	2	
	Convolution Theorem (without proof).	2	
	Differentiation and Integration of transforms.	2	
SECOND INTERNAL EXAMINATION			
V	Numerical Techniques. (Relevant topics in section.19.1,19.2,19.3 Text2)		20%
	Solution Of equations by Iteration, Newton- Raphson Method.	2	
	Interpolation of Unequal intervals-Lagrange's Interpolation formula.	2	
	Interpolation of Equal intervals-Newton's forward difference formula, Newton's Backward difference formula.	3	
VI	Numerical Techniques. (Relevant topics in section 19.5,20.1,20.3, 21.1 Text2)		20%
	Solution to linear System- Gauss Elimination, Gauss Seidal Iteration Method.	3	
	Numeric Integration-Trapezoidal Rule, Simpson's 1/3 Rule.	3	
	Numerical solution of firstorder ODE-Euler method, Runge-Kutta Method (fourth order).	3	
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks : 100

Exam Duration: 3 hours

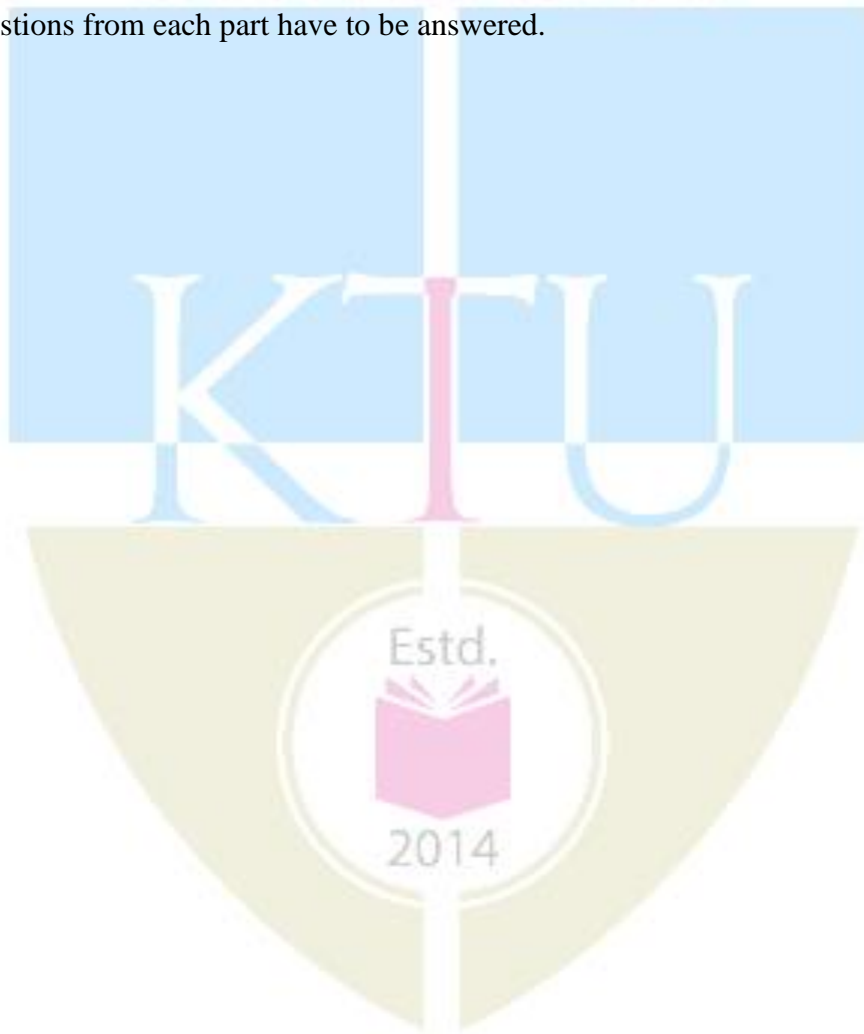
The question paper will consist of 3 parts.

Part A will have 3 questions of 15 marks each uniformly covering modules I and II. Each question may have two sub questions.

Part B will have 3 questions of 15 marks each uniformly covering modules III and IV. Each question may have two sub questions.

Part C will have 3 questions of 20 marks each uniformly covering modules V and VI. Each question may have three sub questions.

Any two questions from each part have to be answered.



Course No	Course Name	L-T-P-Credits	Year of Introduction
EE202	Synchronous and Induction Machines	3-1-0-4	2016
Prerequisite : NIL			
Course Objectives			
<p>To give exposure to the students about the concepts of alternating current machines including the Constructional details, principle of operation and performance analysis.</p> <p>To learn the characteristics of induction machines and to learn how it can be employed for various applications.</p>			
Syllabus			
<p>Alternators – basic principle, constructional details, armature windings, armature reaction, voltage regulation and determination of regulation by different methods; parallel operation of alternators and synchronization; Synchronous motors – principle, performance and power relations; synchronous induction motors.</p> <p>Induction motors – basic principle, rotating magnetic field, constructional details, mechanical power and torque, performance analysis, starting methods, braking, testing, equivalent circuit and circle diagrams; single phase induction motors.</p> <p>Induction generator – principle of operation.</p>			
Expected Outcome			
<p>After the successful completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. identify alternator types, and appreciate their performance 2. determine the voltage regulation and analyse the performance of alternators 3. describe the principle of operation of synchronous motor and different applications. 4. describe the principle of operation of 3-phase induction motors and select appropriate motor types for different applications. 5. analyse the performance of 3-phase induction motors 6. familiarize with principle of operation and application of 1 -phase induction motors. 			
Text Book			
<ol style="list-style-type: none"> 1. Bimbra P. S., <i>Electrical Machinery</i>, 7/e, Khanna Publishers, 2011. 2. Nagrath J. and D. P. Kothari, <i>Theory of AC Machines</i>, Tata McGraw Hill, 2006. 			
Reference Books			
<ol style="list-style-type: none"> 1. Say M. G., <i>The Performance and Design of A. C. Machines</i>, C B S Publishers, New Delhi, 2002. 2. Fitzgerald A. E., C. Kingsley and S. Umans, <i>Electric Machinery</i>, 6/e, McGraw Hill, 2003. 3. Langsdorf M. N., <i>Theory of Alternating Current Machinery</i>, Tata McGraw Hill, 2001. 4. Deshpande M. V., <i>Electrical Machines</i>, Prentice Hall India, New Delhi, 2011. 5. Charles I. Hubert, <i>Electric Machines</i>, Pearson, New Delhi 2007 6. Theodore Wilde, <i>Electrical Machines, Drives and Power System</i>, Pearson Ed. Asia 2001. 			
Course Plan			
Module	Contents	Hours	Semester Exam Marks
I	<p>Alternators - basic principle, constructional features of salient pole type and cylindrical type alternators, advantages of stationary armature, turbo-alternator.</p> <p>Armature winding – types of armature winding- single layer, double layer, full pitched and short pitched winding,</p>	8 hours	15%

	<p>slot angle, pitch factor and distribution factor – numerical problems.</p> <p>Effect of pitch factor on harmonics – advantages of short chorded winding, EMF Equation – numerical problems.</p> <p>Harmonics in generated EMF – suppression of harmonics.</p>		
II	<p>Performance of an alternator – Causes for voltage drop in alternators – armature resistance, armature leakage reactance – armature reaction, synchronous reactance, synchronous impedance, experimental determination – phasor diagram of a loaded alternator.</p> <p>Voltage regulation – EMF, MMF, ZPF and ASA methods – numerical problems.</p>	9 hours	15%
FIRST INTERNAL EXAMINATION			
III	<p>Theory of salient pole machine – Blondel’s two reaction theory – direct axis and quadrature axis synchronous reactances – phasor diagram and determination of X_d and X_q by slip test.</p> <p>Parallel operation of alternators – necessity of parallel operation of alternators, methods of synchronisation– dark lamp method and bright lamp method, synchroscope, Synchronising current, synchronising power, synchronising torque.</p> <p>Effects of changing excitation of alternators, load sharing of two alternators in parallel operation.</p>	9 hours	15%
IV	<p>Synchronous motor – construction and principle of synchronous motor, methods of starting.</p> <p>Effects of excitation on armature current and power factor, v-curve and inverter v-curve, load angle, torque and power relationship, phasor diagram, losses and efficiency calculations.</p> <p>Three phase induction motor – constructional features, slip ring and cage types. Theory of induction motor with constant mutual flux, slip, phasor diagram, expression for mechanical power and torque, torque-slip characteristics, starting torque, full load and pull out torque, equivalent circuit.</p>	9 hours	15%
SECOND INTERNAL EXAMINATION			
V	<p>Circle diagrams – tests on induction motors for determination of equivalent circuit and circle diagram.</p>	10 hours	20%

	<p>Cogging, crawling and noise production in cage motors – remedial measures.</p> <p>Double cage induction motor – principle, torque-slip curves.</p> <p>Starting of induction motors – types of starters – DOL starter, autotransformer starter, star-delta starter, rotor resistance starter – starting torque and starting current-numerical problems.</p> <p>Braking of induction motors – plugging, dynamic braking and regenerative braking (no numerical problems).</p> <p>Speed control – stator voltage control, V/f control, rotor resistance control.</p>		
VI	<p>Induction generator – principle of operation, grid connected and self excited operation, comparison of induction generator with synchronous generators.</p> <p>Synchronous induction motor – principle of operation.</p> <p>Single-phase induction motor – double field revolving theory, equivalent circuit, torque slip curve.</p> <p>Types of single phase induction motor – split phase, capacitor start, capacitor start and run types.</p> <p>Principle of shaded pole motor – applications.</p>	10 hours	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN (End semester exam)

Part A: 8 questions.

One question from each module of Module I - IV; and two each from Module V & VI.

Student has to answer all questions. (8 x 5)=40

Part B: 3 questions uniformly covering modules I&II

Student has to answer any 2 questions: (2 x 10) =20

Part C: 3 questions uniformly covering modules III&IV

Student has to answer any 2 questions: (2 x 10) =20

Part D: 3 questions uniformly covering modules V&VI

Student has to answer any 2 questions: (2 x 10) =20

Note: Each question can have maximum of 4 sub questions, if needed.

Course No.	Course Name	L-T-P -Credits	Year of Introduction
EE204	Digital Electronics and Logic Design	2-1-0-3	2016
Prerequisite : Nil			
Course Objectives			
To impart knowledge about digital logic and to gain the ability to design various digital circuits			
Syllabus			
Review of Number Systems and Codes, Digital Logic, Combinational Logic Circuits, Data Processing Circuits, Arithmetic Circuits, Flip-Flops, Registers, Counters, DACs and ADCs, Design of synchronous Sequential Circuits, Introduction to HDL.			
Expected outcome.			
After the successful completion of the course, the student will be able to:			
<ol style="list-style-type: none"> 1. Familiar with various number systems and Boolean algebra 2. design and analyse any digital logic gate circuits and Flip flop based systems. 3. Familiar with combinational circuits 4. gain the capability of implementing various counters, 5. describe the operation of ADC and DAC circuits 6. acquire basic knowledge on VHDL 			
Text Book:			
<ol style="list-style-type: none"> 1. Floyd T.L, Digital Fundamentals , 10/e, Pearson Education, 2011 2. C.H.Roth and L.L.Kimney Fundamentals of Logic Design, 7/e, Cengage Learning, 2013 			
References:			
<ol style="list-style-type: none"> 1. Donald P Leach, Albert Paul Malvino and GoutamSaha., Digital Principles and Applications, 8/e, by Mc Graw Hill 2. Mano M.M, Logic and Computer Design Fundamentals, 4/e, , Pearson Education. 3. Tocci R.J and N.S.Widmer, Digital Systems, Principles and Applications, 11/e, , Pearson Education. 4. John F. Wakerly, Digital Design: Principles and Practices, 4/e, , Pearson, 2005 5. Taub & Schilling: Digital Integrated Electronics, McGraw Hill,1997 			
Data Book (Approved for use in the examination):Nil			

Course Plan			
Module	Contents	Hours	Sem.ExamMarks
I	Number Systems and Codes : Binary, Octal and hexadecimal conversions- ASCII code, Excess -3 code, Gray code, Error detection and correction - Parity generators and checkers – Fixed point and floating point arithmetic. Binary addition and subtraction, unsigned and signed numbers, 1's complement and 2's complement arithmetic.	7 hours	15%
II	TTL logic and CMOS logic - Logic gates, Universal gates - Boolean Laws and theorems, Sum of Products method, Product of Sum method – K map representation and simplification(upto four variables) - Pairs, Quads, Octets, Dont care conditions.	7 hours	15%
FIRST INTERNAL EXAMINATION			
III	Combinational circuits: Adders _ Full adder and half adder – Subtractors, halfsubtractor and fullsubtractor – Carry Look ahead adders – ALU(block diagram only). Multiplexers, Demultiplexers, Encoders, BCD to decimel decoders.	7 hours	15%
IV	Sequential circuits: Flip-Flops, SR, JK, D and T flip-flops, JK Master Slave Flip-flop, Conversion of flip-flops, Registers -SISO,SIPO, PISO, PIPO. Counters : Asynchronous Counters – Modulus of a counter – Mod N counters.	8 hours	15%
SECOND INTERNAL EXAMINATION			
V	Synchronous counters: Preset and clear modes, Counter Synthesis: Ring counter, Johnson Counter, Mod N counter, Decade counter. State Machines: State transition diagram, Moore and Mealy Machines – Design equation and circuit diagram.	7 hours	20%
VI	Digital to Analog conversion – R-2R ladder, weighted resistors. Analog to Digital Conversion - Flash ADC, Successive approximation, Integrating ADC.	8 hours	20%

	<p>Memory Basics, Read and Write, Addressing, ROMs, PROMs and EPROMs, RAMs, Sequential Programmable Logic Devices - PAL, PLA, FPGA (Introduction and basic concepts only)</p> <p>Introduction to VHDL, Implementation of AND, OR, half adder and full adder.</p>		
END SEMESTER EXAM			

QUESTION PAPER PATTERN (End semester exam)

Part A: 8 questions.

One question from each module of Module I - IV; and two each from Module V & VI.

Student has to answer all questions. (8 x 5) = 40

Part B: 3 questions uniformly covering modules I&II

Student has to answer any 2 questions: (2 x 10) = 20

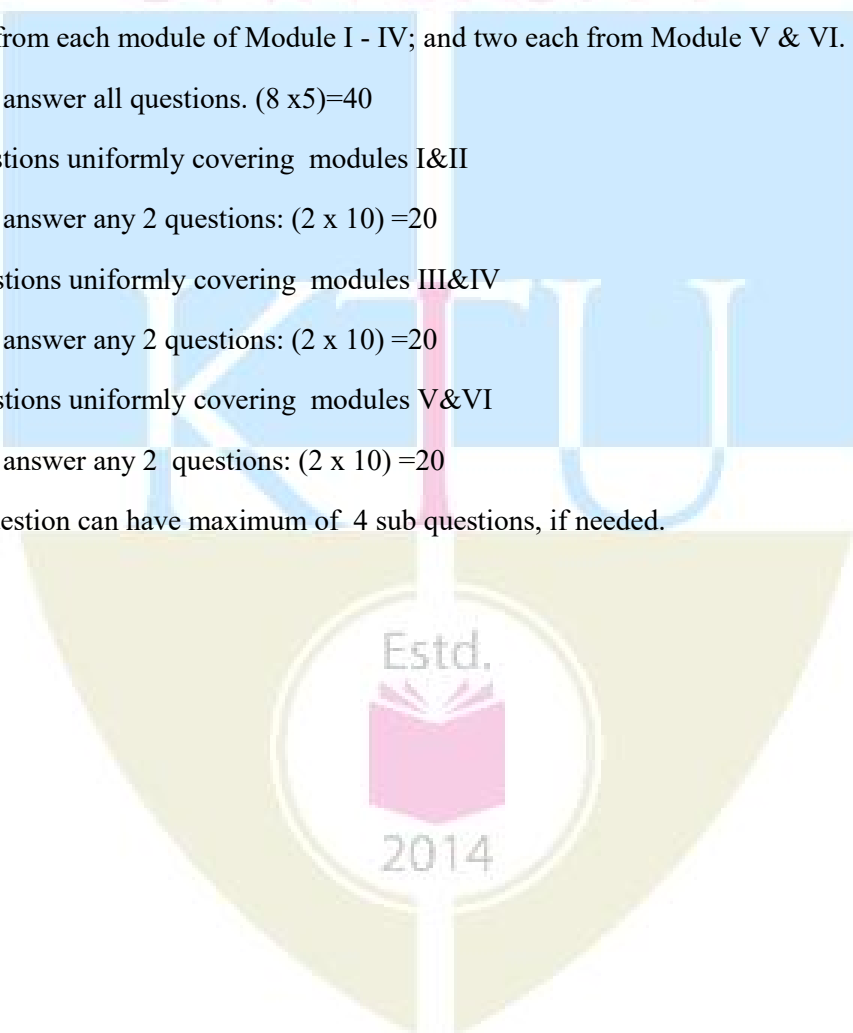
Part C: 3 questions uniformly covering modules III&IV

Student has to answer any 2 questions: (2 x 10) = 20

Part D: 3 questions uniformly covering modules V&VI

Student has to answer any 2 questions: (2 x 10) = 20

Note: Each question can have maximum of 4 sub questions, if needed.



Course No.	Course Name	L-T-P -Credits	Year of Introduction
EE206	MATERIAL SCIENCE	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

To impart knowledge in the field of material science and their applications in electrical engineering

Syllabus:

Conducting materials- properties-applications- Semi conductor materials- properties-applications- Magnetic materials-classification-alloys of iron-ferrites-Dielectric materials-polarization-solid, liquid and gaseous insulators-Dielectric breakdown-superconductors-solar energy materials-Spectroscopy-microscopy-magnetic resonance-nanomaterials

Expected Outcome:

After the completion of the course student will be able to:

1. Describe the characteristics of conducting and semiconducting materials
2. Classify magnetic materials and describe different laws related to them
3. Classify and describe different insulators and to explain the behaviour of dielectrics in static and alternating fields
4. Describe the mechanisms of breakdown in solids, liquids and gases
5. Classify and describe Solar energy materials and superconducting materials
6. Gain knowledge in the modern techniques for material studies

Text Book:

1. Dekker A.J : Electrical Engineering Materials, Prentice Hall of India
2. G K Mithal : Electrical Engg Material Science. Khanna Publishers.

References:

1. Tareev, Electrical Engineerin Materials, Mir Publications
2. Meinal A.B and Meinal M. P., Applied Solar Energy – An Introduction, Addisos Wesley
3. Nasser E., *Fundamentals of Gaseous Ionization and Plasma Electronics*, Wiley Series in Plasma Physics, 1971
4. Naidu M. S. and V. Kamaraju, *High Voltage Engineering*, Tata McGraw Hill, 2004
5. Indulkar O.S & Thiruvegam S., An Introduction to electrical Engineering Materials, S. Chand
6. Agnihotri O. P and Gupta B. K, Solar selective Surface, John wiley
7. Seth. S.P and Gupta P. V, A Course in Electrical Engineering Materials, Dhanpathrai

Course Plan

Module	Contents	Hours	Sem.ExamMarks
I	Conducting Materials: Conductivity- dependence on temperature and composition – Materials for electrical applications such as resistance, machines, solders etc.	8	15%
	Semiconductor Materials: Concept, materials and properties- – Basic ideas of Compound semiconductors, amorphous and organic semiconductors- applications.		
	Dielectrics: Introduction to Dielectric polarization and classification – Clausius Mosotti relation- Behavior of dielectric in static and alternating fields		
II	Insulating materials and classification- properties- Common insulating materials used in electrical apparatus-Inorganic,	6	15%

	organic, liquid and gaseous insulators- capacitor materials- Electro-negative gases- properties and application of SF6 gas and its mixtures with nitrogen Ferro electricity.		
FIRST INTERNAL EXAMINATION			
III	Dielectric Breakdown: Mechanism of breakdown in gases, liquids and solids –basic theories including Townsend's criterion, Streamer mechanism, suspended particle theory, intrinsic breakdown, electro-mechanical breakdown- Factors influencing Ageing of insulators- Application of vacuum insulation- Breakdown in high vacuum-Basics of treatment and testing of transformer oil .	7	15%
IV	Magnetic Materials: Origin of permanent magnetic dipoles- Classification of magnetic materials -Curie-Weiss law- Properties and application of iron, alloys of iron- Hard and soft magnetic materials– Ferrites- Magnetic materials used in electrical machines, instruments and relays-	7	15%
SECOND INTERNAL EXAMINATION			
V	Superconductor Materials:-Basic Concept- types- characteristics-applications Solar Energy Materials: Photo thermal conversion- Solar selective coatings for enhanced solar thermal energy collection –Photovoltaic conversion – Solar cells -Silicon, Cadmium sulphide and Gallium arsenic – Organic solar cells.	7	20%
VI	Modern Techniques for materials studies: Optical microscopy – Electron microscopy – Photo electron spectroscopy – Atomic absorption spectroscopy – Introduction to Biomaterials and Nanomaterials	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN (End semester exam)

Part A: 8 questions.

One question from each module of Module I - IV; and two each from Module V & VI. Student has to answer all questions. (8 x 5)=40

Part B: 3 questions uniformly covering modules I&II.

Student has to answer any 2 questions: (2 x 10) =20

Part C: 3 questions uniformly covering modules III&IV.

Student has to answer any 2 questions: (2 x 10) =20

Part D: 3 questions uniformly covering modules V&VI.

Student has to answer any 2 questions: (2 x 10) =20

Note: Each question can have maximum of 4 sub questions, if needed.

Course No.	Course Name	L-T-P-Credits	Year of Introduction
EE208	MEASUREMENTS AND INSTRUMENTATION	3-1-0-4	2016
Prerequisite : Nil			
Course Objectives To develop understanding of various electrical measuring instruments and instrumentation devices			
Syllabus Measurements standards, errors in measurements, operating torques, classification of electrical meters, Measurement of voltage, current, resistance, power, energy, high voltage and high currents. Magnetic measurements, ac potentiometers, ac bridges, CRO, Transducers			
Expected Outcomes: After the completion of the course student will be able to: <ol style="list-style-type: none"> 1. Compare different types of instruments-their working principles, advantages and disadvantages. 2. Explain the operating principles of various ammeters, voltmeters and ohm meters 3. Describe wattmeters and energy meters 4. Describe different flux and permeability measurements methods 5. Identify different AC potentiometers and bridges, 6. Understand the working and applications of cathode ray oscilloscope 7. Identify the transducers for physical variables and to describe operating principle 			
Text Book: <ol style="list-style-type: none"> 1. Sawhney A.K., A course in Electrical and Electronic Measurements & instrumentation, Dhanpat Rai . 2. J. B. Gupta, A course in Electrical & Electronic Measurement & Instrumentation., S K Kataria & Sons 3. Kalsi H. S., Electronic Instrumentation, 3/e, Tata McGraw Hill, New Delhi, 2012 			
References: <ol style="list-style-type: none"> 1. Golding E.W., Electrical Measurements & Measuring Instruments, Wheeler Pub. 2. Cooper W.D., Modern Electronics Instrumentation, Prentice Hall of India 3. Stout M.B., Basic Electrical Measurements, Prentice Hall 4. Oliver & Cage, Electronic Measurements & Instrumentation, McGraw Hill 5. E.O Doebelin and D.N Manik, Doebelin's Measurements Systems, sixth edition, McGraw Hill Education (India) Pvt. Ltd. 6. P.Purkait, B.Biswas, S.Das and C. Koley, Electrical and Electronics Measurements and Instrumentation, McGraw Hill Education (India) Pvt. Ltd.,2013 			
Course Plan			
Module	Contents	Hours	Sem.ExamMarks
I	General principles of measurements – measurement system-measurement standards – characteristics - errors in measurement-calibration of meters- significance of IS standards of Instruments. Classification of meters - operating forces - essentials of indicating instruments - deflecting, damping, controlling torques. Ammeters and voltmeters - moving coil, moving iron, constructional details and operating, principles shunts and multipliers – extension of range.	9	15%
II	Measurement of resistance: measurement of insulation resistance - loss of charge method, measurement of earth resistance. Measurement of power and energy: Dynamometer type wattmeter – 1-phase and 3-phase power measurement – 1-phase and 3-phase energy meters (induction type) – electronic energy meter, TOD meter.	10	15%

FIRST INTERNAL EXAMINATION			
III	Introduction to high voltage and high current measurements: Measurement of high DC voltages - measurement of high AC voltages - electrostatic voltmeters – sphere gaps - DC Hall effect sensors - high current measurements. Study of Phasor Measurement Units (PMU). Current transformers and potential transformers – principle working, ratio and phase angle errors – numerical problems, Clamp on meters.	9	15%
IV	Magnetic Measurements: Measurement of flux and permeability - flux meter - hall effect Gaussmeter - BH curve and permeability measurement - hysteresis measurement- ballistic galvanometer – principle- determination of BH curve - hysteresis loop. Lloyd Fisher square — measurement of iron losses Measurement of rotational speed using proximity sensors and optical sensors.	9	15%
SECOND INTERNAL EXAMINATION			
V	DC & AC potentiometers - General Principle - calibration of ammeter, voltmeter and wattmeter using potentiometer. AC Bridges: Maxwell's bridge- Schering bridge and Wien's bridge Oscilloscopes – Basic principle of signal display - Block diagram and principle of operation of general purpose CRO - vertical deflecting system - horizontal deflection system - basic sweep generator - XY mode and Lissajous patterns - applications of CRO - dual trace oscilloscope. digital storage oscilloscope	9	20%
VI	Transducers - Definition and classification - common transducers for measurement of displacement, velocity, flow, liquid level, force, pressure, strain and temperature - basic principles and working of LVDT, electromagnetic and ultrasonic flow meters, piezoelectric force transducer, load cell, strain gauge- bridge configuration for four strain gauges, RTD, Thermistors, thermocouple, Need for instrumentation system, data acquisition system.	9	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN (End semester exam)

Part A: 8 questions.

One question from each module of Module I - IV; and two each from Module V & VI.

Student has to answer all questions. (8 x 5) = 40

Part B: 3 questions uniformly covering modules I&II

Student has to answer any 2 questions: (2 x 10) = 20

Part C: 3 questions uniformly covering modules III&IV

Student has to answer any 2 questions: (2 x 10) = 20

Part D: 3 questions uniformly covering modules V&VI

Student has to answer any 2 questions: (2 x 10) = 20

Note: Each question can have maximum of 4 sub questions, if needed.

Course code	Course Name	L-T-P - Credits	Year of Introduction
HS200	Business Economics	3-0-0-3	2016
Prerequisite: Nil			
Course Objectives <ul style="list-style-type: none"> • To familiarize the prospective engineers with elementary Principles of Economics and Business Economics. • To acquaint the students with tools and techniques that are useful in their profession in Business Decision Making which will enhance their employability; • To apply business analysis to the “firm” under different market conditions; • To apply economic models to examine current economic scenario and evaluate policy options for addressing economic issues • To gain understanding of some Macroeconomic concepts to improve their ability to understand the business climate; • To prepare and analyse various business tools like balance sheet, cost benefit analysis and rate of returns at an elementary level 			
Syllabus Business Economics - basic concepts, tools and analysis, scarcity and choices , resource allocation, marginal analysis, opportunity costs and production possibility curve. Fundamentals of microeconomics - Demand and Supply Analysis, equilibrium, elasticity, production and production function, cost analysis, break-even analysis and markets. Basics of macroeconomics - the circular flow models, national income analysis, inflation, trade cycles, money and credit, and monetary policy. Business decisions - investment analysis, Capital Budgeting decisions, forecasting techniques and elementary Balance Sheet and taxation, business financing, international investments			
Expected outcome . A student who has undergone this course would be able to <ol style="list-style-type: none"> i. make investment decisions based on capital budgeting methods in alignment with microeconomic and macroeconomic theories. ii. able to analyse the profitability of the firm, economy of operation, determination of price under various market situations with good grasp on the effect of trade cycles in business. iii. gain knowledge on Monetary theory, measures by RBI in controlling interest rate and emerging concepts like Bit Coin. iv. gain knowledge of elementary accounting concepts used for preparing balance sheet and interpretation of balance sheet 			
Text Books <ol style="list-style-type: none"> 1. Geetika, Piyali Ghosh and Chodhury, <i>Managerial Economics</i>, Tata McGraw Hill, 2015 2. Gregory Mankiw, <i>Principles of Macroeconomics</i>, Cengage Learning, 2006. 3. M.Kasi Reddy and S.Saraswathi, <i>Economics and Financial Accounting</i>. Prentice Hall of India. New Delhi. 			

References:

1. Dornbusch, Fischer and Startz, *Macroeconomics*, McGraw Hill, 11th edition, 2010.
2. Khan M Y, *Indian Financial System*, Tata McGraw Hill, 7th edition, 2011.
3. Samuelson, *Managerial Economics*, 6th edition, Wiley
4. Snyder C and Nicholson W, *Fundamentals of Microeconomics*, Cengage Learning (India), 2010.
5. Truett, *Managerial Economics: Analysis, Problems, Cases*, 8th Edition, Wiley
6. Welch, *Economics: Theory and Practice* 7th Edition, Wiley
7. Uma Kapila, *Indian Economy Since Independence, 26th Edition: A Comprehensive and Critical Analysis of India's Economy, 1947-2015*
8. C Rangarajan, *Indian Economy, Essays on monetary and finance*, UBS Publishers'Distributors, 1998
9. A.Ramachandra Aryasri, *Managerial Economics and Financial Analysis*, Tata McGraw-Hill, New Delhi.
10. Dominick Salvatore, *Managerial Economics in Global Economy*, Thomas Western College Publishing, Singapore.
11. I.M .Pandey, *Financial Management*, Vikas Publishing House. New Delhi.
12. Dominick Salvatore, *Theory and Problems of Micro Economic Theory*. Tata Mac Graw-Hill, New Delhi.
13. T.N.Hajela.*Money, Banking and Public Finance*. Anne Books. New Delhi.
14. G.S.Gupta. *Macro Economics-Theory and Applications*. Tata Mac Graw- Hill, New Delhi.
15. Yogesh, Maheswari, *Management Economics* , PHI learning, NewDelhi, 2012
16. Timothy Taylor , *Principles of Economics*, 3rdedition, TEXTBOOK MEDIA.
17. Varshney and Maheshwari. *Managerial Economics*. Sultan Chand. New Delhi

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Business Economics and its role in managerial decision making-meaning-scope-relevance-economic problems-scarcity Vs choice (2 Hrs)-Basic concepts in economics-scarcity, choice, resource allocation- Trade-off-opportunity cost-marginal analysis- marginal utility theory, Law of diminishing marginal utility -production possibility curve (2 Hrs)	4	15%
II	Basics of Micro Economics I Demand and Supply analysis-equilibrium-elasticity (demand and supply) (3 Hrs.) -Production concepts-average product-marginal product-law of variable proportions- Production function-Cobb Douglas function-problems (3 Hrs.)	6	15%
FIRST INTERNAL EXAMINATION			
III	Basics of Micro Economics II Concept of costs-marginal, average, fixed, variable costs-cost curves-shut down point-long run and short run (3 Hrs.)- Break Even Analysis-Problem-Markets-Perfect Competition, Monopoly and Monopolistic Competition, Oligopoly-Cartel and collusion (3 Hrs.).	6	15%
IV	Basics of Macro Economics - Circular flow of income-two sector and multi-sector models- National Income Concepts-Measurement methods-problems-Inflation, deflation (4 Hrs.)-Trade cycles-Money-stock and flow concept-Quantity theory of money-Fischer's Equation and Cambridge Equation -velocity of circulation of money-credit control methods-SLR, CRR, Open Market Operations-Repo and Reverse Repo rate-emerging concepts in money-bit coin (4 Hrs.).	8	15%

SECOND INTERNAL EXAMINATION			
V	Business Decisions I -Investment analysis-Capital Budgeting-NPV, IRR, Profitability Index, ARR, Payback Period (5 Hrs.)- Business decisions under certainty-uncertainty-selection of alternatives-risk and sensitivity- cost benefit analysis-resource management (4 Hrs.).	9	20%
VI	Business Decisions II Balance sheet preparation-principles and interpretation-forecasting techniques (7 Hrs.)-business financing-sources of capital- Capital and money markets-international financing-FDI, FPI, FII-Basic Principles of taxation-direct tax, indirect tax-GST (2 hrs.).	9	20%
END SEMESTER EXAM			

Question Paper Pattern

Max. marks: 100, Time: 3 hours

The question paper shall consist of three parts

Part A

4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B

4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C

6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.



Course No.	Course Name	L-T-P - Credits	Year of Introduction
EE234	CIRCUITS AND MEASUREMENTS LAB	0-0-3-1	2016
<p>Course Objectives To develop measurement systems for various electrical circuits and systems and to use different transducers for measurement of physical variables.</p>			
<p>List of Exercises/Experiments : (18 experiments are listed, out of which 12 experiments are mandatory).</p> <ol style="list-style-type: none"> 1. Verification of Superposition Theorem in dc circuits. 2. Verification of Thevenin's Theorem in dc circuits. 3. Determination of impedance, admittance, power factor and real/reactive/ apparent power drawn in RLC series/parallel circuits. 4. 3-phase power measurement using one wattmeter and two-wattmeter method. 5. Determination of B-H curve, μ-H curve and μ-B curve of an iron ring specimen. 6. Measurement of voltmeter and ammeter resistances using Wheatstone's bridge and Kelvin's double bridge and extension of range of voltmeters and ammeters 7. Measurement of self/ mutual inductance and coupling co-efficient of iron cored coil and air-cored coil. 8. Calibration of meters and measurement of unknown resistance using slide- wire potentiometer. 9. Calibration of single phase energy meter by direct and phantom loading at various power factors. 10. Calibration of 3-phase energy meter using standard wattmeter. 11. Calibration of wattmeter using Vernier dial potentiometer 12. Measurement of capacitance using Schering Bridge. 13. Extension of instrument range by using Instrument transformers(CT and PT) 14. Characteristics of Thermistor, RTD, and Thermocouple 15. Characteristics of LVDT. 16. Characteristics of strain gauge/ Load cell. 17. Measurement of energy using electronic Energy meter/TOD meter 18. Current measurement using Clamp on meter 			
<p>Expected Outcome: After the completion of the course student will be able to:</p> <ol style="list-style-type: none"> 1. Analyze RLC circuits and coupled circuit to obtain the voltage -current relations 2. Verify DC network theorems by setting up various networks 3. Calibrate the single phase and three phase energy meter at various power factors 4. Measure power in a single and three phase circuits by various methods 5. Determine magnetic characteristics of iron ring specimen 6. Measure high and low resistances using various bridges 7. Use Electronic energy meter, TOD meter and clamp on meter 			
<p>Text Book:</p> <ol style="list-style-type: none"> 1. Sawhney AK: A course in Electrical and Electronic Measurements & instrumentation, Dhanpat Rai . 2. J B Gupta : A course in Electrical & Electronic Measurement & Instrumentation., S K Kataria & Sons 3. Kalsi H. S., Electronic Instrumentation, 3/e, Tata McGraw Hill, New Delhi, 2012 			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
EE232	Electrical Machines Lab - I	0-0-3-1	2016
Course Objectives			
To learn the working and testing methods of DC machines and transformers.			
List of Exercises/Experiments:			
Part A – DC Machines			
1. Open circuit characteristics of DC shunt generator			
<i>Objectives:</i>			
a) Predetermine the OCC at different speeds			
b) Determine the critical field resistance			
c) Obtain maximum voltage built up with given shunt field resistance			
d) Obtain critical speed for a given shunt field resistance			
2. Load test on DC shunt generator			
<i>Objectives:</i>			
a) Determine the external & internal characteristics			
b) Deduce the armature reaction curve			
3. Load test on DC compound generator			
<i>Objectives:</i>			
a) Determine the external characteristics cumulative compound condition			
b) Determine the external characteristics differential compound condition			
4. Brake test on DC shunt motor			
<i>Objectives:</i>			
Plot the following characteristics			
i) Efficiency Vs Output			
ii) Line current Vs Output			
iii) Speed Vs Output			
iv) Speed Vs Torque			
v) Line current Vs Torque			
5. Brake test on DC series motor			
<i>Objectives:</i>			
Plot the following characteristics			
i) Efficiency Vs Output			
ii) Line current Vs Output			
iii) Speed Vs Output			
iv) Speed Vs Torque			
v) Line current Vs Torque			
6. Swinburne's test on a DC shunt machine			
<i>Objectives:</i>			
Predetermine the armature current and percentage efficiency when the machine operates as a motor and as a generator for various load conditions and plot efficiency Vs output curves.			
7. Hopkinson's test on a pair of DC machines			
<i>Objectives:</i>			
Determination of the efficiency of the given dc shunt machine working as a motor and			

generator
under various load conditions.

8. Retardation test on a DC machine

Objectives:

- a) Separation of hysteresis, eddy current, friction & windage losses
- b) Find the moment of inertia of the rotating system

9. Separation of losses in a DC shunt motor

Objectives:

- a) Separation of hysteresis, eddy current, friction & windage losses
- b) Plot the losses vs speed curves

Part B – Transformers

10. O.C. & S.C. tests on the single phase transformer

Objectives:

Predetermination of the following

- a) Efficiency at different load conditions and different power factors
- b) Regulation at different load conditions and different power factors
- c) Equivalent circuit referred to HV and LV sides
- d) UPF load at which efficiency is maximum
- e) Power factors at which regulation is maximum and zero
- f) Regulation vs. power factor curves

11. Load test on the single phase transformer

Objectives:

- a) Determination of the efficiency at different load conditions and unity power factor
- b) Determination of the regulation at different load conditions and unity power factor
- c) Plot efficiency vs. output & regulation Vs output curves

12. Separation of losses in a single phase transformer

Objectives:

Separate the hysteresis & eddy current losses at different voltages & different frequencies keeping V/f constant & plot losses vs. frequency curves. Hence

- i) Separate the hysteresis & eddy current losses at normal voltage & different frequencies & plot losses vs. frequency curves
- ii) Separate the hysteresis & eddy current losses at normal frequency & different voltages & plot losses vs. voltage curves.

13. Sumpner's test

Objective:

- a) Predetermination of efficiency at different load conditions and power factors
- b) Predetermination of regulation at different load conditions and power factors
- c) Plot efficiency vs. output & regulation vs. power factor curves
- d) Obtain the equivalent circuit referred to LV & HV sides

14. Scott connection of single phase transformers

Objectives:

Determine the efficiency at different load conditions when

- a) Main transformer alone loaded
- b) Teaser transformer alone loaded
- c) both transformers loaded under balanced conditions
- d) both transformers loaded under unbalanced conditions
- e) Plot efficiency vs. output curves for each case.

15. Parallel operation of single phase transformers

Objectives:

- a) To determine the load sharing of each transformer by their equivalent impedances
- b) To verify the load sharing by actual measurements

16. Three phase connection of single phase transformers

Objectives:

- a) Determine the polarity of single phase transformers
- b) Connect three single phase transformers in star-star configuration
- c) Connect three single phase transformers in star-delta configuration
- d) Determine the transformation ratio in the above cases

17. O.C. & S.C. tests on the Three phase transformer

Objectives:

Predetermination of the following

- a) Efficiency at different load conditions and different power factors
- b) Regulation at different load conditions and different power factors
- c) Equivalent circuit referred to HV and LV sides

18. Load Test on V connected Transformers

Objectives:

Connect two single phase transformers in V-V connection and conduct a load test to plot the efficiency curve.

Out of the above experiments, minimum twelve experiments should be done in lab taking at least six experiments from both Part A and Part B.

Expected outcome:

After the successful completion of the course, the students will be able to test and validate DC generators, DC motors and transformers

After the successful completion of this course, the students will be able to

1. Analyse the characteristics of different dc generators
2. Separate the losses in dc motors
3. Analyse the performance of different types of dc motors
4. Determine the performance characteristics of single phase transformers
5. Compare the performance of transformers in different modes of operations and connections

Text Book:

1. Bimbra P. S., *Electrical Machinery*, 7/e, Khanna Publishers, 2011.
2. Theraja B. L., *A Textbook of Electrical Technology*, S. Chand & Company, New Delhi, 2008.