KAVAYITRI BAHINABAI CHAUDHARI
NORTH MAHARASHTRA UNIVERSITY,
JALGAON (M.S.)

Syllabus for

Second Year Electrical Engineering

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
3rd Cycle

Course outline
Semester - III and IV
w. e. f. 2019 – 20

Syllabus Structure for Second Year Engineering (Semester – III) (Electrical) (w. e. f. 2019 – 20)
(As per AICTE Guidelines)

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
Mathematics – III	B	3	1	-	4	40	60	-	-	100	4
Engineering Mechanics	C	3	-	-	3	40	60	-	-	100	3
Electrical Circuit Analysis	C	3	-	-	3	40	60	-	-	100	3
Electrical Machines-I	D	3	-	-	3	40	60	-	-	100	3
Industrial Organization and Management	A	3	-	-	3	40	60	-	-	100	3
Electrical Circuit Analysis Laboratory	C	-	-	2	2	-	-	25	25(PR)	50	1
Electrical Machines-I Laboratory	D	-	-	2	2			25	25(PR)	50	1
Electrical Workshop Laboratory	D	1	-	2	3	-	-	25	25(OR)	50	2
		16	**1**	**6**	**23**	**200**	**300**	**75**	**75**	**650**	**20**

ISE: Internal Sessional Examination, ESE: End Semester Examination, ICA: Internal Continuous Assessment

Syllabus Structure for Second Year Engineering (Semester – IV) (Electrical) (w. e. f. 2019 – 20)
(As per AICTE Guidelines)

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
Biology	B	3	1	-	4	40	60	-	-	100	4
Electrical Engineering Materials	C	3	-	-	3	40	60	-	-	100	3
Analog and Digital Electronics	D	3	-	-	3	40	60	-	-	100	3
Electrical Machines-II	D	3	-	-	3	40	60	-	-	100	3
Entrepreneurship Development	A	3	-	-	3	40	60	-	-	100	3
Electrical Engineering Materials Laboratory	C	-	-	2	2	-	-	-	-	-	1
Analog and Digital Electronics Laboratory	D	-	-	2	2	-	-	25	25(PR)	50	1
Electrical Machines-II Laboratory	D	-	-	2	2	-	-	25	25(PR)	50	1
Measurement and Instrumentation Laboratory	D	1	-	2	3	-	-	25	25(OR)	50	2
Environmental Studies	H	-	-	-	-	-	60	40	-	100	-
Internship – I*	H	-	-	-	-	-	-	-	-	-	-
		16	**1**	**8**	**25**	**200**	**300**	**75**	**75**	**650**	**21**

ISE: Internal Sessional Examination, ESE: End Semester Examination, ICA: Internal Continuous Assessment

* Internship-I is a mandatory and non-credit course. It shall be during summer vacation after Semester – IV. The satisfactory completion of Internship – I should be submitted to University at the end of Semester – VIII.

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Syllabus for

Second Year Electrical Engineering

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
3rd Cycle

COURSE OUTLINE

Semester – III

w. e. f. 2019 – 20

MATHEMATICS-III

COURSE OUTLINE

Course Title:	Mathematics III	Short Title:	M-III	Course Code:	

Course description:

This course is an advanced level Engineering Mathematics which will further strengthen the knowledge of the students who have completed Engineering Mathematics –I and II in their first year. The course coverage explores Basic Probability, Continuous Probability Distributions, Basic Statistics, Applied Statistics, Small samples and Bivariate Distributions. The goal of this course is to understand various functions of probability and statistics and their applications in engineering field.

	Hours/week	No. of weeks	Total hours	Semester credits
Lecture	03	14	42	04
Tutorial	01	14	14	

Prerequisite course (s):

Knowledge of HSC, Engineering Mathematics - I & II subject of first year of engineering.

Course objectives:

1. To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering.
2. To provide an overview of probability and statistics to engineers.

Course outcomes:

1. Upon completion of this course, students will be able to solve field problems in engineering involving PDEs.
2. Estimate Laplace and Fourier transform and z transform.
3. Understanding the methods of statistics.
4. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data.
5. Calculate and understand small samples.

COURSE CONTENT

Mathematics-III		Semester:	III
Teaching Scheme:		Examination scheme	
Lectures:03	3 hours/week	End semester exam (ESE):	60 marks
Tutorial:01	1 hours/week	Duration of ESE:	03 hours
		Internal Sessional Exams (ISE):	40 marks

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Laplace Transform: Properties of Laplace Transform, Inverse Laplace transform, Convolution theorem. Evaluation of integrals by Laplace transform, solving ordinary differential equations by Laplace Transform.

Unit–II:	No. of Lectures: 08 Hours	Marks: 12
Fourier Transform and Z-transform Fourier sine and cosine integrals, Fourier sine transform, Fourier cosine transform, Inverse Fourier transform. Z – Transform**:** Definition, Region of convergence, Properties of Z-Transform, Inverse Z-Transform		
Unit–III	**No. of Lectures: 08 Hours**	**Marks: 12**
Basic Statistics Measures of Central tendency, Moments, skewness and Kurtosis, Binomial, Poisson and Normal distributions, Correlation and regression.		
Unit–IV	**No. of Lectures: 09 Hours**	**Marks: 12**
Applied Statistics Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Small samples : T-distribution for small sample -Test for single mean, difference of means and correlation coefficients, test for ratio of variances, F-test for equality of population variances. Chi-square test for goodness of fit and independence of attributes.		
Text Books:-		
1. H. K. Dass “Advanced Engineering Mathematics” S. Chand publications, 1988. 2. S. C. Gupta “Fundamentals of Statistics”, Himalaya Publishing House.		
Reference Books		
1. E. Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 10th edition, 2010. 2. P. G. Hoel, S. C. Port and C. J. Stone, “Introduction to Probability Theory”, Universal Book Stall, 2003. 3. S. Ross, “A First Course in Probability”, Pearson Education India, 2002. 4. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 3rd edition, 2011. 5. T. Veerarajan, “Engineering Mathematics”, Tata McGraw-Hill, New Delhi, 2010. 6. Chandrika Prasad & Reena Garg, “Advanced Engineering Mathematics”, Khanna Book Publishing 1st edition, 2018. 7. Ramana B.V., “Higher Engineering Mathematics”, Tata McGraw Hill, 6th edition, 2008. 8. Sashtry, “Advanced Engineering Mathematics”, PHI, 2009. 9. S. Chakraborty & B.K. Sarkar, “Discrete Mathematics and Its Applications”, Oxford University Press, 2011.		

Engineering Mechanics

COURSE OUTLINE

Course Title:	**Engineering Mechanics**	**Short Title:**	**EM**	**Course Code:**	

Course description:

Engineers use forces and materials for the benefit of mankind. It requires having knowledge of response of a material under forces. This course is aimed to describe the response of common engineering materials under forces. The direct application comes in case of machine components used in electric machines. The curriculum includes statics as well dynamics of rigid bodies. Statics includes various types of forces, their resolution, resultant forces for a given system, inertia of rigid bodies, strain, etc, Basics of Dynamics are just introduced.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	**14**	**42**	**03**

Prerequisite course(s):

Physics

Course objectives:

Students would be introduced to fundamentals of Engineering Mechanics with emphasis on force systems, axioms, and dynamics of rigid bodies.

Second part of the course would be an introduction to Solid Mechanics, and students would be introduced to basic concepts of mechanics of deformable media: concept of stress tensor, strain tensor, strain rates, constitutive relations, and applications to one/two dimensional problems

Course outcomes:

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

1. Understand the use of basic concepts of Resolution and composition of forces.
2. Analyze beams, truss or any engineering component by applying conditions of equilibrium.
3. List advantages and disadvantages of various geometric sections used in engineering design.
4. Understand the different stresses and strains occurring in components of structure.
5. Calculate the deformations such as axial, normal deflections under different loading conditions.

COURSE CONTENT

Engineering Mechanics		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**

	Internal Sessional Exams (ISE):	**40 marks**
Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**
A) Resultant of coplanar forces: Introduction, basic concepts, principle of mechanics, force systems, composition and resolution of forces, resultant of concurrent force system in plane, moment of forces, couples, Varignon's theorem, equivalent force couple systems, resultant of non-concurrent force system in plane. B) Equilibrium of coplanar force system: Introduction, body constraints, types of supports and loads, free body diagram, conditions of equilibrium, equilibrium of forces in a plane, Lami's theorem, reactions of determinate beams, (simple beams).		
Unit–II:	**No. of Lectures: 08 Hours**	**Marks: 12**
Plane Truss: Types of plane trusses (Perfect and Imperfect) Analysis of plane trusses by method of joints and method of sections. **Friction:** Introduction, laws of friction, application of friction on horizontal and inclined plane, ladder friction		
Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**
A) Kinematics of rectilinear motion of particle: - Introduction, basic concepts, types of rectilinear motions, motion under gravity. **B) Simple Stresses and Strains**- Concept of stress and strain, Types of stresses and strains, Hooke's law,– stress – strain diagram for mild steel – Working stress –Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses.		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
A) Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, **B)Flexural Stresses-Theory of simple bending** – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I section,T section, Angle and Channel sections – Design of simple beam sections.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
A) Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs **B)Shear Stresses- Derivation of formula** – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections		
Text Boobs:		

1. B. C. Punmia, "Strength of materials and mechanics of structures", Laxmi Publications
2. Ramamrutham, "Strength of Materials",dhanpat Rai Publication, 2011.
3. D.S. Bedi, "Engineering Mechanics", Khanna Book Publishing Co. (P) Ltd.
4. R.S. Khurmi, "Engineering Mechanics", S.Chand Publishing, 19th edition, 2005.
5. R.K. Bansal, "A Textbook of Engineering Mechanics", Laxmi Publications,2005.

Reference Boobs

1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA, 5th edition, 1968.
2. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.
3. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 6th edition, 2004
4. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 2nd edition, 1978.
5. William Kendrick Hall, "Laboratory Manual of Testing Materials"
6. Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf, "Mechanics of Materials", TMH, 3rd edition, 2004.
7. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi., E. P. Popov - Mechanics of Solids
8. R. T. Shah, "Strength of Materials", Acharya Book Depot, 1962.
9. D. P. Sharma, Engineering Mechanics, Pearson, 2010.

Electrical Circuit Analysis

COURSE OUTLINE

Course Title:	**Electrical Circuit Analysis**	**Short Title:**	**ECA**	**Course Code:**	

Course description:

Introducing the topic and illustrating its importance for electrical engineering field. The concept of magnetic coupling– Analysis of magnetic coupled circuits– Linear transformers– Ideal transformers– Two-port networks and it's different equation forms– Evaluation of its parameter– Analysis of terminated two-port circuits– Interconnected two-port networks– Revision and a set of solved examples. Understanding of different types of network theorems. Getting familiar with steady state and transient responses for different types of circuits. Laplace transform and relation between current and voltage for resistance, capacitance and inductance– Laplace transform and electric circuit sources. Understanding the concepts of two port network.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	14	42	03

Prerequisite course(s):

Physics, Basic Electrical and Electronics Engineering and Engineering Mathematics - I & II

Course objectives:

1. To make the students capable of analyzing any given electrical network.
2. To make the students learn how to synthesize an electrical network from a given impedance/admittance function.
3. To relate various two port parameters and transform them.

Course outcomes:

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

1. Study of magnetic coupling and resonance.
2. Apply network theorems for the analysis of electrical circuits.
3. Obtain the transient and steady-state response of electrical circuits.
4. Analyze circuits using Laplace transform.
5. Analyze two port circuit behaviors.

COURSE CONTENT

Electrical Circuit Analysis		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Magnetic Coupling and Resonance

Coupled Circuits: Self inductance and Mutual inductance, Coefficient of coupling, dot convention, Ideal Transformer, Analysis of multi winding coupled circuits, Analysis of single tuned and double tuned coupled circuits. Resonant Circuits: Series and parallel resonance, frequency- response of series and Parallel circuits, Q–Factor, Bandwidth.

Unit–II:	No. of Lectures: 08 Hours	Marks: 12

Network Theorems

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis, Super Mesh and Node analysis, Millmans Theorem.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Solution of First and Second order networks

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

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Electrical Circuit Analysis Using Laplace Transforms

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Fourier Series and Fourier Transform of Standard Signals.

Unit–V:	No. of Lectures: 09 Hours	Marks: 12

Two Port Network and Network Functions

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

Text Books:

1. D. Roy Choudhury, "Networks and Systems", New Age International Publications.
2. A. Charaborthy, "Circuit Theory (Analysis and Synthesis)", Dhanpat Rai and Co.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers.

Reference Books:

1. Franklin F. Kuo, "Network Analysis and Synthesis", Wiley India, 2nd Edition, 2008.
2. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 3rd edition, 2006.
3. Asfaq Hussain, "Networks and Systems", Khanna Publishing House, Delhi, 2nd edition

2015.
4. R.K. Mehta & A.K. Mal, "Problems and Solutions of Electrical Circuit Analysis", CBS Publishers

Electrical Machines-I

COURSE OUTLINE

Course Title:	**Electrical Machines-I**	**Short Title:**	**EMC-I**	**Course Code:**	

Course description:

This course provides knowledge about DC machines and transformers to familiarize students with construction, their working, operation, performance and applications of Dc machines and Transformer.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	14	42	03

Prerequisite course(s):

Physics, Basic Electrical and Electronics Engineering and Engineering Mathematics - I & II

Course objectives:

The course aimed at acquiring an understanding on basic principles, operation, performance and control of dc machine and transformer. The subject is helpful in the studies of technological aspects such as utilization of electrical energy, switch gear & protection, manufacturing processes & testing & maintenance of electrical machines. The subject provides scope for higher study and able to use updated software.

Course outcomes:

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

1. Apply the basic knowledge of science, mathematics and engineering for understanding the concept of magnetic circuit, electrical machines and transformer.
2. Understand and explain the construction of DC machines and translate knowledge into new context.
3. Analyze the data to determine the characteristic and solve engineering problems.
4. Apply the knowledge of magnetic circuit for construction of transformer, analyse the data for determination of parameter and performance.
5. Apply the knowledge of transformer in different application in power system and industry.

COURSE CONTENT

Electrical Machines-I		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Fundamentals of Rotating Machines

Review of magnetic circuits - MMF, flux, reluctance, inductance calculation of Ampere Turn for series magnetic circuit B-H curve, energy stored in the magnetic circuit, rotating magnetic field;

review of Ampere Law and Biot Savart Law

Principal of energy conversion, physical concept of torque production, constructional feature of DC machines, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, emf generation in armature, use of lap and wave winding, action of commutator.

Unit–II:	No. of Lectures: 08 Hours	Marks: 12

DC Generator

Type of DC Generator, emf equation of DC generator ,voltage built up in DC shunt generator, critical filed resistance, losses and efficiency of DC generator, armature reaction ,characteristic of DC generator, demagnetizing and cross magnetizing AT, compensating winding, commutation process and methods to improve commutation, parallel operation of DC generator.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

DC Motor

Type of DC motors, concept of back emf, general armature torque equation, power stages, losses and efficiency, characteristic of DC motors, speed control of DC motors, testing of DC motors by direct load test, Swinburn's test, back to back and field test.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Transformers –Single Phase

Principle, construction and operation of single-phase transformers, Phasor diagram and referred values, equivalent circuit, voltage regulation, losses and efficiency, maximum efficiency, testing of transformer - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses. single-phase Autotransformers – construction and working.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Transformers –Three Phase

Three-phase transformer – construction, three phase unit transformer and bank of single phase transformer, vector groups, Open Delta connection, Scott connection , parallel operation and load sharing, All day efficiency of distribution transformer, inrush magnetizing current and harmonic phenomena in three phase transformer.

Text Books:

1. Ashfaq Husain, "Electrical Machines", Dhanpat Rai & Co., 3rd Edition, 2016
2. B. L. Theraja, "Electrical Technology", Vol –I and II, S. Chand Publication., Multicolor Edition, 2012

Reference Books:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 7th Edition, 2013.
2. E. Clayton, N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 3rd edition, 2004.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 7th Edition, 2011.
4. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 5th Edition, 2017.

5. P. C. Sen. “D.C. Machines”, Tata McGraw Hill.
6. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
7. G. C. Garg, “Electrical Machines-I”, Khanna Book Publishing, Delhi, 1st edition.
8. Mehta & Mehta, “Electrical Machines”, S. Chand Publications

Industrial Organization & Management					
COURSE OUTLINE					
Course Title:	**Industrial Organization & Management**	**Short Title:**	**IOM**	**Course Code:**	

Course description:

The course explores concepts of management and functioning of organizations. It introduces both theoretical concepts and empirical applications, focusing particularly on production industries. Management studies have influenced every aspect of business thinking and planning. Apart from this, it also influenced our day-today lives in the form of technological advancements. The syllabus explores the knowledge of principle of management, financial management, human resource management, operational management and marketing management.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	14	42	03

Prerequisite course(s):

Knowledge of Social Science

Course objectives:

This subject is designed to expose the students to fundamental concepts of management, its processes and behavioral dynamics in organizations. It will also look at recent developments in business in the context of economic theory. It also aims at making students understand concepts, philosophies, and processes of managing the marketing & financial operations of a firm.

Course outcomes:

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

1. Interpret various concepts of Management.
2. Understand terms related to Economics of Industrial Management
3. Illustrate different plant layouts and terms related to Operational Management
4. Describe concepts of Human Resource Management and laws related to industries.
5. Understand basic concepts of Marketing and Financial Management.

COURSE CONTENT

Industrial Organization & Management		Semester:	III
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Principles of Management

Basic Concepts: Definition, Nature, Importance, Management: Art and Science & as a

Profession, Management Vs Administration, Evolution of Management: Introduction to Scientific Management by Taylor, Administrative, Management by Fayol, Contribution of Peter Drucker, Levels & Functions of Management, Forms of Business Organization.
Approaches to Management: Decision Theory Approach, Contingency Approach, Systems Approach.
Organization: Formal & Informal, Line & Staff relationship, Centralization vs. Decentralization, Span of Management, Departmentation, MBO.

Unit–II:	No. of Lectures: 08 Hours	Marks: 12

Managerial Economics
Introduction: Meaning & Scope of Economics, Basic Theories, Law of Demand & Supply, Elasticity of Demand & Supply.
Consumer Theories: Meaning of Utility & Law of Diminishing Utility.Cost Concepts: Opportunity Costs, Sunk Costs, Marginal Cost, Total & Variable Costs, Fixed Costs, Contribution, Law of Diminishing Return.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Operational Management
Plant location and layout: Factor affecting plant location, different type of plant layout, CPM PERT, quality control manufacturing system, store and inventory control
Work study – techniques of work study method study, work measurement, different charts and diagrams used in method study.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Human Resource Management
Human resource planning, Recruitment, Selection, Placement & Induction, Performance Appraisal & Development, Employee Training, Internal & External Mobility & Retention Management, Wage & Salary Administration, Fringe Benefits & Incentives Payments, Collective Bargaining, Performance appraisal , compensation
Industrial Laws: The factories Act 1947, The Workmen's Compensation Act 1923, Maternity Benefit Act The Payment of Wages Act 1936, The Apprentices Act 1961, industrial safety, prevention of accidents pollution control act

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Marketing Management & Financial Management
Introduction to Marketing: Concept of Market, Types of Market, Definition, Nature & Scope of Marketing, Marketing Approaches, Marketing Process, Functions of Marketing Management, 7 P's of Marketing. Advertising media of advertising market forecasting.
New trends in Marketing: Green Marketing, e- marketing & Viral Marketing.
Introduction to Financial Management: Meaning, Nature & Scope of Financial Management,

Capital Structure, Types & Sources of Finance, Money Market & Capital Market, Role of Financial Institutions in Industry.

Text Books:

1. P. Khanna, "Industrial Engineering Managements"
2. S. S. Khanka "Human resource Management (Text & Cases)" S. Chand publication, 2003.

Reference Books:

1. L. M. Prasad, "Principles of Management", Himalaya Publications House, 1st edition, 2014.
2. D. N. Dwivedi, "Managerial Economics", Vikas Publications, 8th edition, 2015.
3. P. Subba Rao "Essentials of HRM & IR" (Text, Cases & Games), Himalaya Publishing House, 5th edition.
4. R. S. N. Pillai, V. Bagavathi, "Legal Aspects of Business" (Mercantile Laws including Industrial & Company Laws), 2011.
5. Philip Kotler, "Marketing Management", Tata McGraw Hill, 12th edition.
6. Ravi M. Kishor, "Financial Management", Taxmann Publication, 2nd edition, 2011.

Electrical Circuit Analysis Laboratory					
LAB COURSE OUTLINE					
Course Title:	**Electrical Circuit Analysis Laboratory**	**Short Title:**	**ECA Lab.**	**Course Code:**	
Course description:					
Introducing the topic and illustrating its importance for electrical engineering field. The concept of magnetic coupling – Analysis of magnetic coupled circuits – Linear transformers – Ideal transformers – Two-port networks and it's different equation forms – Evaluation of its parameter – Analysis of terminated two-port circuits– Interconnected two-port networks– Revision and a set of solved examples. Understanding of different types of network theorems. Getting familiar with steady state and transient responses for different types of circuits. Laplace transform and relation between current and voltage for resistance, capacitance and inductance – Laplace transform and electric circuit sources. Understanding the concepts of two port network.					

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	02	14	28	01

End Semester Exam (ESE) Pattern:	**Practical (PR)**

Prerequisite course(s):

Physics, Basic Electrical and Electronics Engineering and Engineering Mathematics - I & II

Course objectives:

Students should be able to do hands on and get familiar with the practical aspects of various network theorems, various parameters such as Z- Parameters, Y- parameters, ABCD Parameters and H- Parameters, Filters.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Apply network theorems for the analysis of electrical circuits.
2. Obtain the transient and steady-state response of electrical circuits.
3. Analyze two port circuit behaviors.
4. Analyze filter circuits.
5. Analyze the frequency response of parallel circuit.

LAB COURSE CONTENT

Electrical Circuit Analysis Laboratory		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	**25 marks**
		Internal Continuous Assessment (ICA):	**25 marks**

Teacher should facilitate learning following lab experiments:

1. Verifications of Thevenin's Theorem.
2. Verification of Maximum Power Transfer Theorem.
3. Verification of Superposition Theorem.
4. Verification of Nortons Theorem
5. Pole and Zero plot of one port network.
6. Measurement of hybrid parameter of two port network.
7. Measurement of ABCD parameter of two port network.
8. Measurement of Y parameter of two port network.
9. Measurement of Z parameter of two port network.
10. Frequency response, quality factor and bandwidth of Series Resonance Circuit
11. Frequency response of Parallel Resonance Circuit.

Note: Lab file should consist of minimum **Eight** experiments.

Text Books:

1. D. Roy Choudhury, "Networks and Systems", New Age International Publications.
2. A. Charaborthy, "Circuit Theory (Analysis and Synthesis)", Dhanpat Rai and Co.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers.

Reference Books:

1. Franklin F. Kuo, "Network Analysis and Synthesis", Wiley India, 2nd Edition, 2008.
2. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 3rd edition, 2006.
3. Asfaq Hussain, "Networks and Systems", Khanna Publishing House, Delhi, 2nd edition 2015.
4. R.K. Mehta & A.K. Mal, "Problems and Solutions of Electrical Circuit Analysis", CBS Publishers

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guidelines for ESE:

In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work, performance and oral in the practical examination.

Electrical Machines-I Laboratory					
LAB COURSE OUTLINE					
Course Title:	**Electrical Machines-I Laboratory**	**Short Title:**	**EMC-I Lab**	**Course Code:**	

Course description:

In this laboratory, course emphasis on imparting the practical knowledge and understanding of basic principles, characteristic , performance and testing of DC Machines, Speed control DC Motor and use of other measuring equipment their class of accuracy. It also gives the platform to understand construction, working, performance, testing and selection of transformer.

Laboratory	Hours/week	No. of weeks	Total hours	Semester credits
	02	14	28	01

End Semester Exam (ESE) Pattern:	Practical (PR)

Prerequisite course(s):

Physics, Basic Electrical and Electronics Engineering and Engineering Mathematics - I & II

Course objectives:

The objective of the laboratory is to impart the fundamental knowledge of Machines and transformers. Students will able to develop their ability to apply the specific procedures for analyze the experimental results. The students will able to understand the characteristic of DC machines and application in process and manufacturing. Application of transformer in power system. In this lab course, students will be familiar with the use of different equipments, safety precautions on work place. This makes bridge on theoretical knowledge and practical practices.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Apply the basic knowledge of measuring instruments to conduct experiments on machine with safety precautions.
2. Understand the characteristic of DC machines as generator and its applications.
3. Analyze the data for determination of parameter by conducting different test on DC machines.
4. Explain the different methods of testing on transformer in manufacturing , utility and service industry.
5. Demonstrate the application of transformer in power system, utility and different industry.

LAB COURSE CONTENT

Electrical Machines-I Laboratory		Semester:	III
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	**25 marks**
		Internal Continuous Assessment (ICA):	**25 marks**

Teacher should facilitate learning following lab experiments:

1. Determination of magnetization, external , internal characteristics and critical field resistance of d. c. shunt generator

2. Determination of external characteristics of d.c. compound generator as i) differential compound, ii) cumulative compound generator.
3. Speed control of D.C shunt motor by armature and field control.
4. i) Starting of DC motors using 3 and 4 point starters. ii) Reversal of motor rotation of D. C. motor.
5. Determination of performance characteristic of DC series motor by direct load.
6. Swinburne's tests on DC shunt Motor: Determination of losses & efficiency.
7. Polarity and Ratio test on single phase transformer/three phase transformer.
8. Determination of performance of single phase transformer by direct load test.
9. Determination of performance of single phase transformer by conducting Open circuit and short circuit test.
10. Parallel operation of two single phase transformer.
11. Study of phasor and vector group of three phase transformer.
12. Scott connection of two single phase transformer on no load and at balanced load.

Note: Lab file should consist of minimum **Eight** experiments.

Text Books:

1. Ashfaq Husain, "Electrical Machines", Dhanpat Rai & Co., 3rd Edition, 2016.
2. B. L. Theraja, "Electrical Technology", Vol –I and II, S. Chand Publication., Multicolor Edition, 2012

Reference Books:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 7th Edition, 2013.
2. E. Clayton, N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 3rd edition, 2004.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 7th Edition, 2011.
4. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 5th Edition, 2017.
5. P. C. Sen. "D.C. Machines", Tata McGraw Hill.
6. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
7. G. C. Garg, "Electrical Machines-I", Khanna Book Publishing, Delhi, 1st edition.
8. Mehta & Mehta, "Electrical Machines", S. Chand Publications

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guidelines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work and performance in the practical.

Electrical Workshop Laboratory

LAB COURSE OUTLINE

Course Title:	**Electrical Workshop Laboratory**	**Short Title:**	**EW lab**	**Course Code:**	

Course description:

This course provides the basic practical knowledge about the electrical electronics engineering. The course includes the study of different electrical symbols, electrical shocks and safety precautions, equipments used for the measurement and testing of electrical and electronics devices, different types of electronic circuits, The course may includes visit to the electrical industries or power plant for the enhancement of practical knowledge.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Lecture	**01**	**14**	**14**	**02**
Laboratory	**02**	**14**	**28**	

End Semester Exam (ESE) Pattern:	**Oral (OR)**

Prerequisite course(s):

Knowledge of H.S.C. and Introduction to Electrical Engineering and Introduction to Electronics Engineering.

Course objectives:

The objective of the course is to provide knowledge about practical practices used in electrical engineering. This course will help students to use various tools for measurement and testing of electrical apparatus. The subject provides scope for practical applications of electrical engineering. The course will also help students to use and implement efficient and techno commercial aspect of maintenance and installation.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Understand various electrical symbols and their use in electrical electronics drawing.
2. Understand various cables and its selection in industrial and domestic premises.
3. Understand various various wires for different applications.
4. Apply proper rating or lightning arrester, transformer in power system.
5. Understanding of starter, contractor, relay and timer circuit, electronic ballast and fan regulator.

LAB COURSE CONTENT

Electrical Workshop Laboratory		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**1 hour/week**	**End semester exam (ESE):**	**25 marks**
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA):**	**25 marks**

Theory:

Unit–I: Different types of electrical and electronics materials, Definition, properties and difference of conductor, insulator and semiconductor , Resistors, Capacitors and Inductors, DC/AC voltmeter and ammeter, Analog and digital multi-meter for the measurement of electrical quantities, CRO, Function Generator, Megger, Clip-on meter, Power factor meter, Lux meter.

Unit–II: Cables: Classification of cable, Cables, Connectors and Switches, Cable standards and specifications, Insulating materials for cables, Cable joining, Coaxial cable, twisted pair cable, Flat ribbon cable Different wires, Size selection of wires, Standard wires TRC and CTS wires, Weather proof wires, Flexible wires.

Unit–III: wiring accessories: Types of switches, Types of lamp holders, ceiling rose, mounting blocks, socket outlets plugs, wooden boards, Main switches, Junction boxes, Distribution boxes, fuse boards Domestic wiring and Lamp circuits: Simple circuit, series and parallel circuit, Fluorescent lamp circuits, domestic switch board wiring. Details and Layout of DC and AC Armature Windings.

Unit–IV: Substation equipment: Classification and use of Lightening arrester, Different type of isolators. Substation earthing, Transformer: Standard rating, vector group of power transformer, Standard rating of instrument transformer, Class of accuracy for instrument transformer.

Unit–IV: Starters: Three phase induction motor starter, Study of three phase induction motor reverse forward starter, Contactor, relay and timer circuit, Electronic ballast and fan regulator, Applications of electrical and electronic circuits for domestic and commercial purpose.

Teacher should facilitate learning following lab experiments:

1. Study and use of
   a. DC/AC voltmeter and ammeter.
   b. Analog and digital multi-meter for the measurement of electrical quantities.
   c. Function Generator, CRO, DSO.
   d. Megger, Clip-on meter.
   e. Power factor meter.
   f. Lux meter
2. Identify and find the value using colour code chart and test different types of resistors.
3. Study of different Cables
   a. Classification of cable, types of three phase cable
   b. Cable standards and specifications
   c. Insulating materials for cables, cable joining
   d. Coaxial cable, twisted pair cable, flat ribbon cable.
4. Study of different wires
   a. Size selection of wires
   b. Standard wires TRC and CTS wires
   c. Weather proof wires, flexible wires.

5. Study of wiring accessories
   a. Types of switches
   b. Types of lamp holders, ceiling rose, mounting blocks, socket outlets plugs, wooden board.
   c. Main switches (ICDP/ICTP/MCB), Junction boxes, Distribution boxes, fuse boards.
6. Study of domestic wiring and Lamp circuits
   a. Simple circuit, series and parallel circuit,
   b. Fluorescent lamp circuits, domestic switch board wiring.
7. Study and layout of AC and DC armature windings
8. Study of substation equipment
   a. Classification and use of Lightening arrester
   b. Different type of isolators.
   c. Substation earthing
9. Study of transformers
   a. Standard rating, vector group of power transformer.
   b. Standard rating of instrument transformer
   c. Class of accuracy for instrument transformer.
10. Study of Starters:
    a. Three phase induction motor starter.
    b. Study of three phase induction motor reverse forward starter.
11. Study of different contactor, relay and timer with switching demonstration.
12. Study of electronic ballast and fan regulator
13. Fabrication of any small electrical/electronic circuit for domestic and commercial application.

Note: Lab file should consist of minimum **Eight** experiments.

Text Books:

1. S. L. Uppal, G. C. Garg, "Electrical Wiring, Estimating and Costing" Khanna Publishers 6th Edition, 2012

Reference Books:

1. B. D. Arora , "Electrical wiring, Estimation and Costing" New Heights, New Delhi, 1984
2. P. P. Gupta, "Maintenance of Electrical Equipments" Dhanpatrai and Sons, 1984.
3. A. K. Sawhney. "Electrical & Electronic Measurement and Instrumentation" Dhanpant Rai & Co 18th edition, 2007.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guidelines for ESE:
In ESE the student may be asked questions on practical. Evaluation will be based on answers given by student in oral examination.

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Syllabus for

Second Year Electrical Engineering

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
3rd Cycle

COURSE OUTLINE

Semester – IV

w. e. f. 2019 – 20

Biology					
COURSE OUTLINE					
Course Title:	**Biology**	**Short Title:**	**Bio**	**Course Code:**	

Course description:

This course is introduced for learning the basic fundamentals of Life sciences (zoology & Botany) to undergraduate students. The prospectus includes a prior knowledge of Biotechnology. The goals of the course are to understand the basic principles of Biology and its applications in the field of Engineering.

	Hours/week	No. of weeks	Total hours	Semester credits
Lecture	**03**	**14**	**42**	**04**
Tutorial	**01**	**14**	**14**	

Prerequisite course(s):

Course objectives:

1. Students will understand the structures and characteristics or functions of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
2. Students will learn the basic principles of inheritance at the molecular, cellular and Organism levels.
3. Students will test and deepen their mastery of genetics by applying this knowledge in a variety of problem-solving situations.

Course outcomes:

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

1. Use current techniques and analysis methods in molecular biology and genetics.
2. Understand the current concepts in Cell Biology, Stem Cell Biology and Development.
3. Know the structure/function of the basic components of prokaryotic and eukaryotic cells including macromolecules and organelles.
4. Demonstrate proficiency with at least one instrument commonly used in biological research (microscope, etc).
5. Understand episodic tasks relevant to cell.

COURSE CONTENT

Name of the Subject: Biology		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I	**No. of Lectures: 08 Hours**	**Marks: 12**

Diversity of Organism and Cell Biology

Introduction: Living systems, Bio-mimicry, Metabolism, Taxonomy, Concept of species, Structural organization of life, Concepts of modern cell, history of cell, Cell theory, Structure of cell:- Cell shape, size and cell number, Types of cells:- Prokaryotic cells and Eukaryotic cells, Chemistry of cells.

Cell Division: Cell cycle, mitosis, meiosis, mitotic cell division, cell cycle check points, meiotic cell division, embryonic cell division, cell death.

Unit–II	No. of Lectures: 09 Hours	Marks: 12

Plant and Animal Kingdom

Plant Kingdom:

Introduction to plants, Salient features of major plant groups: Bryophyta, Pteridophyta, Gymnospermae, Angiospermae,

Plant Growth & Development: Introduction, Seed Dormancy, Seed Germination, Phases of growth, Plant growth hormones.

Animal Kingdom:

Animal Classification, Salient features of non-chordates upto phylum level: Phylum porifera, phylum cindaria, phylum ctenophore, phylum platyhelminthes.

Unit–III	No. of Lectures: 09 Hours	Marks: 12

Plant Cell and Animal cell culture and Applications

Plant Cell Culture:

Brief introduction to cell culture with respect to the properties of plant cells, Media requirements, Typical media used, Classification of tissue culture, callus culture, cell suspension culture, Application of callus culture and cell suspension culture, Plant cell cultivation Bioreactors

Animal Cell Culture:

Brief introduction to animal cell culture, Culture medium: Natural and Artificial media, introduction to balanced salt solutions and simple growth medium, Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium, Animal Bioreactors.

Unit–IV	No. of Lectures: 08 Hours	Marks: 12

Microbial Culture and Applications:

Introduction, Microbial Culture Techniques, growth curve, Pure culture techniques – microbial culture media, isolation, identification and maintenance of cultures, incidences of microorganisms in soil, water, air, food and sewage, food spoilage organisms, Applications of Microbial Culture Technology.

Unit–V	No. of Lectures: 08 Hours	Marks: 12

Biotechnology and its Applications:

Definitions, scope of Biotechnology, Recombinant DNA Technology: Making Recombinant DNA, Tools in Genetic Engineering, Polymerase Chain reaction (PCR).

Applications of Biotechnology:

Bioinformatics, Biomechanics, Biotechnology of waste treatment, Biosensors, Forensic science, Food Biotechnology, Fermentation Technology.

Text Books:

1. B.D. Singh "Genetics" Kalyani Publications Third Edition.
2. C.B. Pawar "Cell Biology" Himalaya Publications, Third Edition.
3. C.B. Pawar "Cell and Molecular Biology" Himalaya Publications.
4. Text book of Zoology by V.K. Agrawal, S. Chand Publication, 2006.
5. Text book of Botany by Dr. B.P. Pandey S. Chand Publication.
6. Text book of Biotechnology by R.C. Dubey, S. Chand Publications.

Reference Books:

1. P. K. Gupta, Introduction to Biotechnology, Rastogi Publications.
2. B. D. Singh, Biotechnology: Expanding Horizons, Kalyani Publishers, New Delhi, Second Revised Edition, 2008.
3. S. S. Purohit, Biotechnology: Fundamentals and Applications, Agrobios (India), 2005, 4th Edition.

Electrical Engineering Materials					
COURSE OUTLINE					
Course Title:	**Electrical Engineering Materials**	**Short Title:**	**EEM**	**Course Code:**	
Course description:					
The objective of this course is to introduce the students to the fundamental knowledge of various materials used in electrical engineering. The course provides the essential knowledge for the selection of different conducting and insulating materials. This course includes the classification and application of electrical engineering materials. Applications of modern electrical engineering materials for nanotechnology and solar photovoltaic systems.					
Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**	
	03	**14**	**42**	**03**	
Prerequisite course(s):					
Physics, Chemistry, Basic Electrical & Electronics Engineering.					
Course objectives:					
The objective of the course is to provide the knowledge of different electrical engineering materials and their applications in designing electrical equipments. The course also provides the study of thermal properties for the efficient design and long life cycle of electrical equipments					
Course outcomes:					
After successful completion of this course the student will be able to: 1. Classify different electrical engineering materials and testing of various electrical engineering materials. 2. Understand the electrical and thermal characteristics of conducting, semiconducting, insulating and magnetic materials for the manufacturing of electrical machines and electronic components. 3. Understand dielectric properties of insulating materials in static and alternating fields. 4. Understand and plot the B-H curve of different magnetic materials, their suitability in manufacturing of energy efficient electrical machines. 5. Recognize the materials used for solar photovoltaic systems and nanotechnology.					
COURSE CONTENT					
Electrical Engineering Materials			**Semester:**	**IV**	
Teaching Scheme:			**Examination scheme**		
Lectures:	**3 hours/week**		**End semester exam (ESE):**		**60 marks**
			Duration of ESE:		**03 hours**
			Internal Sessional Exams (ISE):		**40 marks**
Unit–I:		**No. of Lectures: 09 Hours**		**Marks: 12**	
Conductors					

Classification: High conductivity, high resistivity materials, Fundamental requirements of high conductivity materials and high resistivity materials, Mobility of electron in metals, Factors affecting conductivity and resistivity of electrical material.

Thermoelectric Effect: See back effect, Peltier effect, Thomson effect.

Commonly used high conducting materials, properties, characteristics and applications of copper, aluminum, bronze, brass, High resistive materials, Constantan, platinum, nichrome, properties, characteristics, Materials used for AC and DC machines.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Semi-Conductors and Superconductors

General concepts, energy bands, Types of semiconductors: intrinsic Semi-conductors, extrinsic Semi-conductors. Compound semiconductor, amorphous semiconductor. Hall effect, drift, mobility, diffusion in Semiconductors.

Superconductors: Superconductivity, Properties of Superconductors, Critical field, Meissner effect, Type-I and type-II Superconductors.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Dielectrics and Insulators

Properties of gaseous, liquid and solid dielectric, dielectric as a field medium, Electric conduction in gaseous, liquid and solid dielectric, Breakdown in dielectric materials, mechanical and electrical properties of dielectric materials, Effect of temperature on dielectric materials, polarization, loss angle and dielectric loss.

Petroleum based insulating oils, transformer oil, capacitor oils, and properties. Classification of insulation (Solid) and application in AC and DC machines. Solid electrical insulating materials, fibrous, impregnated paper, plastics, filling and bounding materials, fibrous, film, mica, XLPE, mica based materials, ceramic materials.

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Magnetic Materials

Basic terms, Classification of magnetic material, diamagnetic, paramagnetic, ferromagnetic, anti-ferromagnetic and amorphous material. Hysteresis loop, magnetic susceptibility, coercive force, curie temperature. Magneto-striction, factors affecting permeability and hysteresis loss.

Common magnetic materials, Soft and hard magnetic materials. Electric steel, sheet steel, cold rolled grain oriented silicon steel, hot rolled grain oriented silicon steel, hot rolled silicon steel sheet

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Modern Engineering Materials

Materials for Electronic Components - Resistors, Capacitors, Inductors, Relays, Bipolar transistors, Field effect transistor (FET), Integrated circuits, Power devices

Nanotechnology – Introduction, Nano-devices, applications

Solar/Photovoltaic Cell- Introduction, Photo generation of charge carriers, p-n junction, Light absorbing materials: Silicon thin films, concentrating photovoltaic.

Text Books:

1. S. P. Seth and P. V. Gupta, "A course in Electrical Engineering Materials", Dhanpat Rai Publication, 3rd edition.
2. A. J. Dekker, "Electrical Engineering Materials", PHI Pvt. Ltd.
3. C. S. Indulkar and S. Thiruvengadam, "Electrical Engineering Materials", S Chand Publication, 1st edition.

Reference Books:

1. R. K. Rajput, "Electrical Engineering Materials", Laxmi Publication, 2nd edition.
2. S. P. Chaitra and B. K. Bhatt, "Electrical Engineering Materials", Khanna Publication
3. N. Algappan and N. T. Kumar, " Electrical Engineering Materials" , T.T.T.I. Madras, TMH, 34th edition.

Analog and Digital Electronics					
COURSE OUTLINE					
Course Title:	**Analog and Digital Electronics**	**Short Title:**	**ADE**	**Course Code:**	
Course description:					
This course provides an introduction to solid state devices, power semiconductor devices, linear integrated circuits and voltage regulator ICs which includes over view of semiconductor devices, integrated circuits, their characteristics and applications, digital electronics, combinational circuits, sequential circuits.					
Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**	
	03	**14**	**42**	**03**	
Prerequisite course(s):					
Physics, Basic Electrical & Electronics Engineering.					
Course objectives:					
1. To introduction to BJT and diode rectifier. 2. To develop the concept of basics of operational amplifier, timers and its applications. 3. To understand the behavior of semiconductor devices operated as power switches. 4. This course provides an introduction to digital electronics SOP and POS form, k-map technique, flip-flops, sequential circuits such as ripple counter, synchronous counter, Mod-n counter, shift resister and its applications.					
Course outcomes:					
After successful completion of this course the student will be able to:					
1. Apply basic knowledge of science and engineering to understand electronic devices and circuits such as rectifier, amplifiers etc. 2. Analyze the circuit for determination of circuit parameters and response of op-amp IC741 and its applications. 3. Describe the use of different integrated circuits timers, PLL and voltage regulators. 4. Illustrate the basic logic gates and various reduction techniques of digital logic circuit in detail and gain the basic concept of combinational circuits. 5. Able to design sequential circuits using excitation and state table.					
COURSE CONTENT					
Analog and Digital Electronics			**Semester:**	**IV**	
Teaching Scheme:			**Examination scheme**		
Lectures:	**3 hours/week**		**End semester exam (ESE):**		**60 marks**
			Duration of ESE:		**03 hours**
			Internal Sessional Exams (ISE):		**40 marks**
Unit–I:		**No. of Lectures: 09 Hours**		**Marks: 12**	

Diode and BJT Applications: DC Power supplies, types, Diode rectifier: Introduction, half wave rectifier, full wave rectifier-Center tap and bridge rectifier With capacitor filter and its analysis for ripple factor and efficiency. Comparison of rectifiers.
BJT amplifier: Single stage common emitter, common base and common collector amplifier, Multistage amplifier, direct coupled, RC coupled and transformer coupled, FET amplifiers and comparison.

Unit–II:	No. of Lectures: 08 Hours	Marks: 12

Operational amplifier: Op-amp parameters such as CMRR, slew rate, frequency response and gain limitations. Inverting, non inverting amplifier. Summer and substractor. Op-amp applications: Integrator, differentiator. Op-amp as Comparator, Schmitt trigger, Instrumentation amplifier, Waveform generation using Op-amp – sine, square and triangular.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Timer and Voltage Regulators: IC 555 Timer: Functional block diagram, modes of operation-Astable, Monostable, Study of VCO and PLL, Types of voltage regulators, Series and shunt voltage regulators, Protection circuits for voltage regulators, Fixed and variable voltage regulators using ICs Viz 78xx,79xx, LM723, LM317.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Combinational Circuits: Standard representation of logic functions: SOP and POS forms, K-map (for 2, 3 & 4 variables): representation of logic functions, simplification of logic functions and minimization of logic functions, don't care conditions. Arithmetic and logical functions: adders and subtractor (Half and Full), BCD-to-7-segment decoder, Code converters: binary-to-gray and gray-to-binary, Data transmission: Encoders, Multiplexers, Demultiplexers, look ahead carry.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Flip-Flops and Sequential Circuits:
A 1-Bit Memory Cell, Clocked S-R flip-flop, Edged triggered J-K flip-flop, Race around condition, J-K master slave flip-flop, Edged triggered D- type flip-flop, T-type flip-flop.
Classification of sequential circuits-synchronous and asynchronous, Registers, application of shift registers, ring counter, twisted ring counter. Asynchronous and synchronous counter, 4 bit UP/DOWN ripple counter.

Text Books:

1. S. Salivahanan, N. Suresh Kumar, "Electronic devices and circuit", McGraw hill education (India) private limited, Chennai, 4th edition, 2017.
2. Ramakant A. Gaikwad, "Op- Amp and Linear Integrated Circuits", PHI Learning Pvt. Ltd, Delhi, 2014.

3. R. P. Jain, “Modern Digital Electronics” McGraw Hill Education (India) Private Limited, Fourth Edition, 2017.

Reference Books:

1. David A. Bell, “Electronics devices and circuit”, Oxford University Press, 5th edition, 2015.
2. K. R. Botkar, “Integrated Circuit”, Khanna Publication, New Delhi
3. Robert F. Coughlin, Frederick F. Driscoll, “Operational Amplifier and Linear Integrated Circuits”, Pearson Education Asia, 6th Edition, 2001.
4. Stephen Broown, Zvonko Vranesic, “Fundamental of Digital Logic with VHDL Design”, McGraw Hill Publication, 3rd edition, 6th reprint, 2015.
5. David J. Comer, “Digital Logic and State Machine Design”, Oxford University Press, 3rd edition, 2014.
6. L. K. Maheshwari, “Analog Electronics”, Laxmi Publications.
7. A.K. Maini, “Analog Electronics”, Khanna Publishing House, 1st 2018.
8. I. G. Nagrath, “Analog Electronics”, PHI.
9. A. Anand Kumar, “Digital Electronics”, PHI.
10. R. Anand, “Digital Electronics”, Khanna Publishing House.

Electrical Machines-II					
COURSE OUTLINE					
Course Title:	**Electrical Machines-II**	**Short Title:**	**EMC-II**	**Course Code:**	

Course description:

This course is an advanced level Electrical Machines-I which will further strengthen the knowledge of the students. The course explores on understanding of construction, basic principles underlying the operation of electrical machines, performance, characteristic and testing of AC Machines, Voltage regulation of synchronous alternator, parallel operation and salient features and characteristic of synchronous motor. It also gives the platform to understand construction, working, performance and application of three phase and single phase motors.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	14	42	03

Prerequisite course(s):

Electrical Machine-I

Course objectives:

The object of syllabus to impart the fundamental knowledge of Synchronous machines. Students will be able to develop their ability to apply the specific procedures for comprehensive treatment of rotating machines. In the earlier stage the machine worked in isolation and its simple analysis was sufficient. Now the electric machines form an integral part of large system comprising of other components as well. The object is not great depth, but enough to give theory at a level that can be understood by undergraduate. With this beginning, the students will have the foundation to continue his education and able to do better in professional duties in the field of manufacturing, testing, operation and control.

Course outcomes:

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

1. Apply the basic knowledge of science, mathematics and engineering for understanding the AC machines fundamental.
2. Explain construction, operation and behaviors of synchronous alternator under different nature of load.
3. Analyze the data to calculate and evaluate the performance and characteristic of induction motor.
4. Analyze the characteristic of three phase induction motor for its suitability in speed control, starting torque and braking applications.
5. Understand the behavior of torque production in single phase induction motor and characteristic and applications.

COURSE CONTENT

Electrical Machines-II		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**

	Duration of ESE:	**03 hours**
	Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Fundamentals of AC machine

Concept and general terms pertaining to rotating machine, emf generation in AC machines. Generated emf in full pitch and short pitch winding, Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, concentrated and distributed, Sinusoidally distributed winding, winding distribution factor.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Synchronous Alternator

Principle of generator, construction, excitation system, E.M.F. equation, Alternator on- load, effect of armature current; armature reaction; resistance drop; Concept leakage reactance, synchronous reactance and synchronous impedance. Voltage regulation of non salient pole alternator by direct load testing, synchronous impedance method and m.m.f. method.

Two reaction theory for salient pole machines, direct axis and quadrature axis reactance, power angle relation for non salient pole machines and salient pole Parallel operation of alternator: need, conditions and method of parallel operation, Two alternators working in parallel, Effect of changing mechanical torque and excitation. Load sharing between two parallel connected alternators. Alternator on an infinite bus.

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

Induction Machines

Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque, method to improve starting torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency, circle diagram. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency), effects of harmonics. Methods of starting, braking and speed control for induction motors, linear induction motors.

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Synchronous Motor

Motor action, phasor diagram on the basis of synchronous impedance, expression for gross mechanical power developed; power flow. Operation with constant load and variable excitation : locus of tip of current phasor under the above condition and v curve

Operation with const. excitation and variable load: locus of tip of current phasor circle phasor. Starting method, hunting and it causes and remedies

Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**

Pulsating and revolving magnetic fields

Pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding, Windings spatially shifted by 90 degrees, torque of pulsating magnetic fields, revolving magnetic field.

Single-phase motors

Constructional features, principle of operation for single phase induction motor, capacitor start motor, split phase motor and shaded pole motor induction motor, development of torque, torque slip characteristic, starting characteristic. Construction, working operation, characteristic of repulsion, ac series motor and universal motor.

Text Books:

1. Ashfaq Husain, "Electrical Machines", Dhanpat Rai & Co., 3rd edition, 2016
2. B. L. Theraja, "Electrical Technology" Vol II, S Chand Publication, Multicolor, 2012.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 7th Edition, 2011.

Reference Books:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 7th Edition, 2013.
2. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2005.
4. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 5th Edition, 2017.
5. P. C. Sen. "D.C. Machines", Tata McGraw Hill.
6. G. C. Garg, "Electrical Machines – II", Khanna Book Publishing, Delhi
7. Say, "The Performance & Design of Alternating Current Machines", CBS Publishers
8. S. K. Sen, "Principle of Electrical Machine Design with Computer Programs", Oxford & IBH

Entrepreneurship Development

COURSE OUTLINE

Course Title:	**Entrepreneurship Development**	**Short Title:**	**ED**	**Course Code:**	

Course description:

Last few decades have seen the advent of various new disciplines in the area of management. One such discipline, Entrepreneurship has emerged quite recently. The syllabus explore the concept of entrepreneurship, financial requirements of a new enterprise, Expansion strategies of an enterprise, challenges for small enterprises and Institutional Support for small enterprises

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	**14**	**42**	**03**

Prerequisite course(s):

Industrial Organization and Management.

Course objectives:

The economic objectives of country, such as industrial development, regional growth, employment generation and development of small scale industries entirely depend on the growth of entrepreneurship. As concept, Entrepreneurship poses a challenge for entrepreneurs to select and implement business strategies to tread the glorious path of success and growth. Successful entrepreneurship requires passion of an entrepreneur and thus, it is more than the money and luck. In the contemporary world, the study of this discipline become of umpteen importance to understand the complexities of business environment at national and international levels.

Course outcomes:

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

1. Understand concept of entrepreneurship and learn the procedure of setting up an enterprise.
2. Understand the concepts of human resource management, marketing management, financial management, production and operation management in a new enterprise.
3. Function on multidisciplinary teams and understand the impact of engineering solutions in a global, economic, environmental, and societal context.
4. Understand the role of small scale enterprises in economic development of a country and understand the linkage between small and large scale enterprises.
5. Develop skills to become entrepreneurs in view of economic objectives of country, such as industrial development, regional growth, employment generation and development of small scale industries through technological developments.

COURSE CONTENT

Entrepreneurship Development	**Semester:**	**IV**
Teaching Scheme:	**Examination scheme**	

Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to Entrepreneurship

Introduction, Concept of entrepreneurship: Significance of entrepreneurship, Theories of entrepreneurship, Models of entrepreneurship development

Definition of entrepreneur: Traits and characteristics of successful entrepreneur , Functions of an entrepreneur, Types of entrepreneurs, Factors influencing entrepreneur, Professional vs. family entrepreneurs, Entrepreneurial leaders vs. managers,

Entrepreneurial process: Entrepreneurial motivation, Entrepreneurial barriers, Women as entrepreneur , Role of woman entrepreneurs in society, Barriers to women entrepreneurs , Myths of entrepreneurship, Problems faced by entrepreneurs and capacity building for entrepreneurship, Profiles of successful entrepreneurs.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Financial requirements of a new Enterprise

Estimating financial requirements, Estimation of fix capital requirements, Estimation of working capital requirements

Identifying the sources of finance –sources of long-term financing: Sources of medium term financing, Sources of short-term financing

Institutions providing financial assistance: Venture capital funding- venture capital funding in the Indian scenario, Venture capital funding process, Importance of financial management, Working capital management, Accounting and book keeping, Financial statement, Financial ration analysis

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

Expansion strategies of an Enterprise

Expanding and enterprise: Expansion through concentration, Expansion through integration, Expansion through diversification, Expansion through cooperation,

Expansion through internationalization, Expansion through digitalization, Organization life cycle, Strategic management, The essence of business ethics

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Challenges for small Enterprises

Problem faced by small enterprises: Managerial problems, Marketing management, Human resource, Production management, Technological problems

Role of central and state governments in promoting small enterprises: Fiscal and tax concessions for small enterprises, Industrial policies for small enterprises, Importance of marketing, Customer relationship management (CRM), Marketing services

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Institutional Support for small enterprises and decision support system

Institutions supporting small scale enterprises: Small scale industries (SSI) board, Khadi and village industries commission (KVIC), Micro, small and medium enterprises development organization (MSME-DO), National small industries corporation limited (NSIC), National institute for entrepreneurship and small business development (NIESBUD)‘ Indian institute of entrepreneurship (IIE), State industrial development / Investment Corporation (SIDCs/SIICs), State directorate of Industries (SDIs), District industry centers (DICs) ,Industry associations , Non-Governmental organization

Institutions providing financial association: Small industries development bank of India (SIDBI), State financial corporation (SFCs) Technological up gradation and moderation of small enterprises: ISO 9000/14001 certification fee reimbursement scheme,

Text Books:

1. Alpana Trehan, “Entrepreneurship” Wiley Indis Pvt Ltd, 2011.
2. Jack M. Kaplan, “Patterns of Entrepreneurship” Wiley, 2006.

Reference Books:

1. Poornima M. Charantimath, “Entrepreneurship Development - Small Business Enterprises” Pearson.
2. Thomas W. Zimmerer & Norman M. Scarborough, “Essential of Entrepreneurship and Small Business Management” 4th Edition, Pearson.

Electrical Engineering Materials Laboratory					
LAB COURSE OUTLINE					
Course Title:	**Electrical Engineering Materials Laboratory**	**Short Title:**	**EEM Lab.**	**Course Code:**	
Course description:					
The objective of this course is to introduce the students to the fundamental knowledge of various materials used in electrical engineering. Testing of electrical engineering material and application. Testing of insulation oil as per IS.					
Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**	
	02	**14**	**28**	**01**	
End Semester Exam (ESE) Pattern:					
Prerequisite course(s):					
Physics, Chemistry, Basic Electrical & Electronics Engineering.					
Course objectives:					
The objective of the course is to provide students with the essential knowledge of different electrical engineering materials and their applications in designing electrical equipments. The students will able to carry different test on electrical engineering materials to find characteristic and applications. The students will able to select the material for different applications. This course also provides a platform for further studies in solar electric power generation.					
Course outcomes:					
Upon successful completion of lab Course, student will be able to: 1. Do testing of transformer oil as per IS. 2. Understand break down mechanisms for insulating materials. 3. Apply basic knowledge of science and understand the characteristic of conducting material and their applications. 4. Analyze the practical; data for determination of properties of materials. 5. Understand the testing of power capacitor.					
LAB COURSE CONTENT					
Electrical Engineering Materials Lab		**Semester:**	**IV**		
Teaching Scheme:					
Practical:	**2 hours/week**				
Teacher should facilitate learning following lab experiments: 1. Testing of insulating oil as per IS 2. Testing of solid insulating materials as per IS 3. Testing of power capacitors as per IS 4. Measurements of resistivity of conducting materials.					

5. Measurements of resistivity of resistive material.
6. Study and use of Gauss meter.
7. Use of spark gap for high voltage testings for air.
8. To study See back and Peltier effects.
9. Study of hysteresis loop of ferromagnetic materials.
10. Study of various insulating materials.

Note: Lab file should consist of minimum **Eight** experiments.

Evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Text Books:

1. S. P. Seth, P. V. Gupta, "A course in Electrical Engineering Materials", Dhanpat Rai Publication, 3rd edition.
2. A. J. Dekker, "Electrical Engineering Materials", PHI Pvt. Ltd.
3. C. S. Indulkar, S. Thiruvengadam, "Electrical Engineering Materials", S Chand Publication, 1st edition.

Reference Books:

1. R. K. Rajput, "Electrical Engineering Materials", Laxmi Publication, 2nd edition.
2. S. P. Chaitra, B. K. Bhatt, "Electrical Engineering Materials", Khanna Publication
3. N. Algappan, N. T. Kumar, " Electrical Engineering Materials" , T.T.T.I. Madras, TMH, 34th edition.

Analog and Digital Electronics Laboratory					
LAB COURSE OUTLINE					
Course Title:	**Analog and Digital Electronics Laboratory**	**Short Title:**	**ADE Lab.**	**Course Code:**	
Course description:					
This course provides an introduction to solid state devices, power semiconductor devices, linear integrated circuits and voltage regulator ICs which includes over view of semiconductor devices, integrated circuits, their characteristics and applications, digital electronics, combinational circuits, sequential circuits.					
Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**	
	02	**14**	**28**	**01**	
End Semester Exam (ESE) Pattern:		**Practical (PR)**			
Prerequisite course(s):					
Physics, Basic Electrical & Electronics Engineering.					
Course objectives:					
1. To introduction to BJT and diode rectifier. 2. To develop the concept of basics of operational Amplifier and its applications. 3. To understand the behavior of semiconductor devices operated as power switches. 4. This course provides an introduction to digital electronics SOP and POS form, k-map technique, flip-flops, sequential circuits such as ripple counter, synchronous counter, Mod-n counter, shift resister and its applications.					
Course outcomes:					
Upon successful completion of lab Course, student will be able to:					
1. Apply basic knowledge of science and engineering to understand electronic devices by experimenting rectifier circuits. 2. Analyze the circuit for determination of circuit parameters and response of op-amp IC741 and its applications. 3. Describe the use of timers in different modes and determine the practical times and also design the voltage regulators. 4. Illustrate the basic concept of combinational circuits through the experiments. 5. Able to design sequential circuits using excitation and state table.					
LAB COURSE CONTENT					
Analog and Digital Electronics Laboratory		**Semester:**	**IV**		
Teaching Scheme:		**Examination scheme**			
Practical:	**2 hours/week**	**End semester exam (ESE):**		**25 marks**	
		Internal Continuous Assessment (ICA):		**25 marks**	

Teacher should facilitate learning following lab experiments:

1. Observe the input and output voltage of half wave, full wave rectifiers.
2. Op-amp as square wave, sine wave generator using IC 741.
3. Op-amp as comparator using IC 741
4. Op-amp as Schmitt trigger using IC 741.
5. IC 555 applications – Astable & Monostable Multivibrator.
6. Low voltage regulator using IC 723.
7. High voltage regulator using IC 723.
8. IC 78XX used as Positive voltage regulator.
9. IC 79XX used as Negative voltage regulator.
10. Design and verify operation of half adder and full adder.
11. Design and verify operation of half substractor.
12. Design and construct basic flip-flops.
13. Design and verify the 4-bit synchronous counter.
14. Design and verify the 4-bit asynchronous counter.

Note: Lab file should consist of minimum **Eight** experiments.

Text Books:

1. S. Salivahanan, N. Suresh Kumar, "Electronic devices and circuit", McGraw hill education (India) private limited, Chennai, 4th edition, 2017.
2. Ramakant A. Gaikwad, "Op- Amp and Linear Integrated Circuits", PHI Learning Pvt. Ltd, Delhi, 2014.
3. R. P. Jain, "Modern Digital Electronics" McGraw Hill Education (India) Private Limited, Fourth Edition, 2017.

Reference Books:

1. David A. Bell, "Electronics devices and circuit", Oxford University Press, 5th edition, 2015.
2. K. R. Botkar, "Integrated Circuit", Khanna Publication, New Delhi
3. Robert F. Coughlin, Frederick F. Driscoll, "Operational Amplifier and Linear Integrated Circuits", Pearson Education Asia, 6th Edition, 2001.
4. Stephen Broown, Zvonko Vranesic, "Fundamental of Digital Logic with VHDL Design", McGraw Hill Publication, 3rd edition, 6th reprint, 2015.
5. David J. Comer, "Digital Logic and State Machine Design", Oxford University Press, 3rd edition, 2014.
6. L. K. Maheshwari, "Analog Electronics", Laxmi Publications
7. A.K. Maini, "Analog Electronics", Khanna Publishing House
8. I. G. Nagrath, "Analog Electronics", PHI
9. A. Anand Kumar, "Digital Electronics", PHI
10. R. Anand, "Digital Electronics", Khanna Publishing House

Guide lines for ICA:
ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.
Guidelines for ESE:
In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work, performance and oral in the practical examination.

Electrical Machines-II Laboratory					
LAB COURSE OUTLINE					
Course Title:	**Electrical Machines-II Laboratory**	**Short Title:**	**EMC-II Lab.**	**Course Code:**	

Course description:

In this laboratory course emphasis on imparting the practical knowledge and understanding of basic principles, determination of characteristic , performance and testing of AC Machines, Voltage regulation of synchronous alternator. Application of single phase motors

Laboratory	Hours/week	No. of weeks	Total hours	Semester credits
	02	14	28	01

End Semester Exam (ESE) Pattern:	Practical (PR)

Prerequisite course(s):

Electrical Machine-I.

Course objectives:

The objective of the laboratory is to impart the fundamental knowledge of Synchronous machine and AC motors. Students will able to develop their ability to apply the specific procedures for analyze the experimental results. The students will able to understand the characteristic of Synchronous alternator and motor, application in process and manufacturing. Application of different methods to find voltage regulation of synchronous alternator. In this lab course, students will be familiar with the use of different equipments, safety precautions on work place. This makes bridge on theoretical knowledge and practical practices.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Apply the basic knowledge of measuring instruments to conduct experiments on machine with safety precautions.
2. Understand the characteristic of synchronous alternator for its regulation and efficiency.
3. Analyze the experiments data to determine its parameter and performance of synchronous machines.
4. Demonstrate the behaviors of synchronous motor at different excitation and load conditions.
5. Analyze and categorize the different machines as per their characteristics and solve engineering problems with safety precautions.

LAB COURSE CONTENT

Electrical Machines-II Laboratory		Semester:	IV
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	**25 marks**
		Internal Continuous Assessment (ICA):	**25 marks**

Teacher should facilitate learning following lab experiments:

1. Determination of voltage regulation of three phase alternator by direct load test.
2. Open and short circuit test on three phase alternator: determination of its regulation by

e.m.f. method and m.m.f. method.

3. Zero power factor test on three phase alternator: determination of regulation by Potier triangle method.
4. Determination of direct axis and quadrature axis reactance by slip test on synchronous machine. Determination of voltage regulation by two reactance theory.
5. Synchronizing alternators: lamp methods and use of synchroscope.
6. Synchronous alternator on infinite bus: behavior of machine under change in mechanical power and excitation.
7. Characteristic of synchronous motor at constant load and variable excitation.
8. Characteristic of synchronous motor at constant excitation and variable load.
9. Determination of performance of three phase induction motor by direct load test.
10. Determination of performance of three phase induction motor by no load, blocked rotor test and construction of circle diagram.
11. No load and blocked rotor tests on capacitor start single phase induction motor and determination of parameters of equivalent circuit.
12. Load test on single phase induction motor.
13. Speed control of three phase slip ring induction motor.

Note: Lab file should consist of minimum **Eight** experiments.

Text Books:

1. Ashfaq Husain, "Electrical Machines", Dhanpat Rai & Co., 3rd edition, 2016
2. B. L. Theraja, "Electrical Technology" Vol II, S Chand Publication, Multicolor, 2012.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 7th Edition, 2011.

Reference Books:

1. E. Fitzgerald, C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 7th Edition, 2013.
2. E. Clayton, N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2005.
4. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 5th Edition, 2017.
5. P. C. Sen. "D.C. Machines", Tata McGraw Hill.
6. G. C. Garg, "Electrical Machines – II", Khanna Book Publishing, Delhi
7. Say, "The Performance & Design of Alternating Current Machines", CBS Publishers
8. S. K. Sen, "Principle of Electrical Machine Design with Computer Programs", Oxford & IBH

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guidelines for ESE:
ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work and performance in the practical.

Measurement and Instrumentation Laboratory

LAB COURSE OUTLINE

Course Title:	**Measurement and Instrumentation Lab.**	**Short Title:**	**MI Lab**	**Course Code:**	

Course description:

In this laboratory, course emphasis on imparting the practical knowledge and understanding of basic principles, characteristic, performance of different measuring instruments and measurement of different electrical quantities. It also gives the platform to understand need and importance of calibration and standardization.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Lecture	**01**	**14**	**14**	**02**
Laboratory	**02**	**14**	**28**	

End Semester Exam (ESE) Pattern:	**Oral (OR)**

Prerequisite course(s):

Physics, Basic Electrical & Electronics Engineering.

Course objectives:

The objective of the laboratory is to impart the fundamental knowledge of measuring instruments. Students develop their ability to select the specific instrument in reference of ranges and resolution of instruments for proper and correct analysis. The students will able to understand the characteristic of measuring instruments. In this lab course, students will be familiar with the use of different equipments, safety precautions on work place. This makes bridge on theoretical knowledge and practical practices

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Conduct practical and able to analyze the practical data for various purposes.
2. Apply various electrical and non electrical measurement methods to obtain electrical and non electrical quantities.
3. Able to select the measuring instrument with proper range and type for practical uses.
4. Calibrate various types of instruments as per IS.
5. Do professional duties in technical field and able to use advance measuring instruments.

LAB COURSE CONTENT

Measurement and Instrumentation Laboratory		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**1 hour/week**	**End semester exam (ESE):**	**25 marks**
Practical:	**2 hours/week**	**Internal Continuous Assessment (ICA):**	**25 marks**
Theory:			

Unit–I: Introduction to Measurement and instrumentation

Definition, purpose, measurement – definitions, types and Classification of instruments, Generalized measurement system, standards, and calibrations, Errors – types – gross, systematic, random, limiting, sources of errors, techniques to minimize them. Instrument transformers-theory, Expression for ratio and phase angle errors.

Unit–II: D.C. and A .C. Bridges

DC Bridges: Wheatstone bridge, Kelvin's double bridge, Megger, D.C. potentiometer. AC Bridges: Classification, Maxwell, Anderson, Schering, and Wein Bridge. Introduction to PMMC and MI.

Unit–III: Measurement of Power: Construction and principle of operation of electrodynamic wattmeter, low P. F. wattmeters, Active & reactive power measurement in three phase system for balanced and unbalanced load using three wattmeter method, two wattmeter method & one wattmeter method.

Unit–IV: Measurement of Energy: Construction and principle of operation, Torque equation for the induction type of energy-meter, Calibration of Energy meters, and three phase energy meter. Electronic Energy meters- construction and principle.

Unit–V: Introduction to transducers:

Transducers: Definition, classification, selection of transducer. Measurement of temperature: Using R T D, thermocouple. Pressure Measurement: Bourdon Tubes, bellows, diaphragms. Displacement measurement: LVDT, strain gauge -types, working principles

Teacher should facilitate learning following lab experiments:

1. Measurement of active power and reactive power in three phase circuit by two wattmeter method and one wattmeter method.
2. Calibration of single phase energy meter at different P.F.'s
3. Calibration of three phase two elements energy meter at different P.F.'s
4. Kelvin's double bridge: Measurement of low resistance
5. Strain Measurement using strain gauge.
6. Measurement of temperature by RTD/Thermocouple.
7. Measurement of pressure by using pressure transducer.
8. Measurement of displacement by using LVDT.
9. Measurement of inductance and capacitance by Andersons Bridge and Schering bridge.
10. Measurement of earth resistance.
11. Measurements of phase angle error and ratio error of current Transformer
12. Measurements of phase angle error and ratio error of Potential Transformer
13. Study of DSO.

Note: Lab file should consist of minimum **Eight** experiments.

Text Books:

1. A. K. Sawhney. "Electrical & Electronic Measurement and Instrumentation" Dhanpant

Rai & Co, 18th edition 2007.

Reference Books:

1. E. W. Golding, "Electrical Measurements and Measuring instruments", Reem Publication, 23rd edition.
2. C. T. Baldwin, "Fundamentals of Electrical Measurements", Kalyani Publication, 2nd edition.
3. Cooper and Derfllick, "Electronic Instrumentation and Measurements Techniques", Prentice-Hall of India, 3rd edition.
4. J. B. Gupta, "Electrical & Electronic Measurement and Instrumentation", S. K. Kataria & Son, 14th edition.
5. R. K. Rajput, "Electrical & Electronic Measurement and Instrumentation", S. Chand.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guidelines for ESE:

In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work, performance and oral in the practical examination.

Environmental Studies					
COURSE OUTLINE					
Course Title:	**Environmental Studies**	**Short Title:**	**EVS**	**Course Code:**	**Non Credit**
Course description:					
The course aims to percolate the importance of environmental science and environmental studies.					
COURSE CONTENT					
Environmental Studies	**Semester:**	**IV**			
	Examination scheme				
	End Semester Exam (ESE):	**60 marks**			
	Duration of ESE:	**03 hours**			
	Internal Continuous Assessment (ICA):	**40 marks**			
Unit–I:	**No. of Lectures: 02 Hours**				
Multidisciplinary nature of environmental studies Definition, scope and importance, Need for public awareness.					
Unit–II:	**No. of Lectures: 08 Hours**				
Natural Resources : **Renewable and non-renewable resources** Natural resources and associated problems. a. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e. Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles.					
Unit–III:	**No. of Lectures: 06 Hours**				

Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of thefollowing ecosystem :-
  a. Forest ecosystem
  b. Grassland ecosystem
  c. Desert ecosystem
  d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit–IV:	No. of Lectures: 08 Hours	

Biodiversity and its conservation

- Introduction – Definition: genetic, species and ecosystem diversity.
- Biogeographic classification of India
- Value of biodiversity : consumptive use, productive use, social, ethical, aestheticand option values
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation
- Hot-sports of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit–V:	No. of Lectures: 08 Hours	

Environmental Pollution

Definition, Cause, effects and control measures of :-

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management: floods, earthquake, cyclone and landslides.

Unit–VI:	No. of Lectures: 07 Hours	

Social Issues and the Environment

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. CaseStudies
- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear
- Accidents and holocaust. Case Studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Public awareness.

Unit–VII:	No. of Lectures: 06 Hours	

Human Population and the Environment

- Population growth, variation among nations.
- Population explosion – Family Welfare Program
- Environment and human health.
- Human Rights.
- Value Education.
- HIV/AIDS.
- Women and Child Welfare.
- Role of Information Technology in Environment and human health.
- Case Studies.

Unit–VIII:	No. of Lectures:	

Field work

- Visit to a local area to document environmental assets, river/forest/grassland/hill/mountain

- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5lecture hours)

Guide lines for ICA:

Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty in charge will assess the assignments continuously and grade or mark each assignment on completion date declared for each assignments.

Reference Books:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay NaturalHistory Society, Bombay (R)
10. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment.Cambridge Univ. Press 1140p.
11. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws.Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems &Solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
16. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ.Co. Pvt. Ltd. 345p.
17. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)
19. Townsend C, Harper J, Michael Begon, Essentials of Ecology, Black well Science (TB)

Internship - I

Internship is a mandatory and non-credit course. It is mandatory for all admitted students to undergo Internship during the degree course. The course Internship – I shall be of THREE weeks duration during summer vacation after Semester - IV. Following are the intended objectives of internship training:

- Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
- Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
- Exposure to the current technological developments relevant to the subject area of training.
- Experience gained from the 'Industrial Internship' will be used in classroom discussions.
- Create conditions conducive to quest for knowledge and its applicability on the job.

Students shall choose to undergo Internship / Innovation / Entrepreneurship related activities for Internship. Students shall choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small / Medium enterprises / academic institutions / research institutions. In case student want to pursue their family business and don't want to undergo internship, a declaration by a parent may be submitted directly to the Department Head / TPO.
During the last year of FOUR year Bachelor of Engineering coursethe student should take project work, as specified in the curriculum, based on the knowledge acquired by the student during the degree course and during Internship. The project work provides an opportunity to build a system based on area where the student likes to acquire specialized skills. The work may also be on specified task or project assigned to the student during Internship.

The internship activities and list of sub-activities for Internship – I are as under.

- Inter/ Intra Institutional Activities:
    - Training with higher Institutions such as IITs, NITs, University Departments, Recognized Research Labs etc.
    - Soft skill training organized by Training and Placement Cell of the respective institutions
    - Online certification courses by SWAYAM, NPTEL, QEEE etc.
    - Learning at Departmental Lab/Tinkering Lab/ Institutional workshop
    - Working for consultancy/ research project within the institutes
    - Training on Software (As per the need of respective branch)
    - Field Survey / Case Study

- Internship:
    - Internship with Industry/Govt. / NGO/ PSU/ Any Micro/ Small/ Medium enterprise/ academic institutions / research institutions
    - Online Internship

Faculty Mentor/Supervisors have to play active roles during the internship and minimum 20 students are to be supervised by each faculty mentor or as per the departmental strength. Mentor shall be responsible for selection of Internship activities by the student under his/her supervision and shall avoid repetition of activities by the student. The college / Institute shall facilitate internship for the students.

Every student is required to prepare a file for Internship – I containing documentary proofs (daily training diary, comprehensive report and completion certificate) of the activities done by him/her. The students should record in the daily training diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students. The daily training diary should include Date, Time of Arrival, Time of Departure, Main points of the day. The daily training diary should be signed after every day by the supervisor/ in charge of the section where the student has been working.

After completion of Internship, the student should prepare a comprehensive report to indicate what he / she has observed and learnt in the training period. The report should include Internship Objectives (in measurable terms), Internship Activities, and Internship Outcome.

The completion certificate should be signed by the supervisor/ in charge of the section where the student has been working with performance remark as Satisfactory / Good / Excellent.

The evaluation of Internship – I shall be in Semester – V. The evaluation shall be done by expert committee constituted by the concerned department including Department Head/ TPO/ faculty mentor or guide. It should be evaluated on the basis of the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Originality.
- Adequacy and purposeful write-up.
- Practical applications, relationships with basic theory and concepts taught in the course.
- Skill/ knowledge acquired

Hence the satisfactory completion of Internship – I shall be submitted to the university at the end of Semester - VIII of FOUR year Bachelor of Engineering course. Only after successfully completion of Internship- I (during summer vacation after Semester – IV) and Internship- II (during summer vacation after Semester – VI), Internship should be printed in the final year mark sheet as COMPLETED.