UNIVERSITY OF MUMBAI
Syllabus structure (R-2007)
at
S.E.(ELECTRICAL ENGINEERING)

Semester: IV

Sr. No	Subjects	Scheme of Instructions, Periods per week (60 min)			Scheme of Evaluation					
		Lectures	Practicals	Tutorials	Paper		Term work	Practical and oral	Oral	Total
					Hours	Marks				
1	Engineering * Mathematics IV	5	**	**	3	100	**	**	**	100
2	Elements of Power System	4	**	2	3	100	25	**	25	150
3	Electrical Machines – I	4	2	**	3	100	25	50	**	175
4	Electronics Circuit Design	3	2	**	3	100	25	50	**	175
5	Analog and Digital Integrated Circuits	3	2	**	3	100	25	**	**	125
6	Electrical Instrument and Instrumentation	3	2	**	3	100	25	**	**	125
Total		22	8	2	18	600	125	100	25	**850**

* Subject is common to Instrumentation, Electrical and Bio medical engineering

University of Mumbai			
Class: S.E.	**Branch:** Electrical Engineering	**Semester:** IV	
Subject: Engineering Mathematics-IV			
Periods per Week (Each 60 min.)	Lecture	05	
	Practical	---	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory	04	100
	Practical and Oral	---	---
	Oral	---	---
	Term Work	---	---
	Total	04	100

Module	Contents	Hours
1	**Vector Analysis:** Scalar and vector point functions, curl, gradient and divergence, conservative, irrotational and solenoidal fields. **a) Line Integral**, Greens thoerem for plane regions and properties of line integral, Stoke's theorem, Gauss's divergence theorem (without proof) related identities and deductions.	16
2	**Matrices** **a) Types of matrices.** adjoint of a matrix inverse of a matrix, rank of a matrix, linear dependence and independence of rows and columns of a matrix over a real field, reduction to normal form and partitioning of a matrix. **b) Systems of homogeneous** and non-homogeneous equations, their consistency and solutions. **c) Brief revision** of vectors over real fields, inner product, norm, linear independence and orthogonality of vectors. **d) Characteristic Polynomial**, characteristic equation, characteristic roots, and characteristic vectors of square matrix, properties of characteristic roots and vectors of different types of matrices such as orthogonal matrix, Hermitian matrix, Skew-Hermitian matrix, Diagonal matrix, Cayley-Hamilton theorem (without proof), functions of square matrix , minimal polynomial and derogatory matrix. **e) Quadratic forms**, Congruent and orthogonal reduction of quadratic form, rank, index, signature and class value of quadratic form.	22
3.	**Probability and Statistics :** Concept of probability, conditional probability. Baye's	22

	theorem (without proof). **a) Random variable** Probability distribution for discrete and continuous random variables. Density function and distribution function. Expected value, variance, moments, moment generating function, binomial, Poission, normal distributions for detailed study with proof, **b) Curve fitting** Correlation, Karl Pearson coefficient & Spearman's rank correlation coefficient (without proof), regression, lines of regression.	

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Q.1 will be compulsory and based on the entire syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus

Books Recommended:

Text Books:

1. Wartikar P.N. / Wartikar J. N., *Textbook of Applied Mathematics*, Pune Vidyarthi Griha Prakashan, 1981.
2. Shastri S.S., *Engineering Mathematics,* Prentice Hall.

Refenece Books:

3. Shantinarayan, *Matrices*, S. Chand & co.
4. Gupta Kapoor, *Mathematical Statistics*.

University of Mumbai			
Class: S.E.	**Branch:** Electrical Engineering	**Semester: IV**	
Subject: Elements of Power System			
Periods per Week (Each 60 min)	Lecture	4	
	Practical	---	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory	3	100
	Practical and Oral	---	---
	Oral	---	25
	Term Work	---	25
	Total	3	150

Module	Contents	Hrs
1	**Introduction** Electrical supply system, typical AC supply system comparison between DC and AC supply systems, comparison between overhead and underground system, choice of working voltage for transmission and distribution	06
2	**Transmission Line Parameters** **Inductance** Definition of inductance, Inductance of a single phase two wire line Conductor types, bundled conductors, Inductance of composite condu phase line, double circuit three phase line **Resistance** Resistance, Skin effect and proximity effect **Capacitance** Potential difference between two conductors of a group of parallel Conductors, Capacitance of a two wire line, three phase line with equilateral spacing, three phase line with unsymmetrical spacing, Earth effect on transmission line capacitance, Bundled conductors, method of GMD.	10
3	**Representation of Power System Components** Introduction, Single phase solution of balanced three phase networks one line diagram, impedance and reactance diagram, Per unit (p.u.) system, per unit impedance diagram, representation of loads	06
4	**Transmission Line : Model and Performance** Short, medium and long line model, equivalent circuit of a long line, Ferranti effect, tuned power lines, surge impedance loading power flow through transmission lines	05
5	**Mechanical design of transmission line** Components of overhead lines, types of towers, conductor materials,	05

	cross arms, Conductor configuration, spacing and Clearance Span lengths, Sag and Tension.	
6	**Overhead Line Insulators** Types of insulators, potential distribution over a string of suspension insulators, methods of equalizing potential	05
7	**Underground Cable** General construction, classification of cables, Insulation resistance of single core cable, capacitance of single core cable, grading of cable, Selection of cable	05
8	**Grounding and safety techniques** Measurement of earth resistance, soil resistivity, tolerable limits of body currents, tolerable step and touch voltage, actual step and touch voltage, measurement of tower footing resistance, methods of neutral grounding, grounding practices	06

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Q.1 will be compulsory and based on the entire syllabus.
4. Remaining questions will be mixed in nature
5. In question paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus
6. No question should be asked from the pre-requisite module

Oral Examination:

The oral examination will be based on entire syllabus of Power Plant Engineering (Semester III) and Elements of Power System (Semester IV).

Term work:

Term work consists of minimum eight experiments and a written test. The distribution of the term work shall be as follows,

Laboratory work (Experiments and Journal) :10 marks
Test (at least one) :10 marks
Attendance (Practical and Theory) :05 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Books Recommended:

Text books:

1. Wadhwa C. L *Electrical power system* Willey Eastern Ltd.
2. Kothari Nagrath *Power system engineering* 3rd edition, TCMH

Reference books:

3. Stevenson's *Modern power system analysis* TMH publication
4. .Mehta V.K.,Chand S. *Principles of power system*
5. Gupta, B.R. Power System Analysis & Design. Wheeler Publ. 3rd edn, 1998

University of Mumbai			
Class: S.E.	**Branch:** Electrical Engineering	**Semester:** IV	
Subject: Electrical Machines – I			
Periods per Week (Each 60 min)	Lecture	4	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory	3	100
	Practical and Oral	2	50
	Oral	---	---
	Term work	---	25
	Total	5	175

Module	Contents	Hours
1	**Basics of Magnetism** Magnetic field, magnetic circuit, Faraday's laws, hysteresis and eddy current losses, energy stored & RL time constant.	05
2	**Electromechanical Energy Conversion** Principle, energy stored in magnetic field, torque in singly and doubly excited magnetic field, torque from energy and co energy.	06
3	**DC Motors** Construction, commutator & process of commutation, armature reaction, methods to improve commutation, Emf and torque equations, type of motors, load characteristics and applications, torque speed relations, starters For shunt and series motors, design of grading of resistance for starter, speed Control, losses and efficiency, testing- retardation, brake load, Swinburne, Hopkinson's, Field test.	13
4	**Transformer – Single Phase** Construction, emf equation, development of Equivalent Circuit- Ideal transformer, transformer on no load and On load, phasor diagram, O.C. & S.C. test, polarity test, efficiency and regulation of transformer, all day efficiency, Sumpners Test, impulse test, parallel operation, autotransformer.	12

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Q.1 will be compulsory and based on the entire syllabus.
4. Remaining questions will be mixed in nature.

5. In question paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus

Practical and Oral Examination:

Practical examination will be based on one experiment performed from the list of experiments given in the syllabus and the oral will be based on entire subject.

Term work:

Term work consists of minimum eight experiments and a written test. The distribution of the term work shall be as follows,

Laboratory work (Experiments and Journal)	:10 marks
Test (at least one)	:10 marks
Attendance (Practical and Theory)	:05 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

List of Laboratory Experiments:

1. To perform brake test on D.C. shunt Motor, to determine the percentage efficiency.
2. To perform fields test on D.C. series machines, & find out percentage efficiency.
3. To perform load test on D.C. shunt motor, find out percentage efficiency, and plot mechanical and electrical characteristics.
4. To perform open circuit and short circuit test on a single phase transformer.
5. To perform parallel operation of two single phase transformer for their load sharing between them.
6. Speed control D.C. shunt motor by
   i) Variation of flux or flux control method.
   ii) Armature or rheostat method.
7. To study D.C. machines parts.
8. To study starters of DC. Shunt Motor.
9. To perform Sumpner's test or back-to-back test on two identical Single phase transformers for finding its percentage regulation and efficiency.
10. To perform swinburns test on D.C. machine to find out percentage efficiency.
11. To calculate the losses and efficiency of a D.C. machine by regenerative method of testing.

Books Recommended:

1. Bimbhra P.S., *Electric Machinery* , Khanna Publisher,
2. Bimbhra P.S., *Generalized Machine Theory*, Khanna Publisher,
3. Nagrath I.J., Kothari D.P., *Electric Machines*, TMH Publishcations.

University of Mumbai			
Class: S.E.	**Branch:** Electrical Engineering	**Semester** IV	
Subject: Electronic Instrument and Instrumentation			
Periods per Week (Each 60 min)	Lecture	4	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory	4	100
	Practical and oral	---	---
	Oral	---	---
	Term Work	---	25
	Total	4	125

Module	Contents	Hours
1	**Study Of digital instruments:** Meter, digital voltmeter, digital ammeter, digital frequency meter, digital phase meter, digital energy meter, digital tachometer, digital multimeter.	07
2	**High frequency measurement:** Introduction, resonance method, measurement of inductance, measurement of capacitance, measurement of effective resistance, variation (resistance) method, reactance variation method, Q-meter and its applications.	07
3	**Transducer for measurement:** Temperature, vibration, velocity, Flow, level, photo-electric, strain gauge and measurement of strain performance, characteristics and selection for given application.	10
4	**Signal conditioning and data acquisition system:** Chopper stabilized amplifier, Instrumentation amplifier, Generalized data acquisition system, P.C. based data acquisition system.	07
5	**SCADA and PLC:** Introduction to SCADA, block diagram representation and function of each unit (only), advantages and disadvantages of SCADA system, introduction to PLC.	05
6	**Signal generator:** Requirement of a good lab type signal generator, A.F. signal generator, function generator.	04
7	**Oscilloscopes:** Study of dual trace oscilloscope, dual beam oscilloscope, sampling oscilloscope, analog storage oscilloscope [principle of operation and waveform], comparison between analog and digital oscilloscope, use of	08

	CRO in tracing diode and transistor characteristics.	

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3. Q.1 will be compulsory and based on the entire syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

Term work:

Term work consists of minimum eight experiments and a written test. The distribution of the term work shall be as follows,

Laboratory work (Experiments and Journal) :10 marks
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Attendance (Practical and Theory) :05 marks

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List of Laboratory Experiments:

1) Study of Digital Voltmeter.
2) Use of CRO in tracing Characteristics of Diode and Transistor.
3) Study of Q-meter.
4) Study of LVDT.
5) Study of Thermistor.
6) Study of Thermocouple.
7) Study of Instrumentation Amplifier.
8) Study of Data Acquisition System.
9) Study of High Frequency measurement.
10) Study of filter circuit.

Books Recommended:

Text books:

1) Cooper W.D. and Helfrick A.D., *Electronic Instrumentation and Measurement Techniques*, Prentice Hall of India, 3rd Edition, 1993.
2) Kalsi H.S., *Electronic Instrumentation*, Tata McGraw Hill, 3rd Edition, 1997.

Reference books:

1) Rangam Sharma and Mani., *Instrumentation Device and systems*, Tata McGraw Hill, 1985.
2) Doebelin E.O., *Measurement system application and Design*, Tata McGraw Hill, 4th Edition,1990.
3) Jones and Chin., *Electronic Instruments and measurements*, John Wiley and Sons, 1987.

4) Jog N.K., *Electronics instrumentation and control*, Nandu Publications, 1st Edition 2001.
5) Sawahney A.K., *Electonics,electrical instrument & intrumentation* --- 17th Edition, 2007.

University of Mumbai			
Class: S.E.	**Branch:** Electrical Engineering	**Semester:** IV	
Subject: Electronics Circuit Design			
Periods per Week (Each 60 min)	Lecture	3	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory	3	100
	Practical and Oral	2	50
	Oral	---	---
	Term Work	---	25
	Total	5	175

Module	Contents	Hours
1	**Cascade amplifiers** Types of coupling, effect of coupling on performance of BJT and JFET amplifiers, cascade connection, Darlington-pair	05
2	Design of Single stage and two stage amplifier (RC coupled) using BJT and JFET	07
3	**Oscillators** Positive feedback oscillators,frequency of oscillation and condition for sustained oscillations of a)RC phase shift b)Wien bridge c)Hartley/ Colpitts with derivations, crystal Oscillator, UJT relaxation oscillator	07
4	**Power Amplifier** Analysis Class A, B, and AB power amplifiers, design of transformer coupled Class A amplifier	07
5	**Operational Amplifier** Basics of an op-amp, op-amp parameters. Frequency Response of an op-amp. op-amp applications: Voltage follower, inverting and non- inverting amp. adder, subtractor, V to I and I to V converter, gyrator (simulation *of* inductance), precision rectifier, schmitt trigger, sample and hold circuits, clipping and clamping, active filters: LP, HP and BP	10

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6. No question should be asked from the pre-requisite module

Practical and Oral Examination:

Practical examination will be based on one experiment performed from the list of experiments given in the syllabus and the oral will be based on entire subject.

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List of Laboratory Experiments:

1. Study of RC coupled amplifier performance.
2. Study of Darlington pair amplifier
3. Design of single stage CE amplifier and performance analysis
4. Design of single stage CS amplifier and performance analysis
5. Study of a RC phase shift oscillator
6. Study of a Wien Bridge oscillator
7. Study of a Hartley/ Colpitts oscillator
8. Study of UJT Relaxation Oscillator
9. Power amplifier circuit analysis
10. Linear applications of op-amp
11. Non linear applications of op-amp
12. Active filters

Books Recommended:

Text books:

1. Boylestad Robert and Nashelsky Louis - '*Electronic Devices and Circuits*', Prentice-Hall of India,
2. Millman and Halkias, '*Integrated Electronics*', Tata McGraw Hill,

Reference books:

3. Gayakwad Ramakant A, *OP _AMP' sand Linear IC's*, Prentice Hall of India,
4. Newman D.A., *'Electronic Circuit Analysis and Design'*, McGraw Hill International.
5. David Bell, *Electronic Devices and Circuits*,5e Oxford University Press

1 Implementing study of gates and Logic Operations like , NOT, AND, OR, NOR,XOR & XNIR using (i) all NAND gates (ii) all NOR Gates.
2 Implementing a Binary to Gray, gray to binary or Binary to XS3 code converter using gate Ics.
3 Simplifying 3, 4 variable logic functions and implementing them using gate Ics. AND/OR, OR/AND, all NOR.
4 Constructing flip-flops like SR, D, JK and T using all NAND gates and a Debounce switch.
5 Designing a mod N counter where N <14 using J K flip-flops and D flip-flops.
6 Design of a ripple counter / OR a two bit comparator using gate Ics.
7 Building of a ring counter and twisted ring counter using D flip – flop Ics.
8 Any one of the following.
   (i) Full Adder using Gates and using Decoder or a Multiplexer.
   (ii) Using a counter ICS like 7490 or 7492 or 7493 as a BCD counter
   (iii) Using a shift register as a sequence generator.

Books Recommended:

Text books:

1. Jain R.P., *"Modern Digitals Electronic* "Tata McGraw Hill, 1984.
2. Morris M. Mano. "*Digital design*", Prentice Hall International – 1984.

Reference books:

1. Alan b. Marcovitz, "*introduction to logic Design*", McGraw Hill International 2002.
2. Malvino & Leach, *"Digital principal and Application"* , Tata McGraw Hill, 1991.
3. Bignell James& Donovan Robert "*Digital electronic"* Delmar, Thomas Learning, 2001.
4. Jog N.K. *'Logic Circuits"* 2nd , Nandu Publishers & printers Pvt. Ltd 1998.