# UNIVERSITY OF MUMBAI

No.UG /233 of 2008

**CIRCULAR :**

A reference is invited to the Ordinances, Regulations and syllabi relating to the Bachelor of Engineering degree course **vide** this office Circular No. UG/347 of 2002, dated 17th August, 2002 and the Principals of the affiliated Colleges in Engineering are hereby informed that the recommendation made by the Faculty of Technology at its meeting held on 26th March, 2008 has been accepted by the Academic Council at its meeting held on 15th April, 2008 **vide** item No.4.33 and that, in accordance therewith, the Scheme of Examination and syllabi for the Second Year (Sem. III & IV) leading to the B.E.degree course for the Electrical Engineering is revised as per **Appendix** and that the same has been brought into force with effect from the academic year 2008-2009.

MUMBAI-400 032
10th June, 2008

for REGISTRAR

---

To,

The Principals of the affiliated colleges in Engineering.

**A.C./4.33/15.4.2008**

---

No.UG/233-A of 2008, MUMBAI-400 032 10th June,2008

Copy forwarded with compliments for information to :-

1) The Dean, Faculty of Technology,
2) The Chairman, Board of Studies in Electrical Engineering.
3) The Controller of Examinations,
4) The Co-Ordinator, University Computerization Centre,

for REGISTRAR

Copy to :-

The Director, Board of College and University Development, , the Deputy Registrar (Eligibility and Migration Section), the Director of Students Welfare, the Executive Secretary to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-center, Ratnagiri for information .

The Controller of Examinations (10 copies), the Finance and Accounts Officer (2 copies ), Record Section (5 copies ), Publications Section (5 copies), the Deputy Registrar, Enrolment, Eligibility and Migration Section (3 copies ), the Deputy Registrar, Statistical Unit ( 2 copies), the Deputy Registrar (Accounts Section),Vidyanagari (2 copies ), the Deputy Registrar, Affiliation Section ( 2 copies ), the Director, Institute of Distance Education, ( 10 copies) the Director University Computer Center (IDE Building ), Vidyanagari, (2 copies ) the Deputy Registrar ( Special Cell), the Deputy Registrar,(PRO) . the Assistant Registrar, Academic Authorities Unit (2 copies )and the Assistant Registrar, Executive Authorities Unit (2 copies ) . They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above Circular and that, no separate Action Taken Report will be sent in this connection. the Assistant Registrar Constituent Colleges Unit (2 copies ), BUCTU, Account Unit V(1 copy ), the In-charge Director, Co-ordinator,

Enclosure to Item No. 4.33
15.4.2008

# UNIVERSITY OF MUMBAI

Revised Syllabus

and Scheme of Examination

For

The Second Year

(Sem.III & IV)

of the

B.E. Degree Course

in Electrical Engineering

**(With effect from the academic year 2008-2009)**

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

## Semester III

| Sr.No | Subject | Scheme of Instructions, Periods per week ( 60 min) | | | Scheme of Evaluation | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Paper | | Term work | Practical and oral | Oral | Total |
| | | | | | Hours | Marks | | | | |
| 1 | *Engineering Mathematics -III | 5 | --- | --- | 3 | 100 | --- | --- | --- | 100 |
| 2 | Power Plant Engineering | 3 | --- | 1 | 3 | 100 | 25 | --- | --- | 125 |
| 3 | Basic Electronics | 3 | 2 | --- | 3 | 100 | 25 | 50 | --- | 175 |
| 4 | Electrical Network | 3 | 2 | --- | 3 | 100 | 25 | --- | 25 | 150 |
| 5 | Electrical Measurements & Measuring Instruments | 3 | 2 | --- | 3 | 100 | 25 | --- | --- | 125 |
| 6 | Numerical Techniques | 3 | --- | 1 | 3 | 100 | 25 | --- | --- | 125 |
| 7 | *Presentation & Communication Techniques | 2 | 2 | --- | --- | --- | 50 | --- | --- | 50 |
| Total | | 22 | 8 | 2 | | 600 | 175 | 50 | 25 | **850** |

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

# 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 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Theory | Practical | Tutorial | Paper | | Term work | Practical and oral | Oral | Total |
| | | | | | Hours | Marks | | | | |
| 1 | *Engineering Mathematics- IV | 3 | --- | --- | 3 | 100 | --- | --- | --- | 100 |
| 2 | Elements of Power System | 4 | --- | 1 | 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 Engineering, Electrical and Bio medical engineering

| University of Mumbai | | | |
|---|---|---|---|
| **Class:** S.E. | **Branch:** Electrical Engineering | **Semester:** III | |
| **Subject:** Engineering Mathematics-III (Abbreviated as EM-III) | | | |
| Periods per Week (60 min. each) | Lecture | 05 | |
| | Practical | --- | |
| | Tutorial | --- | |
| | | Hours | Marks |
| Evaluation System | Theory | 05 | 100 |
| | Practical & Oral | --- | --- |
| | Oral | --- | --- |
| | Term Work | --- | --- |
| | Total | 05 | 100 |

| Module | Contents | Hours |
|---|---|---|
| 1 | **Laplace Transform**<br>Functions of bounded variations.<br>Laplace Transforms of 1, $t^n$, $e^{at}$, sin at, cos at, sinh at, cosh at, erf(t) Linear property of L.T .First shifting theorem Second shifting theorem $L\{t^n f(t)\}$, $L\{f(t)/t\}$, $L\{\int f(u)du\}$, $L\{d^n/dt^n f(t)\}$.Change of scale property of L.T. Unit step function , Heavyside, Dirac delta functions, Periodic functions and their Laplace Transforms.<br>**a) Inverse Laplace Transforms**<br>Evaluation of inverse L.T., partial fractions method, convolution theorem.<br>**b) Applications** to solve initial and boundary value problems involving ordinary diff. Equation with one dependant variable. | 15 |
| 2 | **Complex Variables**<br>Functions of complex variables, continuity and derivability of a function, analytic functions, necessary condition for f(z) to be analytic, sufficient condition (without proof), Cauchy – Riemann conditions in polar forms. Analytical and Milne – Thomson method to find analytic functions f(z) = u + iv where (i) u is given (ii) v is given (iii) u+v (iv) u-v is given. Harmonic functions and orthogonal trajectories.<br>**a) Mapping**<br>Conformal mapping, Bilinear mapping, fixed points and standard transformation, inversion, reflection, rotation and magnification.<br>**b)Line Integral** of function of complex variable, Cauchy's theorem for analytical function (with proof), Cauchy's Goursat theorem (without proof), properties of line integral, Cauchy's | 25 |

| | | |
|---|---|---|
| | Integral formula and deduction.<br>**c) Singularities and poles:** Taylor's and Laurent's development (without proof), residue at isolated singularity and it's evaluation.<br>**d) Residue theorem** application to evaluate real integrals of type<br>$\int_0^{2\pi} f(\cos\theta, \sin\theta)d\theta$ *and* $\int_{-\infty}^{+\infty} f(x)dx$ | |
| 3 | **Fourier series**<br>Orthogonality & orthogonal functions, Expression for the function in a series of orthogonal functions, Dirichlet's conditions, Fourier series of periodic functions with period 2pi or 2*l*. (Derivation of Fourier coefficients a0, an, bn is not expected) Dirichlet's theorem Even & Odd functions. Half range sine & cosine expressions Parsaval's identities (without proof)<br>**a) Complex form of Fourier Series:** Fourier transform & Fourier integral in detail | 20 |

## Theory Examination:

1. Question paper will consist of total 7 questions carrying 20 marks each.
2. Only 5 questions need to be attempted.
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.

## Text Books:


1. Wartikar P.N. / Wartikar J. N., *Textbook of Applied Mathematics*, Pune Vidyarthi Griha Prakashan, 1981.
2. Kreyszig Erwin, Advanced Engineering Mathematics, 8th ed., Wiley Student Edition, New Delhi, 2006.


## Reference Books:


1. Churchil, *Coplex variables*, Mc Graw Hill.
2. Shantinarayan, *Theory of function Complex Variable*, S. Chand & co.
3. Shastri S.S., *Engineering Mathematics,* Prentice Hall.
4. Glyn James, Advanced Modern Engineering Mathematics, 3rd ed., Pearson Education Ltd., 2004.
5. Potter Merle C., Goldberg J. L., Aboufadel Edward F., 3rd ed., Oxford University Press, New Delhi, 2005.

| University of Mumbai | | | |
|---|---|---|---|
| **Class:** S.E. | **Branch:** Electrical Engineering | **Semester:** III | |
| **Subject:** Power Plant Engineering (Abbreviated as PPE) | | | |
| Periods per Week (each 60 min) | Lecture | 3 | |
| | Practical | --- | |
| | Tutorial | 1 | |
| | | Hours | Marks |
| Evaluation System | Theory | 3 | 100 |
| | Practical and Oral | --- | --- |
| | Oral | --- | --- |
| | Term Work | --- | 25 |
| | Total | 3 | 125 |

| Module | Contents | Hours |
|---|---|---|
| 1 | **Introduction**<br>Conventional and non conventional sources of energy<br>Structure of power industry | 02 |
| 2 | **Economics of the power plant**<br>Load curve, load duration curve, various factors and effects of fluctuating load on operation and design of plant, methods of meeting fluctuating load. selection of generating equipment , load shearing cost of electrical energy , tariff methods, performance and operating of power plants. | 05 |
| 3 | **Thermal power plant**<br>Fuels and their handling, combustion process- fluidized bed combustion, typical layout of power plant , components, working efficiency of thermal power plant, selection criteria | 04 |
| 4 | **Hydro power plant**<br>Rainfall, run off and its measurement , hydrograph, flow duration curve mass curve reservoir storage capacity, classification of plants-run off river plant , storage river plant , pumped storage plant | 05 |
| 5 | **Nuclear power plant**<br>Introduction of nuclear engineering –radioactive decay , half life fission, fusion, nuclear material , thermal fission reactor and power plant – PWR BWR , liquid metal fast breeder reactors , reactor control | 05 |
| 6 | **Diesel and gas turbine power plant**<br>General layout, application of diesel power plant , advantages and disadvantages component, performance of gas turbine power plant , gas turbine material . | 05 |
| 7 | **Environmental impact of power plant** | 05 |

| | | |
|---|---|---|
| | Social and economical issue of power plant, green house effect, Acid precipitation – acid rain and acid snow , dry deposition and acid fog thermal pollution, air pollution , radiation from nuclear power plant effluents | |
| 8 | **Renewable energy sources**<br>**Solar energy**: most common type of plant solar energy & the environment, solar active & passive collector, solar thermal power plant, parabolic trough solar dish & solar power tower.<br>**Wind energy**: – basic, advantages, component of wind electric generator, wind farms, comparison with other energy, limitation efficiency, geothermal energy, tidal energy | 05 |

## Theory Examination:

Question paper will comprise of total 7 questions, each of 20 marks.

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

**Term work:**

Term work consists of minimum eight assignments and a written test. A power plant visit should be arranged and report of the same must be submitted as a part of term work .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.

**Text Books:**

1. M.V. Deshpande , *Elements of power station design* , Tata Mc Graw Hill
2. D.H.Bacon, *Engineering Thermodynamics*, London butterworth
3. P. K. Nag, *Power plant Engineering* - stream & nuclear, Tata Mc Graw Hill

**Reference Books:**

1. Fredrick T. Morse. *Power plant Engineering* , east west press private Ltd
2. Mahesh Varma : *Power plant Engineering* , Metrolitan book Co Pvt Ltd
3. George W. Sutten (Editor) : *Direct Energy Conversion* , Latur university, Electronics series Vol-3, Mc Graw hill

| University of Mumbai | | | |
|---|---|---|---|
| **Class:** S.E. | **Branch:** Electrical Engineering | **Semester:** III | |
| **Subject:** Basic Electronics(Abbreviated as BE) | | | |
| 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 | **Types of Diodes & Application:**<br>**Types of diodes**: Zener, Varactor, Schottkey and PIN diodes.<br>**Rectifier and Filter Analysis**: specification of the devices and components required for C, L, LC, CLC & RC filter.<br>**Clippers and clampers**: Single and double ended clipping circuits, clamping circuits, voltage doubler circuit | 06 |
| 2 | **Bipolar Junction Transistor:**<br>**Biasing Circuits**: Types, dc circuit analysis, load line, thermal runaway, stability factor analysis, thermal stabilization and compensation.<br>**Modeling:** Small signal analysis of all configurations with different biasing network using h-parameter model. Introduction to $r_e$-model and hybrid-pi model.<br>**Amplification.** Derivation of expression for voltage gain, current gain. input impedance and output impedance of CC, CB, CE amplifiers. | 07 |
| 3 | **Field Effect Transistor:**<br>**JFET and MOSFET:** Types, construction and their characteristics, Biasing circuits for FET amplifiers, FET small signal analysis, derivation of expressions for voltage gain and output impedance of CS and CD amplifiers. | 07 |
| 4 | **Low and High Frequency Analysis of BJT and JFET amplifier circuits.** | 04 |
| 5 | **Feedback Amplifiers** (Negative Feedback): Introduction to positive and negative feedback, negative feedback -current, voltage, Series and Shunt type. It's effect on input impedance, | 04 |

| | | |
|---|---|---|
| | output impedance, voltage gain, current gain and bandwidth | |
| 6 | **DC and AC analysis of differential amplifier**, single and dual inputs and balanced and unbalanced outputs using BJT. FET differential amplifier | 04 |
| 7 | **Optoelectronic devices**: Photoconductive , photo emissive and photovoltaic devices, principle, construction and applications, LED, photodiode, phototransistor , solar cell, optoisolators | 04 |

## 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. Study of VI characteristics of standard PN junction diode, zener diode, schottkey diode.
2. Rectifier- Filter performance analysis
3. Study of various clipping and clamping circuits
4. BJT biasing network stability analysis
5. Frequency response of BJT CE amplifier
6. Study of JFET characteristics and calculation of coefficients
7. Study of MOSFET characteristics and calculation of coefficients
8. Frequency response of JFET CS amplifier
9. Study of negative feedback on amplifier performance
10. Study of photo devices applications
11. Study of differential BJT amplifier

**Text Books:**


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


**Reference Books:**


1. Thomas Floyd, '*Electronic Devices*' , Prentice-Hall of India
2. Ramakant A. Gayakwad, *OP – AMPs and Linear IC's*,
3. Newman D.A., *Electronic Circuit Analysis and Design*, 2nd edition, McGraw Hill International.
4. David Bell, *Electronic Devices and Circuits*,5e Oxford University Press

| University of Mumbai | | | |
|---|---|---|---|
| **Class:** S.E. | **Branch:** Electrical Engineering | **Semester:** III | |
| **Subject:** Electrical Network(Abbreviated as EN) | | | |
| Periods per Week (each 60 min) | Lecture | 3 | |
| | Practical | --- | |
| | Tutorial | 2 | |
| | | Hours | Marks |
| Evaluation System | Theory | 3 | 100 |
| | Practical and Orai | --- | --- |
| | Oral | --- | 25 |
| | Term Work | --- | 25 |
| | Total | 3 | 150 |

| Module | Contents | Hours |
|---|---|---|
| 1 | **Network Theorems**<br>Solution of network using dependent sources, mesh analysis, super mesh analysis, nodal analysis, super node analysis, superposition theorem, Thevenin's theorems and Norton's theorem, maximum power transfer theorem. Solution of network with A.C. sources: mesh analysis, nodal analysis, superposition theorem, Thevenin's theorems and Norton's theorem, maximum power transfer theorem, Tellegen's theorem, Millman's theorem, reciprocity theorem, magnetic coupling | 07 |
| 2 | **Graph theory and network topology**<br>Introduction ,graph of network, tree, co-tree, loop incidence matrix, cut set matrix, tie set matrix and loop current, number of possible tree of a graph, analysis of network Network equilibrium equation, duality, general network transformation | 04 |
| 3 | **First Order differential equations**<br>General and partial solutions, time constant, integrating factor more complicated network, initial conditions in elements geometrical interpretation of derivative, procedure for evaluating initial condition, initial condition of networks | 05 |
| 4 | **The Laplace Transform**<br>The Laplace transform and its application to network analysis, transient and steady state response to step, ramp, impulse and sinusoidal input function, transform of other signal waveform, shifted step, ramp and impulse function, waveform synthesis | 05 |
| 6 | **Network Functions; Poles and Zeros**<br>Terminal pairs or ports, network functions for one port and two | 05 |

| | | |
|---|---|---|
| | ports, the calculation of Network functions, ladder network General network, poles and zeros of network functions, restrictions on Pole and zero locations for driving point functions, restrictions on Pole and zero locations for Transfer functions, time domain behavior from pole and zero plot | |
| 7 | **Two port parameters** Relationship of two port variables, short circuit admittance parameters, open circuit admittance parameters, transmission parameters, the hybrid Parameters, relationships between parameter sets, parallel connection of two port networks | 05 |
| 8 | **Network Synthesis** Properties of positive real function, testing of positive real functions, driving point synthesis of LC, RC, RL network. | 05 |

## Theory Examination:

Question paper will comprise of total 7 questions, each of 20 marks.

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

## Oral Examination:

Oral examination will be based on entire subject.

**Term work:**

Term work consists of minimum eight experiment /computer simulations 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.

**Text Books:**


1. M.E. Van Valkenburg, *Network Analysis*, Printce Hall India Private Limited,third Edission.
2. Choudhary D. Roy, *Networks and Systems*, New Age International Publisher


**Reference Book:**


1. Hayt W.H Jr. and Kammerly J.E., *Engineering Circuit Analysis*, T.M.H. Publication, 5th edition

| University of Mumbai | | | |
|---|---|---|---|
| **Class:** S.E. | **Branch:** Electrical Engineering | | **Semester:** III |
| **Subject:** Electrical Measurements and Measuring Instruments(Abbreviated as EMMI) | | | |
| Periods per Week (Each 60 min) | Lecture | 3 | |
| | Practical | 2 | |
| | Tutorial | --- | |
| | | Hours | Marks |
| Evaluation System | Theory Examination | 3 | 100 |
| | Practical and Oral | -- | -- |
| | Oral | | |
| | Term Work | -- | 25 |
| | Total | 3 | 125 |

| Module | Contents | Hours |
|---|---|---|
| 1 | **Units & standards:** Errors in measurements, system of units, Dimensions of electrical qualities in CGS & SI units. | 03 |
| 2 | **Galvanometers:** D.C. permanent magnet moving coil type, ballistic galvanometer, flux meter, A.C. Vibration Galvanometer. (only the basic working principle) | 04 |
| 3 | **Potentiometers:** Principle of D.C. potentiometer (only Crompton's type) & its applications. | 04 |
| 4 | **A.C. bridge methods:** A.C. bridge circuits for measurements of self inductance, capacitance, Q factor & frequency.(only the basic type) | 05 |
| 5 | **Magnetic properties of materials:** The magnetic dipole moment of current loop, diamagnetism, the origin of permanent magnetic dipoles in matter, paramagnetism, ferromagnetism. | 04 |
| 6 | **Magnetic measurements:** Hysterisis loop & B-H curve determination (using step by step method), A.C. power loss in sheet steel by wattmeter method (Epstein square and Llyod- Fisher square). | 05 |
| 7 | **Measuring instruments:** General features of indicating, recording & integrating type of instruments, principles of moving iron, moving coil, rectifier, thermocouple type ammeter & voltmeter, electrostatic voltmeter, extension of ranges for moving coil ammeters & voltmeters, theory of dynamometer type wattmeter, principle of induction type energy meters, errors, testing & adjustments, principles of power factor meter, (dynamometer type only) frequency meters (reed type & moving coil type) & synchroscope (Weston type only). | 07 |

| | | |
|---|---|---|
| 8 | **Instrument transformers:** Theory of current & potential transformers- definition, importance & applications only, definition of Ratio & Phase Angle errors (no derivations). | 4 |

## 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

**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. Demonstration of working parts of types of meter by opening the devices & showing it to students
2. Measurement of low, medium & high resistances
3. Extension of Ranges of Ammeters & Voltmeters

**Study of D.C. potentiometer & its applications for**

4. Calibration of Voltmeter
5. Measurement of resistance
6. Calibration of Ammeter
7. Calibration of Wattmeter

**Measurements using A.C. Bridges**

8. Maxwell's Bridge
9. Hay's Bridge
10. Andersons Bridge

**Text Books:**


1. Sawhney A. K. – *A course in Electrical & Electronic Measurements & Instrumentation* by Dhanpat Rai & Sons 1993
2. Golding E.W. –*Electrical Measurements & Measuring Instruments* by Wheeler Publishing, 5th edition 1994


**Reference Books:**


1. Dekker A.J. –*Electrical Engineering Materials* by Prentice Hall, India , 12th Reprint 1987

| University of Mumbai | | | |
|---|---|---|---|
| **Class:** S.E. | **Branch:** Electrical Engineering | **Semester:** III | |
| **Subject:** Numerical Techniques(Abbreviated as NT) | | | |
| Periods per Week (Each 60 min) | Lecture | 3 | |
| | Practical | --- | |
| | Tutorial | 1 | |
| | | Hours | Marks |
| Evaluation System | Theory | 3 | 100 |
| | Practical and Oral | --- | --- |
| | Oral | --- | --- |
| | Term Work | --- | 25 |
| | Total | 3 | 125 |

| Module | Contents | Hours |
|---|---|---|
| 1 | **Errors in numerical computation:** Error types, analysis and estimation, error propagation. | 02 |
| 2 | **Roots of equations:** The bisection method, the false position method, the Newton-Raphson method, The Secant method. | 05 |
| 3 | **System of Linear Algebraic equations:** Gauss-Elimination method, Gauss-Jordan method. LU decomposition and matrix inversion. Gauss-Seidal method. | 05 |
| 4 | **Curve fitting:** Interpolation- Newton's divided difference, Lagrange Interpolating polynomials, approximation- least square approximation techniques, linear regression and polynomial regression. | 06 |
| 5 | **Numerical differentiation:** Methods based on interpolation and finite differences. | 05 |
| 6 | **Solution to ordinary differential equation:** Picard's method, Euler's method, Modified Euler's method, Predictor-corrector method, Adams-Bashforth method. | 05 |
| 7 | **Optimization:** One-dimensional unconstrained- Golden-section search, quadratic interpolation, Newton's method,linear programming –graphical solution, simplex method. | 06 |
| 8 | **Numerical Integration:** Simpson's 1/3rd rule, Simpson's $3/8^{th}$ rule | 02 |

**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

**Term work:**

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

| | |
|---|---|
| Laboratory work (Programs 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. Chappa Seven C , Canale R P ,*Numerical Methods for Engineers*, Tata McGraw Hill.
2. *Numerical Methods for Engineers,* (using MATLAB and C), Thomson Asia Pvt. Ltd.

| University of Mumbai | | | |
|---|---|---|---|
| Class: S.E. | Branch: Electrical Engineering | Semester: III | |
| Subject: Presentation and Communication Techniques(Abbreviated as PCT) | | | |
| Periods per Week (each 60 min) | Lecture | 02 | |
| | Practical | 02 | |
| | Tutorial | -- | |
| | | Hours | Marks |
| Evaluation System | Theory | --- | --- |
| | Practical and Oral | -- | -- |
| | Oral | --- | -- |
| | Term Work | --- | 50 |
| | Total | -- | 50 |

| | Contents | Hours |
|---|---|---|
| 1. | **Communication in a business organization:** Internal and external communication, Types of meetings, strategies for conducting successful business meetings, documentation (notice, agenda, minutes, resolution) of meetings. Introduction to modern communication techniques. (e-mail, internet, video-conferencing, etc.) Legal and ethical issues in communication (Intellectual property rights: patents, TRIPS, Geographical indications). | 05 |
| 2 | **Advanced technical writing:** Report writing: Definition and importance of reports, qualities of reports, language and style in reports, types of reports, formats (letter, memo, project-repots). Methods of compiling data for preparing report. A computer-aided presentation of a technical project report based on survey-based or reference based topic. The topics are to be assigned to a group of 8-10 students. The written report should not exceed 20 printed pages. Technical paper-writing, Writing business proposals. | 07 |
| 3 | **Interpersonal skills:** Introduction to emotional intelligence, motivation, Negotiation and conflict resolution, Assertiveness, team-building, decision-making, time-management, persuasion | 03 |

| | |
|---|---|
| **Presentation skills:** Elements of an effective presentation, Structure of a presentation, Presentation tools, Audience analysis, Language: Articulation, Good pronunciation, Voice quality, Modulation, Accent and Intonation. | 03 |
| **Career skills:** Preparing resumes and cover letters. Types of Resumes, Interview techniques: Preparing for job interviews, facing an interview, verbal and non-verbal communication during interviews. observation sessions and role-play techniques to be used to demonstrate interview strategies (mock interviews). | 03 |
| **Group discussion:** Group discussions as part of selection process. Structure of a group discussion, Dynamics of group behavior, techniques for effective participation, Team work and use of body language. | 03 |

**erm work:**

**art-I (25 Marks): Assignments;**

wo assignments on communication topics
hree assignments on report-writing
hree assignments on interpersonal skills
wo assignments on career skills
least one class test (written)
stribution of term work marks will be as follows:

| | |
|---|---|
| signments | : 10 marks |
| ritten test | : 10 marks |
| tendance (Theory and Practical) | : 05 marks |

**art-II (25 Marks): Presentation;**

stribution of term work marks will be as follows:

| | |
|---|---|
| roject report presentation | : 15 marks |
| roup discussion | : 10 marks |

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

**ext Books:**


1. Lesikar and Petit, *Report writing for business*, Tata McGraw Hill.
2. Raman and Sangeeta Sharma, *Technical communication*, Oxford University Press, New Delhi.


**eference Books:**


1. Wallace & Masters, *Personal development for Life & work*, Thomson Lerning.
2. Heta Murphy, *Effective Business Communication*, McGraw Hill.
3. Huckin & Olsen, *Technical writing and professional communication*, McGraw Hill.
4. Fred Luthans, *Organizational behavior*, McGraw Hill.

**University of Mumbai**

| | | |
|---|---|---|
| **Class:** S.E. | **Branch:** Electrical Engineering | **Semester:** IV |
| **Subject:** Engineering Mathematics-IV (Abbreviated as EM-IV) | | |
| Periods per Week (60 min. each) | Lecture | 05 |
| | Practical | --- |
| | Tutorial | --- |

| Evaluation System | | Hours | Marks |
|---|---|---|---|
| | Theory | 05 | 100 |
| | Practical and Oral | --- | --- |
| | Oral | --- | --- |
| | Term Work | --- | --- |
| | Total | 05 | 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. | 18 |
| 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. | 25 |
| 3. | **Probability and Statistics :** Concept of probability, conditional probability. Baye's | 17 |

| | | |
|---|---|---|
| | theorem (without proof).<br>**a) Random variable**<br>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.<br>**b) Curve fitting**<br>Correlation, Karl Pearson coefficient & Spearman's rank correlation coefficient (without proof), regression, lines of regression. | |

**Theory Examination:**

1. Question paper will consist of total 7 questions carrying 20 marks each.
2. Only 5 questions need to be attempted.
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.

**Text Books:**


1. Wartikar P.N. / Wartikar J. N., *Textbook of Applied Mathematics*, Pune Vidyarthi Griha Prakashan, 1981.
2. Kreyszig Erwin, Advanced Engineering Mathematics, 8th ed., Wiley Student Edition, New Delhi, 2006.


**Reference Books:**


1. Shastri S.S., *Engineering Mathematics,* Prentice Hall.
2. Shantinarayan, *Matrices*, S. Chand & co.
3. Gupta Kapoor, *Mathematical Statistics.*
4. Glyn James, Advanced Modern Engineering Mathematics, 3rd ed., Pearson Education Ltd., 2004.
5. Potter Merle C., Goldberg J. L., Aboufadel Edward F., 3rd ed., Oxford University Press, New Delhi, 2005.

| University of Mumbai | | | |
|---|---|---|---|
| **Class:** S.E. | **Branch:** Electrical Engineering | | **Semester: IV** |
| **Subject:** Elements of Power System (Abbreviated as EPS) | | | |
| 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**<br>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**<br>**Inductance**<br>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<br>**Resistance**<br>Resistance, Skin effect and proximity effect<br>**Capacitance**<br>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**<br>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**<br>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**<br>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**<br>Types of insulators, potential distribution over a string of suspension insulators, methods of equalizing potential | 05 |
| 7 | **Underground Cable**<br>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**<br>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.

**Text Books:**


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


**Reference Books:**


1. Stevenson's *Modern power system analysis* TMH publication
2. .Mehta V.K.,Chand S. *Principles of power system*
3. Gupta B.R. *Power system analysis & design.*Wheeler publication 3rd edition ,1998

| University of Mumbai | | | |
|---|---|---|---|
| **Class:** S.E. | **Branch:** Electrical Engineering | **Semester:** IV | |
| **Subject:** Electrical Machines – I (Abbreviated as EM-I) | | | |
| Periods per Week (Each 60 min) | Lecture | 4 | |
| | Practical | 2 | |
| | Tutorial | --- | |
| Evaluation System | | Hours | Marks |
| | 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.

**Reference Books:**

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:** Electronics Circuit Design(Abbreviated as ECD) | | | |
| Periods per Week (Each 60 min) | Lecture | 3 | |
| | Practical | 2 | |
| | Tutorial | --- | |
| Evaluation System | | Hours | Marks |
| | Theory | 3 | 100 |
| | Practical and Oral | 2 | 50 |
| | Oral | --- | --- |
| | Term Work | --- | 25 |
| | Total | 5 | 175 |

| Module | Contents | Hours |
|---|---|---|
| 1 | **Cascade amplifiers**<br>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**<br>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**<br>Analysis Class A, B, and AB power amplifiers, design of transformer coupled Class A amplifier | 07 |
| 5 | **Operational Amplifier**<br>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 |

**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

No question should be asked from the pre-requisite module

6. **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. 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

**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:**

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

**University of Mumbai**

| | | |
|---|---|---|
| **Class:** S.E. | **Branch:** Electrical Engineering | **Semester :** IV |
| **Subject:** Analog and Digital Integrated Circuits (Abbreviated as ADIC) | | |
| Periods per Week (Each 60 min) | Lecture | 3 |
| | Practical | 2 |
| | Tutorial | --- |

| Evaluation System | | Hours | Marks |
|---|---|---|---|
| | Theory | 3 | 100 |
| | Practical and oral | --- | --- |
| | Oral | --- | --- |
| | Term Work | --- | 25 |
| | Total | 3 | 125 |

| Module | Contents | Hours |
|---|---|---|
| 1 | **Introduction:** Number systems, binary, octal, hexadecimal and others, conversion from one system to another, binary, BCD and hexadecimal, converting binary to gray & gray to binary and XS3, designing code converter circuit e. g binary to gray, BCD to Seven segment parity generator, weighted, reflective, Sequential, gray, error detecting codes, odd, even parity, Hamming codes, Alphanumeric, morse, teletypewriter ASCII, EBCDIC codes. | 05 |
| 2 | **Boolean Algebra Logic Gates :** AND, OR, NOT, XOR, XNOR, operation NAND, NOR use of the universal gate for performing different operations, laws of boolean algebra De- Morgan's theorems, relating a truth table to Boolean expression multi level circuits. | 04 |
| 3 | **Combinational circuit and Design:** K-Maps and their use in specifying Boolean expressions, Minterm,Maxterm SOP and POS implementation .Implementing logic function using universal gates, variable entered maps for five and six variables function quine Mc Clusky tabular techniques. Binary Arithmetic circuits: Adders, subtractors (Half and Full) BCD adder – subtractor, carry, look ahead adder, Serial adder, multiplier magnitude comparators, Arithmetic Logic units. use of multiplexers in logic design: Multiplexer (ULM) Shannon's theorem ULM trees de- multiplexers, designing using ROMS and ULMS. Hazards in combinational circuits. design of circuit using IC | 06 |
| 4 | **Sequential Logic Circuits :** Comparison of combinational & sequential circuit, multi – | |

| | | |
|---|---|---|
| | vibrators (Astable, monostable and bitable). flip-flops, SR, T, D, JK, Master Slave JK, converting one flip-flop to another, use of debounce switch counters Modulus of a counter, Ripple counters, Up/Down Counter, Designing sequential counters using gate IC and counters IC By drawing state transition diagram & state transition table, ring counter Johnson counter, twisted ring counter. Pseudo random number generator. Unused states and locked conditions. Design of circuit using IC | 05 |
| 5 | **Registers :** Serial input serial output, serial input parallel output,left shift register. Use of register ICs for sequence generator and counters. | 03 |
| 6 | **Memories :** RAM, ROM the basic cell IC bipolar. CMOS, RAM dynamic RAM cell. Magnetic core NVRAM, bubble memory. CCD, PAL, PLA. | 04 |
| 7 | **Logic families :** RTL, DTL, TTL, Schotkey, clamed TTL tristate gate ECL, IIL, MOS devices, CMOS comparison of logic families, interfacing different families. TTL with CMOS, NMOS, TTL ECL & TTL IIL & TTL. | 04 |
| 8 | **Analog IC :** Voltage regulator IC 78xx ,79xx , adjustable voltage regulator using IC 723 , IC 555 timer ( ADC-DAC ) IC 0808 , 0809, function generator IC 8083 | 05 |

**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

**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. 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.

## 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.

**University of Mumbai**

| | | |
|---|---|---|
| **Class:** S.E. | **Branch:** Electrical Engineering | **Semester** IV |
| **Subject:** Electronic Instrument and Instrumentation ((Abbreviated as EII) | | |

| Periods per Week (Each 60 min) | | |
|---|---|---|
| | Lecture | 4 |
| | Practical | 2 |
| | Tutorial | --- |

| Evaluation System | | Hours | Marks |
|---|---|---|---|
| | Theory | 3 | 100 |
| | Practical and oral | --- | --- |
| | Oral | --- | --- |
| | Term Work | --- | 25 |
| | Total | 3 | 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 CRO in tracing diode and transistor characteristics. | 08 |

**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.

**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) 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.

**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.