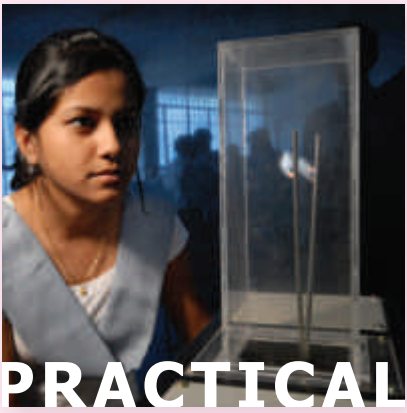
# BHARATI VIDYAPEETH UNIVERSITY,
# Pune.

(Established under Section 3 of UGC ACT 1956)




## COURSE STRUCTURE AND SYLLABUS

**B. Tech. (ELECTRICAL)**
**(Sem. III & IV)**


# COURSE STRUCTURE & SYLLABUS

**BHARATI VIDYAPEETH UNIVERSITY, PUNE**

## B. Tech. (ELECTRICAL) (Sem. III & IV)

## HIGHLIGHTS

Bharati Vidyapeeth University College of Engineering (BVUCOE) is the largest Engineering College in Maharashtra with an intake of 700 students in each academic year. Imparting quality technical education from Under Graduate to Doctorate Level, BVUCOE is probably the only Engineering College in India with an accreditation from both NAAC as well as NBA. The faculty at BVUCOE boasts of highly qualified academicians, a quality that is further emphasized by the fact that 15 of them are presently pursuing their Ph.D. degree.

BVUCOE has been ranked 29th amongst the Top 50 Technical Schools of India in survey conducted by DATAQUEST-IDC. We have enjoyed a ranking in this list for the last 4 years. Research is of utmost importance in all our programs. A total of 113 research papers were published in the academic year 2007-2008.

Currently we have 12 ongoing research projects. The infrastructure of BVUCOE is state-of-the-art with 62 classrooms, 59 laboratories and a well-stocked library that currently holds 27,130 titles. The college has as international presence with MoUs signed with the North Carolina A&T State University (Greensboro, USA), University of Venice (Italy), Actel Corporation (USA).Corporate interaction is also inculcated in our programs through our association with Oracle India Ltd., Infosys Ltd. and Tata Consultancy Services.

## SALIENT FEATURES

Electrical Branch and the Electrical Engineering Department was established in the year 1987 with the permission of AICTE New Delhi with an intake capacity of 60 students. The college and the course were affiliated to the University of Pune. The University Grants Commission and the Ministry of Human Resource Development, Govt. of India awarded the Deemed University status to the Institution and the Department in the year 2000.

The specious infrastructure, well equipped laboratories, meritorious students and academically qualified and enthusiastic faculty being the salient features of the Department. Electrical Department runs U.G., P.G. & Ph.D. courses and imparts education of very high standard and has created its own impression in the society. The students are admitted to B.E. & M.E. course through Common Entrance Examination conducted on All India Basis.

More than 900 students have acquired B.E. (Electrical) degree and most of them have attained high positions in the organizations of repute. Some students continued their studies abroad and some have their own business. This shows the versatility of the knowledge they acquired in the department.

The department, apart from routine academic Curriculum takes keen interest in several other academic activities like conducting seminars, workshops, conferences, expert lectures etc. and updates the practical aspects through industry -institute interaction. The department maintains good culture and discipline by having close association with each student through 'Teacher Guardian Scheme'. One of the main achievements of the department is that in last 3 years BE Electrical students were placed 100 % in top ranking companies in India and abroad.

Infra structure of the Department

The total space available is 785 sq. mts. and has Four class rooms, and following **Laboratories:**

Electrical Machines Labs [A &B], Electrical Measurements and Instrumentation Lab, Switch gear protection and H V Lab, Network Analysis and Microprocessor Lab, Industrial Drives and Control and Basic Electrical Lab, Computer and Software Center / Lab, Power System Lab, Control System Lab

**DEPARTMENTAL LIBRARY**

The Departmental Library, organized by ASEE, is having good number of titles of Text Books, Reference books. Technical Journals U G and P G Seminar and Dissertation Reports, Audio Video CDs on Technical Topics.

**MAJOR GROUPS/AREAS IN THE DEPARTMENT**

Electrical Power System, SCADA and Automation, Computer Applications in Power Systems, Electrical Control Systems, Electrical Machines, Electrical Drives and Control, Electrical Measurements, High Voltage Engineering, Microprocessors and controllers

**EXPERTISE IN RESEARCH AND CONSULTANCY**

The department is actively engaged in number of research projects, which are sponsored, by A.I.C.T.E., U.G.C. & other funding agencies.

**MAJOR EQUIPMENTS**

Synchronous Induction Motor, Linear Induction Motor, Microprocessor Kits, Relay Testing Kit, HV transformer with Sphere gap arrangement, Alternator Protection scheme, Switchgear Testing Kits

**SOFTWARES**

PSCAD, ETAP, Electro-2D/3D, Magneto-2D/3D, ORSTEAD, MATLAB, All other Licensed Windows, Antivirus [Quick Heal]

**Students Placements:**

Recruitment of the Electrical students through Campus Interview

The students are selected in various Companies Like TCS, CTS, Infosys, Wipro, Kanbay, Accenture, Tech Mahindra , HSBC,ICICI Bank ABB, AREVA T&D, Siemens, Rockwell Automation, JSW, L&T, CG, NDPL, Tata Power, Bhatiya Group of Companies-Power Machines Ltd. Dubai, US Technology & many more.

In 2004-05 Placement of the Electrical students was 100 % [57 Out of all 57 Eligible students]

In 2005-06 Placement of the Electrical students is 100 % [ 58 Out of 58 Eligible Students].

In 2006-07 Placement of the Electrical students is 100 % [ 60 Out of 60 Eligible Students].

## B. Tech. - Electrical Engineering

### Semester III

**Total Duration** : 31 Hrs/Week
**Total Marks** : 750

| Subject Code | Subject | Teaching Scheme | | | Examination Scheme (Marks) | | | | Total (Marks) |
|---|---|---|---|---|---|---|---|---|---|
| | | L | P | D | Theory | Unit Test | TW & Pr | TW & Or | |
| K70201 | Engineering Mathematics - III | 04 | - | - | 80 | 20 | - | - | 100 |
| K40202 | DC Machines Theory & Design | 04 | 02 | 02 | 80 | 20 | 50 | 50 | 200 |
| K40203 | Electronics Devices & Circuits | 04 | 02 | - | 80 | 20 | - | 50 | 150 |
| K40204 | Numerical Methods & Computer Programming | 05 | 02 | - | 80 | 20 | - | 50 | 150 |
| K40205 | Electrical Measurements & Measuring Instruments | 04 | 02 | - | 80 | 20 | 50 | - | 150 |
| | **Total** | **21** | **08** | **02** | **400** | **100** | **100** | **150** | **750** |

| Teaching Scheme | | | Examination Scheme | | | | Total |
|---|---|---|---|---|---|---|---|
| Lectures | Practical | Drawing | Theory | Test | T. W. & Pr | T. W. & Or. | |
| 21 | 08 | 02 | 400 | 100 | 100 | 150 | 750 |

### Semester IV

**Total Duration** : 31Hrs/Week
**Total Marks** : 750

| Subject Code | Subject | Teaching Scheme (Hrs) | | | Examination Scheme (Marks) | | | | Total (Marks) |
|---|---|---|---|---|---|---|---|---|---|
| | | L | P | D | Theory | Unit Test | TW & Pr | TW & Or | |
| K40206 | Linear &Digital Integrated Circuits | 04 | 02 | - | 80 | 20 | - | 50 | 150 |
| K40207 | Transformer Theory & Design | 05 | 02 | 02 | 80 | 20 | 50 | 50 | 200 |
| K40208 | Network Analysis | 04 | 02 | - | 80 | 20 | 50 | - | 150 |
| K40209 | Instrumentation | 04 | 02 | - | 80 | 20 | - | 50 | 150 |
| K402010 | Power Generation Techniques | 04 | - | - | 80 | 20 | - | - | 100 |
| | **Total** | **21** | **08** | **02** | **400** | **100** | **100** | **150** | **750** |

| Teaching Scheme | | | Examination Scheme | | | | Total |
|---|---|---|---|---|---|---|---|
| Lectures | Practical | Drawing | Theory | Test | T. W. & Pr. | T. W. & Or. | |
| 21 | 08 | 02 | 400 | 100 | 100 | 150 | 750 |

# RULES FOR CONDUCTING TESTS

**Mode of the test**

In each semester for each subject three tests shall be conducted. The Schedule for the same will be declared at the commencement of academic year in the academic calendar.

Each test shall carry 20 marks.

University examination pattern has given weightage of 20 marks for the tests.

To calculate these marks following procedure is followed:

i) Out of the three tests conducted during the semester, the marks of only two tests in which the candidate has shown his/her best performance shall be considered, to decide the provisional marks in each subject.

ii) Average marks obtained in two tests in which students have performed well, shall be considered as provisional marks obtained by the student in the tests.

iii) If the candidate appears only for two tests conducted during the semester, he/ she will not be given benefit of the best performance in the tests.

iv) If the candidate appears only for one test conducted during the semester, to calculate the marks obtained in the tests it will be considered that the candidate has got 0 (zero) marks in other tests.

v) The provisional marks obtained by the candidate in class tests should reflect as proportional to theory marks. In cases of disparity of more than 15% it will be scaled down accordingly; These marks will be final marks obtained by the student. No scaling up is permitted.

vi) If the candidate is absent for theory examination or fails in theory examination his final marks for tests of that subject will not be declared. After the candidate clears the theory, the provisional marks will be finalized as above.

Paper Pattern for Tests

i) All questions will be compulsory with weightage as following

| | | |
|---|---|---|
| Question 1 | - | 7 marks |
| Question 2 | - | 7 marks |
| Question 3 | - | 6 Marks |

ii) There will not be any sub-questions.

For granting the term it is mandatory to appear for all the three tests conducted in each semester.

Roll numbers allotted to the students shall be the examination numbers for the tests.

# SEMESTER - III

# K70201: ENGINEERING MATHEMATICS – III

**TEACHING SCHEME**
Lectures : 04 Hrs/week

**EXAMINATION SCHEME**
Theory : 80 Marks
Duration : 03 Hours
Unit Test : 20 Marks

---

**Unit-I** (09 Hours)

**Differential Equations:**

Solution of Linear differential equation of nth order with constant coefficients, Method of variation of parameters, Cauchy's and Legendre's linear equations, Simultaneous linear differential equations, Total differential equations, Symmetrical simultaneous differential equations. Applications to Electrical circuits.

**Unit-II** (08 Hours)

**Complex Variables:**

Function of complex variables, Analytic function, Cauchy–Riemann equations, conformal mapping, bilinear transformation, Residue theorem, Cauchy's Integral theorem and Cauchy's Integral formula.

**Unit III** (09 Hours)

**Transforms:**

Fourier transforms: Fourier integral theorem, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms, Inverse Fourier transforms, Discrete Fourier transform and its applications.

Z -Transform: Definition, Properties, Inverse Z-Transform, Applications to difference equation, Relationship between Z-Transform and Fourier Transform.

**Unit-IV** (09 Hours)

**Laplace Transform:**

Definition, Properties and Theorems, Inverse Laplace transform, Methods of finding Inverse Laplace transforms, Laplace transform of Unit-step function, Dirac-delta functions, Periodic functions, Ramp functions, Error function, First order Bessel's function, Si(t), Ci(t), Ei(t) Applications to solution of linear differential equations.

**Unit-V** (09 Hours)

**Vector Differentiation:**

Vector Differentiation, Gradient, Divergence and Curl, Directional derivative, Vector identities, Irrotational and Solenoidal vector fields.

**Unit-VI** (08 Hours)

**Vector Integration:**

Line integral, Surface integral and Volume integral, Work done, Gauss-Divergence theorem, Stoke's theorem and Green's lemma, Applications to Electromagnetic fields.

**Text Books / References**


Peter V. O'Neil, Advanced Engineering Mathematics, 5th ed., Thomson Learning

Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Ltd.

Wylie C. R. and Barrett L. C., Advanced Engineering Mathematics, McGraw-Hill

M. D. Greenberg, Advanced Engineering Mathematics, 2nd ed. Pearson Education

B. S. Grewal, Higher Engineering Mathematics, Khanna Publication, Delhi

P. N. Wartikar and J. N. Wartikar, Applied Mathematics (Volume I & II), Pune Vidyarthi Griha Prakashan

Murray R. Spiegel, Laplace Transforms, Schaum's Outline Series – International Edition


**Syllabus for Unit Test**

| | |
|---|---|
| Unit Test 1 | Unit I & IV |
| Unit Test 2 | Unit II & V |
| Unit Test 3 | Unit III & VI |

# K40202: DC MACHINE THEORY & DESIGN

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 04 Hrs/week | Theory | : 80 Marks |
| Practical | : 02 Hrs/week | Duration | : 03 Hours |
| Drawing | : 02 Hrs/week | Unit Test | : 20 Marks |
| | | T.W. & Or. | : 50 Marks |
| | | T.W. & Pr. | : 50 Marks |

**Unit-I** (08 Hours)

**DC Generator:**

Basic principle of working, E.M.F. equation, Types, characteristics and applications of different types of D.C. generators.

Armature reaction in d.c. generators & its effects. Remedies to overcome armature reaction. Process of commutation & types, causes of bad commutation and remedies, interpoles, compensating windings.

**Unit-II** (08 Hours)

**DC Motors:**

Basic principle of working, Significance of Back e.m.f., Torque equation, Types, characteristics and applications of different types of d.c.motors, Starting, reversing and armature voltage and field control method of speed control, Starters. Armature reaction in dc motors. Study and working principle, control and performance and applications of brushless DC motor & permanent magnet motors.

**Unit-III** (08 Hours)

**Testing of DC Machines:**

Losses, efficiency, condition for maximum efficiency and maximum power output, effect of saturation and armature reaction on losses.

Insulation resistance, Brake Test, Swinburne's test, Regenerative test on shunt motors, Separation of various losses, retardation test, type and routine tests according to ISI specifications.

**Unit-IV** (08 Hours)

**Design of DC Machines**

Choice of specific electric and specific magnetic loading. Determination of

main dimensions using output equation. Design of field system and interpoles. Design of armature. Design of commutator and brushes.

**Unit-V** (08 Hours)

**Estimation from Design:**

Estimation of machine performance in respect of losses, temperature rise and efficiency.

Design of heating coil, motor resistance starter, regulators,

lifting magnets.

**Unit-VI** (08 Hours)

**Heating , Cooling and Ventilation**

Study of different modes of heat generation, temperature rise, heat dissipation, heating and cooling curves, heating time constants, cooling time constants, their estimation, dependence and application.

**List of Practical**

Determination of magnetization, external and internal characteristics of D. C. generator

Speed control of D. C. Shunt motor by Armature and Field control

Study of three point and four point starters

Load test on D. C. Shunt motor

Retardation test on D. C. machine

Hopkinson's test on D. C. machine

Swinburne's test on D. C. machine

**Note**

The term work shall consist of the record of minimum five experiments based on the course outline above.

In design a report of design of dc machine is prepared for a typical dc machine which will contain the entire design procedure and calculations and sketches with dimensions calculated on 1/8 size drawing paper.

**Text Books/References**

B. L. Theraja, Electrical Technology Vol. II
A. E. Clayton, Performance and Design of DC Machines
A. K. Shawney, Electrical Machine Design
R. K. Agarwal, Principle of Electrical Machine Design
S. K. Bhatacharya, Electrical Engineering Drawing
K. L. Narang, Electrical Engineering Drawing

**Syllabus for Unit Test**

| | |
|---|---|
| Unit Test 1 | Unit I & II |
| Unit Test 2 | Unit III & IV |
| Unit Test 3 | Unit V & VI |

## K40203 : ELECTRONICS DEVICES AND CIRCUITS

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 04 Hrs/week | Theory | : 80 Marks |
| Practical | : 02 Hrs/week | Duration | : 03 Hours |
| | | Unit Test | : 20 Marks |
| | | T. W. & Or. | : 50 Marks |

---

**Unit -I** (08 Hours)

**Transistor Theory:**

Transistor circuits- C E ,C B, C C, Cathod follower –comparison Biasing, Temp stabilization, Low frequency analysis usingh-parameters [for C E only], Methods and effects of cascading, frequency response

**Unit –II** (08 Hours)

**A F power Amplifiers:**

Types and class of operation, efficiency of operation considerations. Feedback amplifiers, Types, negative feedback identification of different topologies.

**Unit-III** (08 Hours)

**Special Devices:**

Principles, Characteristics, applications of - FET, UJT, PUT, DIAC, Opto electrical Devices, opto couplers, opt isolators, Optical Decoders, Display Devices such as LED, LCD

**Unit-IV** (08 Hours)

**Digital Circuit:**

Multivibrators, Free running, Mono, Bi-stable, Schmitt trigger, Logic Gates, Types, combinations, applications, truth tables, Single bit comparators, adder, subtractor circuits, Various types of flip-flops- SR, D, JK.

**Unit-V** (08 Hours)

**Shift Registers and counters:**

Types applications and operations of counters – synchronous and asyn, Decade BCD, N-Modulo, Ring, Johnson, Study of Ics-7495, 7490, 7492-93 shift registers, Pulse train generators.

Study and operation of RAM, NVRAM, SRAM, DRAM, ROM, EPROM, PLA, FPLA.

**Unit-VI** (08 Hours)

**Regulated power supplies:**

Discrete, series, shunt regulators, Protection circuits, study of IC regulators- 723, 317, 7805, with applications

**List of Practicals**

Transistor : Biasing and Stabilization

Multistage Amplifiers : Effect of cascading on gain and frequency response

Characteristics and performance of Single Stage FET Amplifier

Audio Frequency Power Amplifier Performance

Feedback Amplifiers : Current series / shunt feedback, effect of negative feedback on Input impedance, output impedance, gain and bandwidth

**OR**

Voltage series / shunt feedback, effect of negative feedback on input impedance, output Impedance, gain and bandwidth

Regulated Power Supplies : Discrete Regulators – shunt and series regulators circuits

**OR**

IC 723 ( low voltage / high voltage ) line, load regulation and performance calculations

Characteristics and applications of optoelectronic devices (viz. photodiode, Phototransistor, LDR, Photovoltaic cell)

Applications of Op-Amp : Inverting, Non-Inverting, Voltage follower, summer, Subtractor

**OR**

Integrator, Differentiator, Multiplication and Division ( Using log, antilog), comparator

Applications of Logic Gates : Study of single bit comparator, BCD Adder or Subtractor ( using IC 7483)

**OR**

Verification of truth tables of SR, D and JK flip-flops and use of flip-flops as counters

**Note**

The term work shall consist of the record of minimum 8 experiments based on the course outlined above.

**Text Books/References**


Boylestad and Nashelsky, Electronic Devices and Circuits Theory, PHI

Ramakant Gaikwad, Operational Amplifiers, PHI

Malvino Leach,Digital Principles, TMH

Deboo Burroughs, Optoelectronics, TMH

C.W. Lander, Power Electronics, TMH

Millman and Halkais, Integrated Electronics, MGH


**Syllabus for Unit Test**

| | |
|---|---|
| Unit Test 1 | Unit I & II |
| Unit Test 2 | Unit III & IV |
| Unit Test 3 | Unit V & VI |

# K40204: NUMERICAL METHODS & COMPUTER PROGRAMMING

**TEACHING SCHEME**
Lectures : 05 Hrs/week
Practical : 02 Hrs/week

**EXAMINATION SCHEME**
Theory : 80 Marks
Duration : 03 Hours
Unit Test : 20 Marks
T. W. & Or. : 50 Marks

---

**Unit-I** (08 Hours)

**Introduction to Numerical Computations:**

Basic Principle of numerical methods and necessity of computers for high speed calculations. Mathematical Preliminaries: Rolle's Theorem, Generalized Rolle's Theorem, Intermediate Value Theorem, Mean-Value Theorem for Derivatives. Errors and their Computation: Absolute, Relative and Percentage Erros.

**Unit-II** (08 Hours)

**Transcendental and Polynomial Equations:**

Roots of an equation and methods to find the same. Methods to solve equations like Bisection, Secant, Regula-Falsi, Newton-Raphson methods, Single Variable, Multivariable Newton-Raphson Technique.Linear Algebraic Simultaneous Equation: Methods like Gauss elimination method and Gauss Jordan method. Iterative method like Gauss-Siedel method, accelerated Gauss- Siedel method and Jacobi's method.

**Unit-III** (08 Hours)

**Interpolation:**

Introduction to Interpolation and calculus of finite differences. Polynomial interpolation methods- Lagranges, Newton's forward, backward and central difference methods, Sterling and Bessel's interpolation.

**Unit-IV** (08 Hours)

**Differentiation and Integration:**

Numerical differentiation using simple interpolation techniques like Lagrangian and Newton Gregory method. Numerical integration using Trapezoidal, Simpsons rule as a special case of Newton cote quadrature techniques. Solution of ordinary differential equation using Euler's, Modified Euler's, Taylor series methods, Runge-kutta second and fourth order techniques using Hune's and polygon method.

**Unit-V** (08 Hours)

**C++ Programming:**

Object Oriented Programming (OOPS) concepts, Class and objects, Abstraction, Encapsulation, Inheritance, and Polymorphism, Attributes of class, Functions in C++- Parameter passing Mechanism, Function overloading, Default values, Inline Functions, Virtual functions, Friend Functions, Static Members and Functions, Inheritance- Types of Inheritance Defining derived class, Access Control, Public - Protected and Private derivation, Derived class constructors, Destructors, Overloading Member functions, Object as a class member, Polymorphism- What is polymorphism, static polymorphism, overloaded Functions, overloaded operators, Operator overloading, L'nary operators Overloading, Dynamic polymorphism.

**Unit-VI** (08 Hours)

**Object- oriented software development with C++:**

Evolution of the software development processes, stream and files- stream classes, stream errors, use case modeling and the programming problem, from use case to classes.

**Term work of NMCP**

LIST OF PROGRAMS using C++

Newton -Raphson method
Gauss elimination method

Lagranges Interolation method
Newton's divided difference interpolation method
Trapezoidal method
Euler's method
Runge Kutta 4$^{th}$ order method
C++ program on Inheritance
C++ program on Polymorphism
C++ program on derived class constructor and destructor

**Note**

The term work shall consist of the record minimum 8 Experiments of the above.

**Text Books/References**


S. S. Sastry, Introductory Methods of Numerical Analysis

M. K. Jain, R. K. Jain, Numerical methods for Scientific and Engineering Computation

Santosh K. Gupta, Numerical methods for Engineers, Wiley Eastern Ltd.

Stagg and E. I. Abid, Computor Methods in power system analysis, TMH (Japan Edn.)

J. B. Scaborough, Numerical Mathematical Analysis

Robert Lafore, Object oriented programming in C++, Techmedia Publications

James P. Cahoon, Jack W. Davidson, C++ Program design, TMH Series

Al Stevens, Clayton Walnum, C ++ Programming-Bible

Balguruswamy, Object Oriented Programming in C++


**Syllabus for Unit Test**

| | |
|---|---|
| Unit Test 1 | Unit I & II |
| Unit Test 2 | Unit III & IV |
| Unit Test 3 | Unit V & VI |

# K40205: ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 04 Hrs/week | Theory | : 80 Marks |
| Practical | : 02 Hrs/week | Duration | : 03 Hours |
| | | Unit Test | : 20 Marks |
| | | T. W. & Pr. | : 50 Marks |

## Unit -I

(08 Hours)

**Introduction:**

Significance of measurement, classification of instruments, mechanical, electrical, electronic instruments, deflection and null type, applications of measurement system.

**Units:**

Absolute units, Fundamental and derived units, international system of units. Dimensions of mechanical, electrical quantities. Absolute measurement of current and resistance. Standards and their classification. Electrical standards of emf , current ,resistance

**Measuring instruments:**

Static characteristics of an instrument, Accuracy, linearity, sensitivity, reproducibility, resolution, Types of errors, necessity of different torques in indicating instruments, recording instrument integrating instrument.

**Measurement of current and voltage:**

Construction, Principle of operation, torque equation and sources of errors in PMMC, Moving Iron instrument, dynamometer type instrument, Extension of ranges using shunts and multipliers.

**Galvanometer:**

Construction, principle of operation of D'Arsonval, vibration and ballistic galvanometer

## Unit II

(08 Hours)

**Instrument Transformers:**

Advantages of instrument transformers over shunts and multipliers, use of instrument transformers, expression for ratio and phase angle errors in case of C.T. and P.T. (No derivation), precaution in using instrument transformers. Clip on ammeter.

**Unit –III** (08 Hours)

**Measurement of resistance :**

Classification of resistances, measurement of Medium resistance, ammeter voltmeter method, Wheatstone bridge, sensitivity of Wheatstone bridge, limitations of the method, measurement of low resistance. D.C. Potentiometer- Calibration of ammeter and voltmeter application, Kelvin bridge, Ohmmeter , measurement of high resistance, difficulties in measurement, use of guard circuit, direct deflection method, loss of charge method, earth tester and measurement of earth resistance, megger.

**A.C. Bridges :**

Generalized equation of balance, Difference between Dc Bridge and Ac Bridge, Measurement of inductance using Maxwell's Bridge, Anderson bridge , Measurement of capacitance using Schering bridge,

(No derivation , only numericals based on balance Equations)

**Unit-IV** (08 Hours)

**Measurement of power:**

Construction, principle of operation of Electrodynamometer type wattmeter, low power factor wattmeter, Errors and their compensation. Measurement of power in three phase circuit for balanced and unbalanced load by one wattmeter and two wattmeter method. Effect of power factor variation on wattmeter reading in two wattmeter method, Measurement of reactive power in three phase balanced load by one wattmeter method. Measurement of power using CT and PT, Three phase wattmeter.

**Unit-V** (08 Hours)

**Measurement of energy:**

Construction, principle of operation and torque equation of induction type energymeter, errors and adjustments. Calibration of energymeter, three phase three wires, and three phase four wire energy meter, electronic energy meter

**Other measuring instruments:**

Power factor meter (electrodynamometer type only), frequency meter (Vibration, Weston type only), synchroscope, Phase sequence indicator, tri-vector meter, maximum demand indicator.

**Unit-VI** (08 Hours)

**Digital equipment:**

comparison between analog and digital instrument s, difference amplifier type electronic voltmeter, rectifier type , peak reading instruments .block diagram and principle of operation of digital multimeter, Function generator block diagram and working, digital storage oscilloscope, Harmonic distortion analyzer block diagram and working.

**List of Practical**

To observe construction and identify parts of PMMC, MI voltmeter, ammeter Electrodynamometer wattmeter, energymeter and write down symbols and Specifications

To measure power in three phase balanced load by one wattmeter method

To measure power in three phase balanced/ unbalanced load by two wattmeter method

To measure reactive power in three phase circuit by one wattmeter method.

To extend range of wattmeter by use of CT and PT

To calibrate single phase energymeter at

i) Unity power factor
ii) 0.5 lagging power factor
iii) 0.5 leading power factor

Calibration of ammeter and voltmeter with the help of potentiometer

To measure low resistance with Kelvin double bridge

To measure earth resistance by earth tester

To measure unknown inductance by Anderson bridge

**Note**

The term work shall consist os the record of minimum 8 experiments out of the above.

**Text Books/References**

A. K. Sawhney, A course in electrical and electronic measurements and instrumentation, Dhanpat Rai and Company

Golding, Electrical measurements

C. T. Baldwin, Electrical measurements

W. D. Cooper, Electronic instrumentation and measurement techniques, Prentice Hall of India
H. S. Kalsi, Electronic instrumentation, Tata McGraw Hill

**Syllabus for Unit Test**

| | |
|---|---|
| Unit Test 1 | Unit I & II |
| Unit Test 2 | Unit III & IV |
| Unit Test 3 | Unit V & VI |

# SEMESTER - IV

## K40206: LINEAR & DIGITAL INTEGRATED CIRCUITS

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 04 Hrs/week | Theory | : 80 Marks |
| Practical | : 02 Hrs/week | Duration | : 03 Hours |
| | | Unit Test | : 20 Marks |
| | | T. W. & Or. | : 50 Marks |

**Unit -I** (08 Hours)

**Basic circuits for Analog ICs :**

Current sources -Widlar, Wilson, and MOSFET voltage sources active level shifters, single supply operation and biasing, external offset, and its compensation. The characteristics of the Operational Amplifiers, open loop and closed loop operations, thermal drift, Important Parameters- Power supply rejection Ratio, Slew rate, gain etc

**Unit –II** (08 Hours)

**Applications of Operational Amplifier :**

AC amplifiers, Norton Amplifier, Instrumentation amplifier, Isolation amplifier with strain gauge and thermister with signal conditioning circuits. Precision full wave and half wave rectifiers, comparators and Schmitt trigger, peak detector clipper and clamper circuits.

**Unit-III** (08 Hours)

**Other applications :**

Basic applications –multipliers, deviders, square root, Adder, sub tractor etc. Waveform generators-Multi vibrators, sine, square, triangular generators, Study of ICs- 8038, 555, 556, LM 324, 741, LM380

**Unit-IV** (08 Hours)

**Digital Electronics :**

Number systems- Binary, Octal, Hexadecimal, conversion methods, Binary addition and subtraction method, 1's and 2's compliment method.

Concept of coding, BCD codes, 8421, Excess-3, Gray code, codes more than 4-bits, ASCII code

**Unit-V** (08 Hours)

**Logic Circuits :**

Logic families: TTL Nand gate, specifications, tri state TTL, ECL, MOS, CMOS families, and their interfacing.

**Unit-VI** (08 Hours)

**Combinational Logic :**

Code conversion, arithmetic circuits, Half and full adder, Subtractor, Binary serial and parallel Adder, IC 7483, BCD Adder, Excess-3 Adder, Digital comparator.

Multiplexer, Demultiplexer, Encoder, Decoder and their applications, Design of ALU.

**List of Practical**

Study of characteristics of typical 74 TTL / 74 CMOS family like : fan in, fan out Standard load, noise margin & interfacing with other families

Half, Full Adder and Subtractor using gates and Ics

code conversion using digital IC'S

Function implementation using Multiplexer and Demultiplexer

Sequence generator using MSJK flip flop IC'S

Study of shift registers : Shift left, Shift right, parallel loading, and pulse train generator

Testing precision full and half wave rectifier

Waveform generator Ics and their circuits

Testing of circuit s using IC 555, Astable and Monostable mode.

Study of characteristics of ICs- 8030, 556

Some of the Following experiments should be implemented using PSPICE or MATLAB

i) Schmitt trigger

ii) Integrator and differtiator

iii) Precision rectifier

iv) PLL/Log antilog/555 circuits

**Note**

The term work shall consist atleast 8 experiment out of the experiments given above.

**Text Books/References**


Ramakant Gaikwad, Op AMP & Ics, PHI

D. Roy Chaudhary, Linear Integrated Circuits, PHI

G B Clayton, Op Amps, ELBS

K R Botkar, Integrated Circuits, Khanna Publisher

R P Jain, Modern Digital Electronics, TMH

Tocci, Digital Systems and Applications, PHI

Douglas Halls, Digital Circuits and Systems, McGHola


**Syllabus for Unit Test**

| | |
|---|---|
| Unit Test 1 | Unit I & II |
| Unit Test 2 | Unit III & IV |
| Unit Test 3 | Unit V & VI |

## K40207: TRANSFORMER THEORY & DESIGN

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 05Hrs/week | Theory | : 80 Marks |
| Practical | : 02Hrs/week | Duration | : 03 Hours |
| Drawing | : 02Hrs/week | Unit Test | : 20 Marks |
| | | T. W. & Or. | : 50Marks |
| | | T. W. & Pr. | : 50 Marks |

**Unit -I** (08 Hours)

**Single Phase Transformers:**

Working Principle, construction, Types of Transformer, E.M.F. equation and transformer ratio, Transformer on No load, Transformer on load, Equivalent resistance, Magnetic leakage, Transformer with resistance & magnetic leakage, Equivalent circuit of Transformer. Open circuit and Short circuit tests on single phase Transformer, Efficiency of a Transformer, Condition for maximum efficiency,

Kapp regulation diagram, Back to back test, All day efficiency of Transformer, Parallel operation of single phase Transformer.

**Unit –II** (08 Hours)

**Pholyphase Transformers:**

Connecting a bank of three single identical single phase transformers. Construction of three phase shell and core type transformer.

Comparison between single three phase unit and three single phase units, standard connections for three phase transformer, their voltage phasor diagrams, phasor groups, Floating neutral, parallel operation of three phase transformers, Three winding transformers, Tertiary winding and use of it in three phase transformers.

Tap changer: types- construction & working.

**Unit-III** (08 Hours)

**Testing & Maintenance of Transformers:**

Concept of polarity of transformer windings, standard practice of marking transformer winding terminals, polarity test using ac supply and voltmeter, open circuit and short circuit tests, methods of carrying out tests and information obtained from these. Sumpner's test (Back to back).

I.S. Specifications of transformers. Concept of routine and type tests.

Testing of transformers as per I.S. specifications.

Transformer oil maintenance, transformer oil testing as per I.S.

**Unit-IV** (08 Hours)

**Design of Transformers:**

Design of distribution and power transformers, specifications, design of main dimensions, core, yoke, winding, tank and cooling tube radiators

**Unit-V** (08 Hours)

**Performance Evaluation:**

Estimation of leakage reactance for equal heights for HV and LV windings. Resistance of windings, Calculations of no load current and losses. Voltage regulation and efficiency. Calculation of mechanical forces during short circuits, remedies to overcome them.

**Unit-VI** (08 Hours)

**AC windings:**

Single and double layer single phase AC winding with integral and fractional slots. Single and double layer integral and fractional slots in case of 3 phase AC winding.

**List of Practicals**

Open circuit and short circuit tests on a single phase transformer.

Polarity test on single phase and three phase transformers

i) Using ac supply and voltmeter

ii) Using battery, tap-key and dc galvanometer.

Study of standard connections for three phase transformers, line to line voltage ratios and phasor groups.

Sumpner's test on two identical single phase transformers.

T- connection of two single phase transformers on no load and at balanced load

V- connection of two single phase transformers on no load and at balanced load

**Note**

The term work shall consist of the record of all five experiments based on the course outline above.

In design, a report of design of transformer is prepared which will contain the entire design procedure, calculations and sketches with dimensions calculated on 1/8 size drawing paper.

**Text Books/References**

M. G. Say, The performance & design of A.C. Machines
B. L. Theraja, Electrical Technology (Vol. II)
U. A. Bakshi, Electrical Circuit & Machine
B. H. Deshmukh, Electrical Technology
A. K. Shawney, Electrical Machine Design
R. K. Agarwal, Principle of Electrical Machine Design
S. K. Bhatacharya, Electrical Engineering Drawing
K. L. Narang, Electrical Engineering Drawing

**Syllabus for Unit Test**

| | |
|---|---|
| Unit Test 1 | Unit I & II |
| Unit Test 2 | Unit III & IV |
| Unit Test 3 | Unit V & VI |

## K40208: NETWORK ANALYSIS

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 04 Hrs/week | Theory | : 80 Marks |
| Practical | : 02Hrs/week | Duration | : 03 Hours |
| | | Unit Test | : 20 Marks |
| | | T. W. & Pr. | : 50 Marks |

---

**Unit -I** (08 Hours)

**Network Theorems:**

Introduction, Thevenin's theorem, Norton theorem, Superposition theorem, Maximum power transfer theorem, Millman's, Reciprocity, Substitution, Compensation, Tellegen's Theorem.

**Unit –II** (08 Hours)

**Transient Response of Passive Circuits:**

Introduction, transient response of series R-L and R-C circuit having DC excitation, Transient response in RL and RC circuit with sinusoidal excitation. Transient response in RLC circuit with DC and sinusoidal excitation

**Unit-III** (08 Hours)

**Laplace Transformation and its application:**

Laplace transform of a derivative and integration. Laplace transform of common forcing functions, Initial and final value theorem, Time displacement theorem, Convolution theorem, Impulse response of R-L and R-C Circuit, Application of Laplace transformation technique in electric circuit analysis.

**Unit-IV** (08 Hours)

**Two Port Networks:**

Short circuit admittance, open circuit impedance, transmission and inverse transmission, hybrid and inverse hybrid parameters. Relation between parameter sets, T, Ladder, lattice, twin T networks. Input and out put impedance in terms of two port parameters. Interconnection of networks, Symmetry and reciprocity.

**Unit-V**

**Network Functions:**

Network function for one port and two port networks, ladder networks, general network, poles and zeros of network functions, Restriction on poles and zeros for driving point functions and transfer functions.

**Unit-VI**

**Fourier Analysis:**

Exponential form of Fourier series, trigonometric form of Fourier series, symmetry in Fourier series, Frequency spectrum, properties of Fourier analysis, shifting of function, applications in circuit analysis.

**List of Practical**

Determination of time-response of R-C circuit to a step DC voltage input(charging and discharging of a capacitor through a resistor)

Determination of time-response of R-L circuit to a step DC voltage input ( Rise and decay of current in an inductive circuit)

Determination of frequency-response of an R-C series circuit.

Verification of Superposition and Thevenin's Theorem.

Verification of Reciprocity Theorem.

Determination of step-response of a second order (R-L-C Series circuit) with variable damping.

Determination of parameters of a two-port network.

Harmonic Analysis of No-Load current of a power transformer.

Determination of parameters of Coupled circuits.

Determination of Resonance, Bandwidth and Q-Factor of an R-L-C Series circuit.

**Note**

The term work shall consist of atleast 8 experiments out of the experiments given above.

**Text Books/References**

M. E. Van Valkenburg, Network Analysis, Prentice, Hall India Pvt. Ltd.

D. Roy Choudhury, Networks & System, New Age International

A. Chakrabarti, Circuit Theory(Analysis and Synthesis), Dhanpat Rai Publication

G. K. Mithal, Network Analysis, Khanna Publication

**Syllabus for Unit Test**

| | |
|---|---|
| Unit Test 1 | Unit I & II |
| Unit Test 2 | Unit III & IV |
| Unit Test 3 | Unit V & VI |

## K40209: INSTRUMENTATION

**TEACHING SCHEME**
Lectures : 04 Hrs/week
Practical : 02Hrs/week

**EXAMINATION SCHEME**
Theory : 80 Marks
Duration : 03 Hours
Unit Test : 20 Marks
T. W. & Or. : 50 Marks

---

**Unit –I** (07 Hours)

**Introduction:**

Definitions of Instrumentation, Measurements, with general block diagram, Transducers-types, applications, special features, comparison and selection factors, Error analysis-types, sources, limiting and minimizing techniques

**Unit –II** (07 Hours)

**Measurement of displacement:**

Potentiometer, Linear-Strain gauge, types, gauge factor, circuits, temperature compensation, calibration, load cell, application for other measurements. LVDT characteristics, uses, circuits, applications for other variables. Angular velocity measurement, electrical taco generators, photo electric tacos, stroboscope relative

Comparison in different methods

**Unit-III** (07 Hours)

**Measurement of Pressure and vibration:**

Definitions, ranges& units, Types, Mechanical instruments –Bourden tube, diaphragm, bellows, use of electrical transducer, Measurement of Vacuum Thermocouple gauges, Pirani gauges, and Ionization type vacuum gauges. Measurement of vibration, seismic accelerometers, types

**Unit-IV** (07 Hours)

**Measurement of temperature:**

Definition, Effects and its use for measurements, Mechanical transducers-all types of thermometers, electrical transducers, resistance thermometers types circuits, thermisters, thermocouples with circuitry, thermopiles

Pyrometer- principles, types, applications, comparison. Use of strain gauge.

**Unit-V** (07 Hours)

**Measurement of flow and level:**

Use of nozzles, orifice, Ventury. Turbine meters, electromagnetic flow meters, Use of thermister, Ultrasonic flow meters, variable area meters, Pitot tube Measurement of liquid level-electric transducers using Resistance, Inductance, Capacitance, Mechanical methods-use of float, pressure gauges. Level measurement in closed tank.

**Unit-VI** (07 Hours)

**Recorders and Special topics:**

Display and recording devices, Analog and digital meters, Recorders-types, working, applications

Methods of data transmission, Telemetry system-types, RF telemetry, FM telemetry.

**List of Practical**

Measurement of capacitance and loss angle by Schering bridge
Strain measurement using strain gauge
Study of LVDT
Temperature measurement by RTD, thermistor and thermocouple
Study of pressure transducers
Study of Recorders
Speed measurement by magnetic pick-up, photoelectric method
Study of C.R.O.s of different types and their applications
Step response of a meters
Measurement of systematic errors of wattmeters
Study of op-amp parameters
Study of op-amp applications

**Note**

The term work shall consists of atleast 8 experiments out of experiments given above.

**Text Books**

A. K. Sawhney, A course in Electrical and Electronic Measurement and Instrumentation, Eleventh Edition- Dhanpat Rai and Sons

B. C.Nekra , K. K. Choudhary, Instrumentation and Measurement Analysis, Sixth Reprint-T.M.H., New Delhi

E. B. Doebelin, Measurement System – Application and Design, Fourth Edition-McGraw Hills International

**Syllabus for Unit Test**

| | |
|---|---|
| Unit Test 1 | Unit I & II |
| Unit Test 2 | Unit III & IV |
| Unit Test 3 | Unit V & VI |

## K 402010: POWER GENERATION TECHNIQUE

**TEACHING SCHEME**
Lectures : 04 Hrs/week

**EXAMINATION SCHEME**
Theory : 80 Marks
Duration : 03 Hours
Unit Test : 20 Marks

---

**Unit -I** (08 Hours)

**Hydro Power Station & Thermal Power Stations:**

Introduction: Importance of electrical energy sources of energy – growth of power system in India.

Hydro Power Station**:** Selection of site – classification of Hydro Power Station – general arrangements and operations of Hydro Power Station – functions of each component – water hammering effect – turbines – hydro electric generators – list of Hydro Power Station in India with capacity.

Thermal Power Station: General lay out – operation - site selection –Fuels used – Types – analysis of coal – classification – liquid fuels – gaseous fuels – Boilers – turbines – condensers – cooling towers – major Thermal Power Station in India.

**Unit –II** (08 Hours)

**Nuclear – Diesel and Gas Power station:**

Nuclear Power Station: Advantages – selection of site – elements of Nuclear Power Station – chain reaction – nuclear materials – moderators – coolants – control rods – main part of reactor- functions – different type of reactors.

Diesel Power Station: Field of use, outline – types of engine – different systems – advantages & disadvantages of diesel power station over Thermal Power Station – present trends in research.

Gas Power Station: Basics – classification - components – governing system – comparison of gas, diesel, & thermal power plant.

Major Electrical equipments in power stations

**Unit-III** (08 Hours)

**Solar and Wind Power Plant:**

Solar**:** Photo Voltiac cell – solar to electric conversion – VI characteristics

– wattage efficiency – spectral response – solar module – solar array – solar PV technologies & systems for rural areas – solar diesel hybrid plant – solar power plant for space craft – economics of solar PV system.

Wind Power Station: introduction – schematic arrangement - vertical axis, horizontal axis – choice of electrical generator – energy storage – grid connection – hybrid solutions : Wind Tidal –diesel, Wind Tidal - solar etc. –wind farms in India / world.

**Unit-IV** (08 Hours)

**Biogas & Geo -Thermal Plants:**

Biogas: biogas anaerobic fermentation process – raw materials – small, medium & large plants – Types: single stage & two stage, dome type – ocean biomass to biogas.

Geothermal: classification – types : vapour dominated, liquid dominated flashed system, double flashed system , binary cycle liquid dominated, Hyber binary cycle, liquid dominated total flow.

**Unit-V** (08 Hours)

**Tidal Energy conversion & Fuel Cells:**

Tidal: tidal range – types : single basin, modulated single basin, double basin – main equipments – energy storage – projects in the world – prospectus – economic factors – disadvantages.

Fuel Cells: concepts- types – schematic of H2 – O2 cells – working – fuels – solid oxide fuel cells – fuel cells with permeable ion – exchange membrane.

**Unit-VI** (08 Hours)

**Load Curves and Economic Aspects :**

Load Curves: load curve – base load station and peak load station - demand factor – maximum demand – average demand – diversity of load– load factor – diversity factor – significance of high Load Factor & diversity factor– plant factor – capacity factor – connected load - load duration curve – integrated load duration curve – selection of units.

Economic Aspects: cost of generating stations – tariff – types of tariff – factors influencing the rate of tariff designing.

**Text Books/References**

S. L. Uppal, Electrical Power, Khanna Publication
S. Rao, Dr. B. B. Panelkar, Energy Technology, Khanna Publication
Arrora, Domkundwar, A Course in Power Plant Engineering, Dhanpatrai & Co. Publications
Soni, Gupta, Bhatanagar, A Course in Electrical Power, Dhanpatrai & Co. Publications
J. B. Gupta, A Course in Power System, S. K. Kataria & Sons

**Syllabus for Unit Test**

| | |
|---|---|
| Unit Test 1 | Unit I & II |
| Unit Test 2 | Unit III & IV |
| Unit Test 3 | Unit V & VI |

# RULES REGARDING ATKT, CONTINUOUS ASSESSMENT and AWARD of CLASS

**A. T. K. T.**

A candidate who is granted term for B.Tech. Semester-I will be allowed to keep term for his/her B.Tech. Semester-II examination even if he/she appears and fails or does not appear at B.Tech. Semester-I examination.

A candidate who is granted term for B. Tech. Semester - III will be allowed to keep term for his/her B.Tech. Semester-IV examination even if he/she appears and fails or does not appear at B.Tech. Semester-III examination.

A candidate who is granted term for B.Tech. Semester-V will be allowed to keep term for his/her B.Tech. Semester-VI examination if he/she appear and fails or does not appear at B.Tech. Semester-V examination.

A candidate who is granted term for B.Tech. Semester-VII will be allowed to keep term for his/her B.Tech. Semester-VIII examination if he/she appears and fails or does not appear at B.Tech. Semester-VII examination.

A student shall be allowed to keep term for the B.Tech. Semester-III course if he/she has a backlog of not more than 3 Heads of passing out of total number of Heads of passing in theory examination at B.Tch. Semester-I & II taken together.

A student shall be allowed to keep term for the B.Tech. Semester-V of respective course if he/she has no backlog of B.Tech Semester-I & II and he/she has a backlog of not more than 3 Heads of passing in theory examination and not more than 3 heads of passing in termwork and practical examination or termwork and oral examination.

A student shall be allowed to keep term for the B.Tech. Semester-VII course if he/she has no backlog of B.Tech. Semester-III & IV and he/she has a backlog of not more than 3 Heads of passing in theory examination and not more than 3 Heads of passing in termwork and practical examination or termwork and oral examination.

**CONTINUOUS ASSESSMENT**

In respect of Term work at B.Tech. Semester-I & II, B.Tech. Semester-III & IV and B.Tech. Semester-V & VI, target date shall be fixed for the completion of each job, project experiment or assignment as prescribed in the syllabus and the same shall be collected on the target date and assessed immediately at an affiliated college by at least one pair of the concerned teachers for the subject and the marks shall be submitted at the end of each term to the Principal of the college.

• Termwork and performance of Practical/Oral examination shall be assessed on the basis of the depth of understanding of the principles involved, correctness of results and not on ornamental or colorful presentation.

• For B.Tech. Semester-VII & VIII, termwork assessment will be done by external and internal examiners jointly during the examination schedule declared by the university. The record of continuous assessment shall be made available to the examiners during Term work and practical and Term work and oral examinations. Examiner shall use this record for overall assessment of the performance of the student. Every practical/termwork assignment shall be assessed on the scale of 20 marks and weightage of 20 marks shall be distributed as follows:

| Sr. No. | Activity | Marks |
|---|---|---|
| 1 | Timely Submission | 04 |
| 2 | Presentation | 06 |
| 3 | Understanding | 10 |

Marks obtained out of 20 for all assignments together will be converted on scale of marks assigned to term work of respective subject in the structure of the course.

**CLASS**

• The class should be awarded to the student on the basis of aggregate marks obtained together in both the semesters of the respective year by him. The award of class shall be as follows.

| | | |
|---|---|---|
| A | Aggregate 66% or more marks | First Class with Distinction |
| B | Aggregate 60% or marks but less than 66% | First Class |
| C | Aggregate 55% or more marks but less than 60% | Higher Second Class |
| D | Aggregate 50% or more marks but less than 55% | Second Class |
| E | Aggregate 40% or more marks but less than 50% | Pass Class |