ARYABHATTA KNOWLEDGE UNIVERSITY

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Notification

The Vice-Chancellor, Aryabhatta Knowledge University, Patna has approved the **Syllabus for Instrumentation Engineering** of Aryabhatta Knowledge University, Patna w.e.f. session 2019-23 is hereby notified in anticipation of post-facto approval of Academic Council and Executive Council of the University.

By order of the Vice-Chancellor

Sd. /-

Registrar (I/C)

Aryabhatta Knowledge University, Patna

Memo No. : - 012/Acad/12-02/AKU/2021-483 Date: 09.02.2021

Copy to:

1. PA to the Vice-Chancellor, PVC Office, Registrar Office, Controller of Examinations for information, Exam Section with copy of said Syllabus for information and needful.

for 09/02/2021

Registrar (I/C)

Aryabhatta Knowledge University, Patna

Aryabhatta Knowledge University

Syllabus for 111 - Instrumentation Engineering

Semester – I

Sl. No.	Course Code	Course Title	L	T	P	Credit
		Theory:				
1	100103	Engineering Chemistry	3	1	0	4
2	103102	Math – I (Calculus & Differential Equation)	3	1	0	4
3	100104	Programming for problem solving	3	0	0	3
4	100105	Workshop manufacturing practices	1	0	0	1
5	100106	English	2	0	0	2
		Practical:				
1	100103P	Engineering Chemistry	0	0	3	1.5
2	100104P	Programming for problem solving	0	0	4	2
3	100105P	Workshop manufacturing practices	0	0	4	2
4	100106P	English	0	0	2	1
		Total				**20.5**

Semester – II

Sl. No.	Course Code	Course Title	L	T	P	Credit
		Theory:				
1	103201	Engineering Physics (Wave and optics and introduction to quantum mechanics)	3	1	0	4
2	103202	Math – II (Linear Algebra, Transform Calculus & Numerical Methods)	3	1	0	4
3	100201	Basic Electrical Engineering	3	1	0	4
4	100202	Engineering Graphics and Design	1	0	0	1
		Practical:				
1	103201P	Engineering Physics (Wave and optics and introduction to quantum mechanics)	0	0	3	1.5
2	100201P	Basic Electrical Engineering	0	0	2	1
3	100202P	Engineering Graphics and Design	0	0	4	2
		Total				**17.5**

Semester – III

Sl. No.	Course Code	Course Title	L	T	P	Credit
		Theory:				
1	104304	Network Theory	3	1	0	4
2	104305	Signals and Systems	3	0	0	3
3	104303	Mathematics-III	3	0	0	3
4	100313	Object Oriented Programming using C++	3	0	0	3
5	104301	Basic Electronics Engineering	3	0	0	3
6	104302	Electrical and Electronic Material	3	0	0	3
		Practical:				
1	100313P	Object Oriented Programming Lab	0	0	2	1
2	104301P	Basic Electronic Science Lab	0	0	2	1
3	104302P	Electrical and Electronic Material Lab	0	0	2	1
4		Internship	0	0	12	4
		Total				**26**

Semester – IV

Sl. No.	Course Code	Course Title	L	T	P	Credit
		Theory:				
1		Digital Circuits	3	1	0	4
2		Analog electronics	3	0	0	3
3		Analog communication	3	0	0	3
4		Measurement & Instrumentation	3	0	0	3
5		Biology – I	2	1	0	3
6		Mooc / Swayam	3	0	0	3
7		Essence of Indian Knowledge Tradition / Indian Constitution				0
		Practical:				
1		Digital Circuit Lab	0	0	2	1
2		Analog electronics Lab	0	0	2	1
3		Analog communication Lab	0	0	2	1
4		Measurement & Instrumentation Lab	0	0	2	1
		Total				**23**

Semester – V

Sl. No.	Course Code	Course Title	L	T	P	Credit
		Theory:				
1		Linear Control System	3	1	0	4
2		Microprocessors & Microcontrollers	3	0	0	3
3		Power Electronics	3	0	0	3
4		Linear Integrated circuits and applications	3	0	0	3
5		Sensors and Transducers	3	1	0	4
6		Mooc / Swayam	3	0	0	3
		Practical:				
1		Linear Control System Lab	0	0	2	1

2		Microprocessors & Microcontrollers Lab	0	0	2	1
3		Power Electronics Lab	0	0	2	1
4		Linear Integrated circuits and applications Lab	0	0	2	1
5		Sensors and Transducers Lab	0	0	2	1
6		Internship	0	0	12	4
		Total				**29**

Semester – VI

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credit**
		Theory:				
1		Industrial Instrumentation	3	1	0	4
2		Analytical Instrumentation	3	0	0	3
3		Professional Skill Development	3	0	0	3
4		Computer Networks and Security	3	0	0	3
5		Instrumentation in process industries	3	0	0	3
6		Artificial Intelligence	3	0	0	3
		Practical:				
1		Industrial Instrumentation	0	0	2	1
2		Analytical Instrumentation	0	0	2	1
		Total				**21**

Semester – VII

Sl. No.	Course Code	Course Title	L	T	P	Credit
		Theory:				
1		Intelligent Instrumentation	3	1	0	4
2		Industrial Safety Management	3	0	0	3
3		Elective – I	3	0	0	3
		Practical:				
1		Intelligent Instrumentation	0	0	2	1
2		a. Industrial Training b. FOSSEE				4+2=6
3		a. Project (Minor) b. Virtual Lab				4+1+5
		Total				**22**

Semester – VIII

Sl. No.	Course Code	Course Title	L	T	P	Credit
		Theory:				
1		Modern Control Theory	3	1	0	4
2		Internet of Things	3	0	0	3
3		Elective – II	3	0	0	3
		Practical:				
1		Modern Control Theory	0	0	2	1
2		Seminar	0	0	3	2
3		Project (Major)	0	0	12	8
		Total				**21**

CONTENTS

Semester – I

BSC	**Engineering Chemistry**	**L:3**	**T:1**	**P:3**	**Credit 5.5**

MODULE 1: ATOMIC AND MOLECULAR STRUCTURE (10 LECTURES)

Failure of classical Newtonian and Maxwell wave mechanics to explain properties of particles at atomic and sub-atomic level; electromagnetic radiation, dual nature of electron and electromagnetic radiation, plank's theory, photoelectric effect and Heisenberg uncertainty principle. Failure of earlier theories to explain certain properties of molecules like paramagnetic properties. Principles for combination of atomic orbitals to form molecular orbitals. Formation of homo and hetero diatomic molecules and plots of energy level diagram of molecular orbitals. Coordination numbers and geometries, isomerism in transitional metal compounds, crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

MODULE 2: SPECTROSCOPIC TECHNIQUES AND APPLICATIONS (8 LECTURES)

Principles of vibrational and rotational spectroscopy and selection rules for application in diatomic molecules. Elementary idea of electronic spectroscopy. UV-vis spectroscopy with related rules and its applications. Fluorescence and its applications in medicine. Basic principle of nuclear magnetic resonance and its application. Basics of magnetic resonance imaging.

MODULE 3: INTERMOLECULAR FORCES AND PROPERTIES OF GASES (4 LECTURES)

Ionic, dipolar and van der waals interactions. Equations of state of ideal and real gases, deviation from ideal behaviour. Vander waal gas equation.

MODULE 4: USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA & WATER CHEMISTRY (8 LECTURES)

Thermodynamic functions: energy, enthalpy entropy and free energy. Equations to interrelate thermodynamic properties. Free energy, emf. And cell potentials, the nernst equation and applications. Corrosion. Use of free energy considerations in metallurgy through ellingham diagrams. Solubility equilibria.

Water chemistry, hard and soft water. Parameters of quality of water to be used in different industries as for drinking water. Calculation of hardness of water in all units. Estimation of hardness using edta and alkalinity method. Removal of hardness by soda lime and ion exchange method including zeolite method

MODULE 5: PERIODIC PROPERTIES (4 LECTURES)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, acid, base, principle of hsab theory, oxidation states, hybridization and molecular geometries.

MODULE 6: STEREOCHEMISTRY (4 LECTURES)

Representations of 3-d structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.

MODULE 7: ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE (4 LECTURES)

Introduction to intermediates and reactions involving substitution, addition, elimination, oxidation-reduction, diels elder cyclization and epoxide ring openings reactions. Synthesis of a commonly used drug molecule like aspirin.

SUGGESTED TEXT BOOKS

1. *University chemistry, by b. H. Mahan*
2. *Chemistry: principles and applications, by m. J. Sienko and r. A. Plane*
3. *Fundamentals of molecular spectroscopy, by c. N. Banwell*
4. *Engineering chemistry (nptel web-book), by b. L. Tembe, kamaluddin and m. S. Krishnan*
5. *Physical chemistry, by p. W. Atkins*
6. *Organic chemistry: structure and function by k. P. C. Volhardt and n. E. Schore, 5th edition*
7. *Http://bcs.whfreeman.com/vollhardtschore5e/default.asp*

COURSE OUTCOMES

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to: analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces. Rationalise bulk properties and processes using thermodynamic considerations. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.list major chemical reactions that are used in the synthesis of molecules.

CHEMISTRY LABORATORY

Choice of 10-12 experiments from the following

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the ph of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

LABORATORY OUTCOMES

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to: estimate rate constants of reactions from concentration of reactants/products as a function of time measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc synthesize a small drug molecule and analyse a salt sample.

BSC	**Mathematics –I (Calculus and Differential Equations)**	**L:3**	**T:1**	**P:0**	**Credit:4**

MODULE 1: CALCULUS (8 LECTURES)

Evolutes and involutes; evaluation of definite and improper integrals; beta and gamma functions and their properties; applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle's theorem, mean value theorems, taylor's and maclaurin theorems with remainders; indeterminate forms and l' hospital's rule; maxima and minima.

MODULE 2: SEQUENCES AND SERIES (7 LECTURES)

Convergence of sequence and series, tests for convergence, power series, taylor's series. Series for exponential, trigonometric and logarithmic functions; fourier series: half range sine and cosine series, parseval's theorem.

MODULE 3: MULTIVARIABLE CALCULUS: DIFFERENTIATION (6 LECTURES)

Limit, continuity and partial derivatives, directional derivatives, total derivative; tangent plane and normal line; maxima, minima and saddle points; method of lagrange multipliers; gradient, curl and divergence.

MODULE 4: MULTIVARIABLE CALCULUS: INTEGRATION (7 LECTURES)

Multiple integration: double and triple integrals (cartesian and polar), change of order of integration in double integrals, change of variables (cartesian to polar), applications: areas and volumes by (double integration) center of mass and gravity (constant and variable densities). Theorems of green, gauss and stokes, orthogonal curvilinear coordinates, simple applications involving cubes, sphere and rectangular parallelepipeds.

MODULE 5: FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS (3 LECTURES)

Exact, linear and bernoulli's equations, euler's equations, equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and clairaut's type.

MODULE 6: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER (6 LECTURES)

Second order linear differential equations with variable coefficients, method of variation of parameters, cauchy-euler equation; power series solutions; legendre polynomials, bessel functions of the first kind and their properties.

MODULE 7: PARTIAL DIFFERENTIAL EQUATIONS: FIRST ORDER (3 LECTURES)

First order partial differential equations, solutions of first order linear and non-linear pdes.

TEXT / REFERENCES:

1. G.b. thomas and r.l. finney, “calculus and analytic geometry”, pearson, 2002.
2. T. Veerarajan, “engineering mathematics”, mcgraw-hill, new delhi, 2008.
3. B. V. Ramana, “higher engineering mathematics”, mcgraw hill, new delhi, 2010.
4. N.p. bali and m. Goyal, “a text book of engineering mathematics”, laxmi publications, 2010.
5. B.s. grewal, “higher engineering mathematics”, khanna publishers, 2000.
6. E. Kreyszig, “advanced engineering mathematics”, john wiley & sons, 2006.
7. W. E. Boyce and r. C. Diprima, “elementary differential equations and boundary value problems”, wiley india, 2009.
8. S. L. Ross, “differential equations”, wiley india, 1984.
9. E. A. Coddington, “an introduction to ordinary differential equations”, prentice hall india, 1995.
10. E. L. Ince, “ordinary differential equations”, dover publications, 1958.
11. G.f. simmons and s.g. krantz, “differential equations”, mcgraw hill, 2007.

ESC	**Programming for Problem Solving**	**L:3**	**T:0**	**P:4**	**Credit:5**

MODULE 1: INTRODUCTION TO PROGRAMMING (6 LECTURES)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc). Idea of algorithm: steps to solve logical and numerical problems. Representation of algorithm: flowchart/pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, type casting/type conversion, run time environment (static, dynamic location), storage classes (auto, register, static, extern), syntax and logical errors in compilation, object and executable code.

MODULE 2: OPERATORS (3 LECTURES)

Arithmetic expressions/arithmetic operators/relational operators/logical operators/bitwise operators and precedence

MODULE 3: CONDITIONAL BRANCHING AND LOOPS (5 LECTURES)

Writing and evaluation of conditionals and consequent branching, iteration and loops

MODULE 4: ARRAYS (4 LECTURES)

Array declaration & initialization, bound checking arrays (1-d, 2-d), character arrays and strings.

MODULE 5: BASIC ALGORITHMS (6 LECTURES)

Searching (linear search, binary search etc.), basic sorting algorithms (bubble, insertion and selection), finding roots of equations, notion of order of complexity through example programs (no formal definition required)

MODULE 6: FUNCTION (4 LECTURES)

Introduction & writing functions, scope of variables functions (including using built in libraries), parameter passing in functions, call by value, passing arrays to functions: idea of call by reference

MODULE 7: RECURSION (5 LECTURES)

Recursion, as a different way of solving problems. Example programs, such as finding factorial, fibonacci series, reverse a string using recursion, and gcd of two numbers, ackerman function etc. Quick sort or merge sort.

MODULE 8: STRUCTURE/UNION (3 LECTURES)

Structures, accessing structure elements, way of storage of structure element, defining structures and array of structures, basic definition of union, comparison b/w structure & union with example

MODULE 9: POINTERS (5 LECTURES)

Idea of pointers, defining pointers, use of pointers in self-referential structures, notion of linked list (no implementation), pointer to pointer, pointer to array, pointer to strings, array of pointer, pointer to function, pointer to structure.

MODULE 10: FILE HANDLING

(Only if time is available, otherwise should be done as part of the lab)

SUGGESTED TEXT BOOKS

1. *Byron gottfried, schaum's outline of programming with c, mcgraw-hill*
2. *e. Balaguruswamy, programming in ansi c, tata mcgraw-hill*

SUGGESTED REFERENCE BOOKS

1. *Brian w. Kernighan and dennis m. Ritchie, the c programming language, prentice hall of India Vashwant Kanetkar, let us c, bpb publication*

THE STUDENT WILL LEARN

1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in c language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

LABORATORY PROGRAMMING FOR PROBLEM SOLVING

[THE LABORATORY SHOULD BE PRECEDED OR FOLLOWED BY A TUTORIAL TO EXPLAIN THE APPROACH OR ALGORITHM TO BE IMPLEMENTED FOR THE PROBLEM GIVEN.]

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1d Arrays: searching, sorting:

Lab 5: 1d Array manipulation

Tutorial 6: 2d Arrays and strings

Lab 6: Matrix problems, string operations

Tutorial 7: Functions, call by value:

Lab 7: Simple Functions

Tutorial 8: Numerical methods (root finding, numerical differentiation, numerical integration):

Lab 8: Programming for solving numerical methods problems

Tutorial 9: Recursion, structure of recursive calls

Lab 9: Recursive functions

Tutorial 10: Pointers, structures and dynamic memory allocation

Lab 10: Pointers and structures

Tutorial 11: File handling:

Lab 11: File operations

LABORATORY OUTCOMES

1. To formulate the algorithms for simple problems
2. To translate given algorithms to a working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at run time
5. To be able to write iterative as well as recursive programs
6. To be able to represent data in arrays, strings and structures and manipulate them through a program

7. To be able to declare pointers of different types and use them in defining self- referential structures.
8. To be able to create, read and write to and from simple text files.

ESC	**Workshop Manufacturing Practices**	**L:1**	**T:0**	**P:4**	**Credit:3**

ECTURES & VIDEOS: (10 HOURS) [L: 1; T: 0; P: 0 (1 CREDIT)]

DETAILED CONTENTS:

1. Manufacturing methods-casting, forming, machining, joining, advanced manufacturing methods (3 lectures)
2. Cnc machining, additive manufacturing (1 lecture)
3. Fitting operations & power tools (1 lecture)
4. Carpentry (1 lecture)
5. Plastic moulding, glass cutting (1 lecture)
6. Metal casting (1 lecture)
7. Welding (arc welding & gas welding), brazing, soldering (2 lecture)

SUGGESTED TEXT/REFERENCE BOOKS:

1. Hajra choudhury s.k., hajra choudhury a.k. and nirjhar roy s.k., "elements of workshop technology", vol. I 2008 and vol. Ii 2010, media promoters and publishers private limited, mumbai.
2. Kalpakjian s. And steven s. Schmid, "manufacturing engineering and technology", 4th edition, pearson education india edition, 2002.
3. Gowri p. Hariharan and a. Suresh babu,"manufacturing technology – i" pearson education, 2008.
4. Roy a. Lindberg, "processes and materials of manufacture", 4th edition, prentice hall india, 1998.
5. Rao p.n., "manufacturing technology", vol. I and vol. Ii, tata mcgrawhill house, 2017.

COURSE OUTCOMES:

1. Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

WORKSHOP PRACTICE: (60 HOURS) [L: 0; T: 0; P: 4 (2 CREDITS)]

1. Machine shop (10 hours) and fitting shop (8 hours)
2. Carpentry (6 hours)
3. Welding shop (8 hours) (arc welding 4 hrs + gas welding 4 hrs)
4. Casting (8 hours) and smithy (6 hours)
5. Plastic moulding & glass cutting (6 hours)
6. 3-d printing of different models (8 hours)

EXAMINATIONS COULD INVOLVE THE ACTUAL FABRICATION OF SIMPLE COMPONENTS, UTILIZING ONE OR MORE OF THE TECHNIQUES COVERED ABOVE.

LABORATORY OUTCOMES

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest.

HSMC	English	L:2	T:0	P:2	Credit:3

DETAILED CONTENTS

1. VOCABULARY BUILDING

A. The concept of word formation

B. Root words from foreign languages and their use in english

C. Acquaintance with prefixes and suffixes from foreign languages in english to form derivatives.

D. Synonyms, antonyms, and standard abbreviations.

E. Affixes, acronyms

2. BASIC WRITING SKILLS

A. Sentence structures

B. Use of phrases and clauses in sentences

C. Importance of proper punctuation

D. Kinds of sentences

E. Use of tense, use in context and coherence of tense in writing

F. Use of voice – active/passive in sentences

G. Use of speech – direct and indirect speech

H. Framing questions- direct, using modal verbs

3. IDENTIFYING COMMON ERRORS IN WRITING

A. Subject-verb agreement

B. Noun-pronoun agreement

C. Misplaced modifiers

D. Articles

E. Prepositions

F. Redundancies

G. Clichés

H. Common english errors

4. NATURE AND STYLE OF SENSIBLE WRITING

A. Describing

B. Defining

C. Classifying

D. Providing examples or evidence

E. Writing introduction and conclusion

F. Organising principle of paragraphs in documents

G. Argument, describing/ narrating/ planning, defining, classifying

H. Lexical resources, using suitable language register

I. Coherence, writing introduction, body and conclusion, techniques for writing precisely, grammar and accuracy

5. WRITING PRACTICES

A. Comprehension

B. Formal letter writing/ application/ report writing/ writing minutes of meetings

C. Essay writing

D. Formal email writing

E. Resume/ cv writing, cover letter,

F. Statement of purpose

6. ORAL COMMUNICATION

(THIS UNIT INVOLVES INTERACTIVE PRACTICE SESSIONS IN LANGUAGE LAB)

A. Listening comprehension

B. Pronunciation, intonation, stress and rhythm

C. Common everyday situations: conversations and dialogues

D. Communication at workplace

E. Interviews

F. Formal presentations

G. Acquainting students with ipa symbols

H. Phonetics (basic)

I. Sounds – vowels, consonants

J. Clearing mother tongue influence

K. Clearing redundancies and common errors related to indianisms

L. Group discussion

M. Expressing opinions

N. Coherence and fluency in speech

7. READING SKILLS

A. Reading comprehension,

B. Paragraph reading based on phonetic sounds/ intonation

8. PROFESSIONAL SKILLS

A. Team building

B. Soft skills and etiquettes

9. ACQUAINTANCE WITH TECHNOLOGY-AIDED LANGUAGE LEARNING

A. Use of computer software (grammarly, ginger…)

B. Use of smartphone applications (duolingo, busuu…)

10. ACTIVITIES

A. Narrative chain

B. Describing/ narrating

C. Writing essays in relay

D. Peer/ group activities

E. Brainstorming vocabulary

F. Cue / flash cards for vocabulary

G. Debates

SUGGESTED READINGS:

A. Practical English usage. Michael swan. Oup. 1995.

B. Remedial English grammar. F.t. wood. Macmillan.2007

C. On writing well. William Zinsser. Harper resource book. 2001

D. Study writing. Liz Hamp-Lyons and ben Heasly. Cambridge university press. 2006.

E. Communication skills. Sanjay Kumar and Pushplata. Oxford university press. 2011.

F. Exercises in Spoken English. Parts. I-iii. Ciefl, Hyderabad. Oxford university press

COURSE OUTCOMES

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Semester – II

BSC	**Physics (Waves and Optics and Introduction to Quantum Mechanics)**	**L:3**	**T:1**	**P:3**	**Credit:5.5**

MODULE 1: WAVES (3 LECTURES)

Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator, forced mechanical and electrical oscillators, impedance, steady state motion of forced damped harmonic oscillator

MODULE 2: NON-DISPERSIVE TRANSVERSE AND LONGITUDINAL WAVES (4 LECTURES)

Transverse wave on a string, the wave equation on a string, harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves

MODULE 3: LIGHT AND OPTICS (3 LECTURES)

Light as an electromagnetic wave and fresnel equations, reflectance and transmittance, brewster's angle, total internal reflection, and evanescent wave. Mirrors and lenses and optical instruments based on them

MODULE 4: WAVE OPTICS (5 LECTURES)

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; young's double slit experiment, newton's rings, michelson interferometer, mach zehnder interferometer. Farunhofer diffraction from a single slit and a circular aperture, the rayleigh criterion for limit of resolution and its application to vision; diffraction gratings and their resolving power

MODULE 5: LASERS (5 LECTURES)

Einstein's theory of matter radiation interaction and a and b coefficients; amplification of light by population inversion, different types of lasers: gas lasers (he-ne, co2), solid-state lasers (ruby, neodymium), dye lasers; properties of laser beams: mono-chromaticity

MODULE 6: INTRODUCTION TO QUANTUM MECHANICS (5 LECTURES)

Wave nature of particles, time-dependent and time-independent schrodinger equation for wave function, born interpretation, probability current, expectation values, free-particle wave function and wave-packets, uncertainty principle.

MODULE 7: SOLUTION OF WAVE EQUATION (6 LECTURES)

Solution of stationary-state schrodinger equation for one dimensional problems–particle in a box, particle in attractive delta-function potential, square-well potential, linear harmonic oscillator. Scattering from a potential barrier and tunneling; related examples like alpha- decay, field-ionization

and scanning tunneling microscope, tunneling in semiconductor structures. Three-dimensional problems: particle in three dimensional box and related examples.

MODULE 8: INTRODUCTION TO SOLIDS AND SEMICONDUCTORS (9 LECTURES)

Free electron theory of metals, fermi level, density of states in 1, 2 and 3 dimensions, bloch's theorem for particles in a periodic potential, kronig-penney model and origin of energy bands.

TYPES OF ELECTRONIC MATERIALS: Metals, semiconductors, and insulators. Intrinsic and extrinsic semiconductors, dependence of fermi level on carrier-concentration and temperature (equilibrium carrier statistics), carrier generation and recombination, carrier transport: diffusion and drift, p -n junction.

TEXT / REFERENCES:

A. *G. Main, "vibrations and waves in physics", cambridge university press, 1993.*
B. *H. J. Pain, "the physics of vibrations and waves", wiley, 2006.*
C. *E. Hecht, "optics", pearson education, 2008.*
D. *A. Ghatak, "optics", mcgraw hill education, 2012.*
E. *O. Svelto, "principles of lasers", springer science & business media, 2010.*
F. *D. J. Griffiths, "quantum mechanics", pearson education, 2014.*
G. *R. Robinett, "quantum mechanics", oup oxford, 2006.*
H. *D.. Mcquarrie, "uantum chemistry", university science books, 2007.*
I. *D. A. Neamen, "semiconductor physics and devices", times mirror high education group, chicago, 1997.*
J. *E.S. Yang, "microelectronic devices", mcgraw hill, singapore, 1988.*
K. B.G. Streetman, " solid state electronic devices", prentice hall of india, 1995

BSC	Mathematics –II (Linear Algebra, Transform Calculus and Numerical Methods)	L:3	T:1	P:0	Credit:4

MODULE 1: MATRICES (10 LECTURES)

Algebra of matrices, inverse and rank of a matrix, rank-nullity theorem; system of linear equations; symmetric, skew-symmetric and orthogonal matrices; determinants; eigenvalues and eigenvectors; diagonalization of matrices; cayley-hamilton theorem, orthogonal transformation and quadratic to canonical forms.

MODULE 2: NUMERICAL METHODS-I (10 LECTURES)

Solution of polynomial and transcendental equations – bisection method, newton-raphson method and regula-falsi method. Finite differences, interpolation using newton's forward and backward difference formulae. Central difference interpolation: gauss's forward and backward formulae. Numerical integration: trapezoidal rule and simpson's 1/3rd and 3/8 rules.

MODULE 3: NUMERICAL METHODS-II (10 LECTURES)

Ordinary differential equations: taylor's series, euler and modified euler's methods. Runge- kutta method of fourth order for solving first and second order equations. Milne's and adam's predicator-corrector methods. Partial differential equations: finite difference solution two dimensional laplace equation and poisson equation, implicit and explicit methods for one dimensional heat equation (bender-schmidt and crank-nicholson methods), finite difference explicit method for wave equation.

MODULE 4: TRANSFORM CALCULUS (10 LECTURES)

Laplace transform, properties of laplace transform, laplace transform of periodic functions. Finding inverse laplace transform by different methods, convolution theorem. Evaluation of integrals by laplace transform, solving odes and pdes by laplace transform method. Fourier transforms.

TEXT / REFERENCES:

A. D. Poole, "linear algebra: a modern introduction", brooks/cole, 2005.

B. N.P. Bali and M. Goyal, "a text book of engineering mathematics", laxmi publications, 2008.

C. B.S. Grewal, "higher engineering mathematics", khanna publishers, 2010.

D. V. Krishnamurthy, V. P. Mainra and J. L. Arora, "an introduction to linear algebra", affiliated east-west press, 2005.

ESC	Basic Electrical Engineering	L:3	T:1	P:2	Credit:5

MODULE 1: DC CIRCUITS (8 LECTURES)

Electrical circuit elements (r, l and c), voltage and current sources, kirchh off current and voltage laws, analysis of simple circuits with dc excitation. Star-delta conversion, network theorems (Superposition, Thevenin, Norton and maximum power transfer theorems). Time-domain analysis of first-order RL and RC circuits

MODULE 2: AC CIRCUITS (8 LECTURES)

Representation of sinusoidal waveforms, peak, RMS and average values (form factor and peak factor), impedance of series and parallel circuit, phasor representation, real power, reactive power, apparent power, power factor, power triangle. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

MODULE 3: MAGNETIC CIRCUITS: (4 LECTURES)

Introduction, series and parallel magnetic circuits, analysis of series and parallel magnetic circuits.

MODULE 4: TRANSFORMERS (6 LECTURES)

Magnetic materials, BH characteristics, ideal and practical transformer, EMF equation, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

MODULE 5: ELECTRICAL MACHINES (10 LECTURES)

Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Generation of rotating magnetic fields, construction and working of a three-phase induction motor, significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Construction and working of synchronous generators.

MODULE 6: ELECTRICAL INSTALLATIONS (6 LECTURES)

Components of LT switchgear: switch fuse unit (SFU), MCB, ELCB, MCCB, types of wires and cables, earthing. Types of batteries, important characteristics for batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

SUGGESTED TEXT / REFERENCE BOOKS

A. D. P. Kothari and i. J. Nagrath, “basic electrical engineering”, tata mcgraw hill, 2010.

B. D. C. Kulshreshtha, “basic electrical engineering”, mcgraw hill, 2009.

C. L. S. Bobrow, “fundamentals of electrical engineering”, oxford university press, 2011.

D. E. Hughes, “electrical and electronics technology”, pearson, 2010.

E. V. D. Toro, “electrical engineering fundamentals”, prentice hall india, 1989.

F. Basic electrical engineering by fitzerald, et al, tata mcgraw hill
G. Fundamentals of Electrical Engg. By r. Prasad, phi publication
H. Basic electrical engineering by V.K. Mehta and Rohit Mehta, S. Chand publication

COURSE OUTCOMES

A. To understand and analyze basic electric and magnetic circuits
B. To study the working principles of electrical machines and power converters.
C. To introduce the components of low voltage electrical installations

LABORATORY

LIST OF EXPERIMENTS/DEMONSTRATIONS

A. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
B. Measuring the steady-state and transient time-response of r-l, r-c, and r-l-c circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of r-l, and r-c circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in r-l-c circuits.
C. Transformers: observation of the no-load current waveform on an oscilloscope (non- sinusoidal wave-shape due to b-h curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
D. Three-phase transformers: star and delta connections. Voltage and current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
E. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
F. Torque speed characteristic of separately excited dc motor.
G. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-slip characteristic of an induction motor. Generator operation of an induction machine driven at super- synchronous speed.
H. Synchronous machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
I. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) components of LT switchgear.

LABORATORY OUTCOMES

A. Get an exposure to common electrical components and their ratings.
B. Make electrical connections by wires of appropriate ratings.
C. Understand the usage of common electrical measuring instruments.
D. Understand the basic characteristics of transformers and electrical machines.
E. Get an exposure to the working of power electronic converters

ESC	Engineering Graphics & Design	L:1	T:0	P:4	Credit:3

TRADITIONAL ENGINEERING GRAPHICS:

Principles of engineering graphics; orthographic projection; descriptive geometry; drawing principles; isometric projection; surface development; perspective; reading a drawing; sectional views; dimensioning & tolerances; true length, angle; intersection, shortest distance.

COMPUTER GRAPHICS:

Engineering graphics software; - spatial transformations; orthographic projections; model viewing; co-ordinate systems; multi-view projection; exploded assembly; model viewing; animation; spatial manipulation; surface modelling; solid modelling, introduction to building information modelling (BIM).

(EXCEPT THE BASIC ESSENTIAL CONCEPTS, MOST OF THE TEACHING PART CAN HAPPEN CONCURRENTLY IN THE LABORATORY)

MODULE 1: INTRODUCTION TO ENGINEERING DRAWING

Principles of engineering graphics and their significance, usage of drawing instruments, lettering, conic sections including the rectangular hyperbola (general method only); cycloid, epicycloid, hypocycloid and involute; scales – plain, diagonal and vernier scales

MODULE 2: ORTHOGRAPHIC PROJECTIONS

Principles of orthographic projections-conventions -projections of points and lines inclined to both planes; projections of planes inclined planes -auxiliary planes

MODULE 3: PROJECTIONS OF REGULAR SOLIDS

Those inclined to both the planes- auxiliary views; draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as wc, bath, sink, shower, etc.

MODULE 4: SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS

Covering, prism, cylinder, pyramid, cone – auxiliary views; development of surfaces of right regular solids- prism, pyramid, cylinder and cone; draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

MODULE 5: ISOMETRIC PROJECTIONS

Principles of isometric projection – isometric scale, isometric views, conventions; isometric views of lines, planes, simple and compound solids; conversion of isometric views to orthographic views and vice-versa, conventions

MODULE 6: OVERVIEW OF COMPUTER GRAPHICS

Listing the computer technologies that impact on graphical communication, demonstrating knowledge of the theory of cad software [such as: the menu system, toolbars (standard, object properties, draw, modify and dimension), drawing area (background, crosshairs, coordinate system), dialog boxes and windows, shortcut menus (button bars), the command line (where applicable), the status bar, different methods of zoom as used in cad, select and erase objects.; isometric views of lines, planes, simple and compound solids]

MODULE 7: CUSTOMISATION& CAD DRAWING

Consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; iso and ansi standards for coordinate dimensioning and tolerancing; orthographic constraints, snap to objects manually and automatically; producing drawings by using various coordinate input entry methods to draw straight lines, applying various ways of drawing circles.

MODULE 8: ANNOTATIONS, LAYERING & OTHER FUNCTIONS

Covering applying dimensions to objects, applying annotations to drawings; setting up and use of layers, layers to create drawings, create, edit and use customized layers; changing line lengths through modifying existing lines (extend/lengthen); printing documents to paper using the print command; orthographic projection techniques; drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; drawing annotation, computer-aided design (cad) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling.

MODULE 9: DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT THAT ILLUSTRATES

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2d blueprint form and as 3d wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; use of solid-modeling software for creating associative models at the component and assembly levels. Floor plans that include: windows, doors, and fixtures such as wc, bath, sink, shower, etc. Applying colour coding according to building drawing practice; drawing sectional elevation showing foundation to ceiling; introduction to building information modelling (BIM).

SUGGESTED TEXT/REFERENCE BOOKS:

A. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), engineering drawing, charotar publishing house
B. Shah, M.B. & Rana B.C. (2008), engineering drawing and computer graphics, pearson education
C. Agrawal B. & Agrawal C. M. (2012), engineering graphics, TMH publication
D. Narayana, K.L. & P Kannaiah (2008), text book on engineering drawing, scitechpublishers
E. (Corresponding set of) CAD software theory and user manuals

COURSE OUTCOMES

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the cad technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed cad laboratory using engineering software

THIS COURSE IS DESIGNED TO ADDRESS:

A. To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
B. To prepare you to communicate effectively
C. To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

THE STUDENT WILL LEARN:

A. Introduction to engineering design and its place in society
B. Exposure to the visual aspects of engineering design
C. Exposure to engineering graphics standards
D. Exposure to solid modelling
E. Exposure to computer-aided geometric design
F. Exposure to creating working drawings
G. Exposure to engineering communication

Semester – III

IE101	Network Theory	L:3	T:1	P:0	Credit:4

Sl. No.	Contents	Contact Hours
1	Introduction to signals, their classification and properties, different types of systems, LTI systems and their properties, periodic waveforms and signal synthesis, properties and applications of Laplace transform	8
2	System modeling in terms of differential equations and transient response of R, L, C, series and parallel circuits for impulse, step, ramp, sinusoidal and exponential signals by classical method and using Laplace transform.	8
3	Graph theory: Concept of tree, Tie-set matrix, Cut-set matrix and application to solve electric networks. Two port networks – Introduction of two port parameters and their interconversion, Interconnection of two 2-port networks, Open circuit and Short circuit impedances and ABCD constants, Relation be- tween image impedances and Short circuit and Open circuit impedances.	10
4	Network functions, their properties and concept of transfer impedance, Hurwitz polynomial, Positive real function and synthesis of LC, RC, RL Networks in Foster's I and II, Cauer's I and II forms.	10
5	Introduction of passive filter and their classification, frequency response, Characteristic impedance of low pass, high pass, Band Pass and Band reject proto- type section	4
	Total	**40**

Sl. No.	Name of Authors / Books /Publishers
1	"Engineering Circuit Analysis", by W H Hayt, TMH Eighth Edition
2	"Network analysis and synthesis", by F F Kuo, John Weily and Sons, 2nd Edition
3	"Circuit Theory", by S Salivahanan, Vikas Publishing House 1st Edition, 2014
4	"Network analysis", by M. E. Van Valkenburg, PHI, 2000
5	"Networks and Systems", by D. R. Choudhary, New Age International, 1999
6	"Electric Circuit", Bell Oxford Publications, 7th Edition.

EC102	Signals and Systems	3L:0T:0P	3 Credits

Sl. No.	Contents	Contact Hours
1	Introduction to Signal and System : Definition, classification of systems, standard test signal, properties of system, properties of linear system, Properties: linearity: additivity and homogeneity, Shift-invariance, Causality	10
2	Linear time-invariant (LTI) systems, impulse response and step response, convolution, Characterization of causality and stability of linear time-invariant systems. System representation through differential equations and difference equations.	7
3	Laplace transformation : Laplace transform of some important function, Shift theorem and its application, Laplace transform of periodic signals, Functional analysis of response, Initial and Final value theorems, Response to periodic sinusoidal excitation, Region Of Convergence, Poles and Zeros of system, Laplace domain analysis, Solution to differential equations.	9
4	Analysis of Fourier Methods : Fourier series expansion, Functional symmetry condition, Exponential form of Fourier series, Fourier integral and Fourier transform, Multiplication and their effect in the frequency domain, Magnitude and Phase response, DTFT, Parseval's Theorem	9
5	Z-transformation : Z transform of Discrete time signal, LTI system, solution of difference equation, Application of Z transform to open loop system, Region Of Convergence, z-domain analysis.	5
	Total	40

BS101	Mathematics III	3L:0T:0P	3 Credits

Sl. No.	Contents	Contact Hours
1	Unit1 (6 Lectures): Polynomials: Orthogonal Polynomials –Lagrange's, Chebysev Polynomials; Trigonometric Polynomials; Wavelet transforms : properties, methods, inverses and their applications.	6
2	Unit2 (10 Lectures): Sets, relations and functions: Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions: Ber and Bei functions; recurrence relations, orthogonality properties.	10
3	Unit3 (6 Lectures): Introduction to Graphs: Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk, trees.	6
4	Unit4 (10 Lectures): Basic Statistics: Measures of Central tendency: Moments, skewness and Kurtosis ; Probability distributions - Binomial, Poisson and Normal ; evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	10
5	Unit5 (10 Lectures): Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	10
	Total	40

Sl. No.	Name of Authors / Books /Publishers
1	1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley and amp; Sons, 2006.
2	2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3	4. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010
4	C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.

IE103	Object Oriented Programming	3L:1T:0P	3 Credits

Sl. No.	Contents	Contact Hours
1	Introduction to C++ : Object Oriented Technology, Advantages of OOP, Input-output in C++, Tokens, Keywords, Identifiers, Data Types C++, Derives data types. The void data type, Type Modifiers, Typecasting, Constant, Operator, Precedence of Operators, Strings.	3
2	Control Structures : Decision making statements like if-else, Nested if-else, goto, break, continue, switch case, Loop statement like for loop, nested for loop, while loop, do-while loop.	3
3	Functions : Parts of Function, User-defined Functions, Value-Returning Functions, void Functions, Value Parameters, Function overloading, Virtual Functions.	3
4	Classes and Data Abstraction : Structure in C++, Class, Build-in Operations on Classes,Assignment Operator and Classes, Class Scope, Reference parameters and Class Objects (Variables), Member functions, Accessor and Mutator Functions, Constructors, default Constructor, Destructors.	15
5	Overloading and Templates : Operator Overloading, Function Overloading, Function Templates, Class Templates.	5
6	Inheritance : Single and Multiple Inheritance, virtual Base class, Abstract Class, Pointer and Inheritance, Overloading Member Function.	5
7	Pointers and Arrays : Void Pointers, Pointer to Class, Pointer to Object, The this Pointer, Void Pointer, Arrays.	6
8	Exception Handling : The keywords try, throw and catch. Creating own Exception Classes, Exception Handling Techniques (Terminate the Program, Fix the Error and Continue, Log the Error and Continue), Stack Unwinding.	5
	Total	40

Sl. No.	Name of Authors / Books /Publishers
1	"Thinking in C++", Volume 1 and 2 by Bruce Eckel, Chuck Allison, Pearson Education
2	"Mastering C++", 1/e by Venugopal, TataMcGraw Hill.
3	"Object Oriented Programming with C++", 3/e by E. Balaguruswamy, Tata McGraw Hill.
4	"Starting Out with Object Oriented Programming in C++", by Tony Gaddis, Wiley India.

Object Oriented Programming Lab are according to the theory mentioned above.	0L: 0T: 2P	1 Credit

ES101	Basic Electronics	3L:0T:0P	3 Credits

Sl. No.	Contents	Contact Hours
1	PN junction diode : Depletion layer, Barrier potential, Forward and Reverse bias, Breakdown voltage, I-V characteristics of PN junction diode, Knee voltage, Ideal PN junction diode, Diode capacitances, Breakdown diodes (Avalanche and Zener diode). Photodiode and Light Emitting Diode.	8
2	Rectifiers and filters : Half wave and Full wave rectifiers (Centre-tap and Bridge), Regulation, Ripple factor, R-C, L-C and Pi filters. Clipping and Clamping circuits, Voltage multiplier.	8
3	BJT: Basic theory and Operation of PNP and NPN transistors, Characteristics of C-B, C-E and C-C configuration. Biasing : Base bias, Emitter feedback bias, Voltage divider bias, Load line, Operating point, Incremental analysis using hybrid model.	10
4	FET : Introduction, Operation, I-V characteristics, JFET parameters, JFET amplifiers. MOSFET: Introduction, Operation, MOSFET parameters.	8
5	Integrated circuit: Characteristics of an ideal Operational Amplifier. Application as inverting, noninverting amplifiers. Summer, Difference Amplifier, Differentiator, Integrator. Feedback Amplifiers.	8
	Total	42

Sl. No.	Name of Authors / Books /Publishers
1	"Electronic devices and circuit theory" by Boylestead and Nashelsky, Pearson
2	"Electronic principle" by Albert Malvino and Davis J Bates, TMH
3	"Integrated Electronics", By Jacob Millman and Christos Halkias

Basic Electronics Lab are according to the theory mentioned above.

ES102	Electrical & Electronic Material	3L:0T:0P	3 Credits

Sl. No.	Contents	Contact Hours
1	Atomic structure and bonding in materials. Crystal structure of materials, Crystal systems, Unit cells and space lattices, Determination of structures of simple crystals by X-ray diffraction, Miller indices of planes and directions, Packing geometry in Metallic, Ionic and Covalent solids. Concept of amorphous, single and polycrystalline structures and their effect on properties of materials. Crystal growth techniques. Imperfections in crystalline solids and their role in influencing various properties.	8
2	Band theory of Solids : Energy band diagram, E – K Diagram, Reduced E – K Diagram, Insulators, Semiconductors & Conductors.	5
3	Semiconductor : Single Crystal, Polycrystalline and Amorphous, Fermi – Dirac Distribution, Hall effect, Intrinsic & Extrinsic, N type & P type, Crystal growth – (1) Preparation of electronic grade polycrystal in Siemens reactor,(2) Czochrarlski Method & Float Zone method of bulk single crystal ingot preparation (3) Mirror finished wafer preparation (4) Epitaxial film growth – Chemical Vapor phase Deposition & Liquid Phase Epitaxy (5) Molecular Beam Epitaxy.	10
4	Dielectric behavior of materials : Polarization, Dielectric constant at low frequency & high frequency, Dielectric loss, Piezoelectricity & FerroElectricity	5
5	Magnetic Properties : Origin of magnetism in metallic and ceramic materials, Paramagnetism, Diamagnetism, Antiferromagnetism, Ferromagnetism, Ferrimagnetism, magnetic hysteresis, Influence of temperature on magnetic behaviour, domains and Hysteresis.	5
6	Superconductors : Low and High temperature (YBaCuO) superconductors, Meissner effect, Applications.	4
7	Printed Circuit Board : Manufacturing process, Single- & Double-sided boards, surface mounted devices	3
	Total	40

Sl. No.	Name of Authors / Books /Publishers
1	"Solid State Physics", by Kittel, McGraw Hill.
2	"Principles of Electric Engineering Materials & Devices", by S.O. Kasp, McGraw Hill.
3	"Structure & properties of materials (VOL VI), Electronic Properties", by Robert M. Rose, Lawrence A.Shepherd & John Wulf, Wiley Eastern Ltd.

Electrical and Electronics Materials Lab are according to the theory mentioned above. 0L:0T:2P 1Credit

Semester – IV to VIII

(in process…)