Nirma University
Institute of Technology
Department of Instrumentation and Control Engineering

B Tech in Instrumentation and Control Engineering

MA101: Calculus

[3 1 0 4]

Learning outcomes:

On completion of the course student

CLO1: will be able to find higher ordered derivatives and hence represent function in power series of (x-a)

CLO2: will apply the knowledge of function of several variables , its derivatives in engineering problems

CLO3: will apply the knowledge of special functions(Gamma, Beta, Elliptic, Error) and its application in engineering problems

CLO4: will apply the knowledge of multiple integration and its application in engineering problems

Syllabus:

Unit I: Differential Calculus Review of limits, continuity and differentiability, Successive differentiation, Leibnitz theorem (without proof), Indeterminate forms, Taylor's and Maclaurin's expansion of single variable, Partial Differentiation, Total derivative, Chain Rule, Implicit function, Euler's theorem and its applications, Taylor's and Maclaurin's expansion of function of several variables, Maxima and Minima of function of several variables, Lagrange's method of undetermined multipliers, Jacobian.

Unit II: Integral Calculus Review of proper and improper integrals, Reduction formulae, Beta-Gamma functions, Error function, Tracing of curves, Rectification, Quadrature, Volume of solid of revolution, Area of surface of revolution, Double integral and evaluation, Change of order of integration, Change of variable, Triple integral and evaluation, Area using double integration, Volume as double and triple integration, Volume of solid by double integration.

References:

1. Thomas' Calculus(Latest edition), Pearson publication.
2. G B Thomas and R. L. Finney, Calculus and Analytic Geometry (Latest edition), Narosa Publication, Delhi.
3. James Stewart, Calculus (Latest edition), Thomson Learning.
4. B. S. Grewal, Higher Engineering Mathematics, (Latest edition) Khanna publication, Delhi.
5. Dr. K. R. Kachot, Higher Engineering Mathematics Vol I (Latest edition), Mahajan Publication, Ahmedabad.
6. Sharma and Yeolekar, Engineering Mathematics Vol. I. (Latest edition), PHI, New Delhi.

L	T	P	C
2	0	0	2

Course Code	HSXXX
Course Title	Principles of Economics

Course Learning Outcomes (CLO):

At the end of the course, students will be able to-

1. interpret the various basic economic principles
2. relate the economic fundamentals with engineering practices
3. infer the macro-economic aspects of engineering projects

Syllabus:	**Teaching hours:**
Unit I **Basic Economic Concepts:** Needs, wants, means/resources – marginal principle and economic efficiency, trade - off, opportunity cost, rationality, externalities, differences between micro economics and macro economics	**3**
Unit II **Demand and Supply:** Meaning and determinants of demand and supply, law of demand and law of supply equilibrium between demand and supply.. The concept of elasticity – meaning and types	**3**
Unit III **Production, Cost and Revenue:** Production function, law of variable proportion and laws of returns to scale, different types of costs – variable cost, fixed cost, total cost, average cost, average fixed cost, average variable cost and marginal cost, Total revenue, average revenue and marginal revenue, profit function	**3**
Unit IV **Market Structures & Pricing:** Concept of market and equilibrium-characteristics of perfect competition, monopoly, monopolistic competition and oligopoly–price determinations	**6**
Unit V **Macro-Economic Environment:** Basic macro- economic concepts – aggregate demand aggregate supply, money, income employment consumption savings and investment. National Income Accounting-concepts and methods of national income – recent changes in the methodology of national income accounting	**7**
Unit VI **Banking:** Meaning and functions of commercial banks and central bank	**3**
Unit VII **Inflation:** Meaning, and types of inflation, Causes and effect of inflation on different **s**ectors of the economy	**2**

Unit VIII **3**

International Trade: Meaning and significance of International Trade, Cases for and against globalization. World Trade Organization (WTO) – functions and recent deliberations in World Trade Organization (WTO)

Self -Study:

The self -study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings^:

1. Mankiw, N. G. Principles of Economics. Mason. Mason,USA: South-Western Cengage Learning.
2. Samuelson P. A. & Nordhaus, W.D. Economics. India: Tata McGraw Hill Education.
3. Pindyck, R.S., Rubinfeld, D. L. & Mehta, P. L. Micro Economics. New Delhi, India: Pearson.
4. Ahuja H.L. Modern Economics. New Delhi,India: S. Chand & Company Ltd.
5. Dornbusch, R., Fisher, S, & Startz, R. Macro Economics. India: Tata McGraw Hill Education.
6. Gupta, G. S. Macro Economics Theory and Applications. India:Tata McGraw Hill.

L =Lecture, T =Tutorial, P= Practical, C=Credit

^ this is not an exhaustive list

L	T	P	C
3	1	0	4

Course Code	**2MA201/MA102**
Course Title	**Calculus and Differential Equations**

Course Learning Outcomes (CLO)

At the end of the course, students will be able to-

1. apply differential and integral calculus to solve engineering problems,
2. use power series to solve differential equations appears in engineering filed,
3. deal with functions of several variables that are essential in engineering.

Syllabus:

Teaching hours

Calculus **7**

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

Infinite Series **7**

Convergence of series, tests for convergence, power series, Taylor's and Maclaurin's series. Series for exponential, trigonometric and logarithmic functions

Multivariable Calculus: Differentiation **7**

Limit, continuity and partial derivatives, total derivative and chain rule, Euler's theorem, Taylor's series in two variables, Tangent plane and normal line, Maxima, minima and saddle points Method of Lagrange multipliers

Multivariable Calculus: Integration **9**

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).

Ordinary Differential Equations **10**

Second order linear differential equations with constant coefficients, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties

Partial Differential Equations: First Order **5**

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

Tutorials

This shall consists of at least 8 tutorials (TA) based on the syllabus

Self-Study

Self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from the self-study contents.

Suggested Readings:

1. G B Thomas and R L Finney, Calculus and Analytic geometry; Pearson
2. T Veerarajan, Engineering Mathematics; McGraw-Hill
3. B V Ramana, Higher Engineering Mathematics; McGraw-Hill
4. N P Bali and M Goyal, A text book of Engineering Mathematics; Laxmi Publications
5. B S Grewal, Higher Engineering Mathematics; Khanna Publishers
6. E Kreyszig, Advanced Engineering Mathematics; John Wiley & Sons
7. W E Boyce and R C DiPrima, Elementary Differential Equations and Boundary Value Problems; Wiley India
8. S L Ross, Differential Equations; Wiley India
9. E A Coddington, An Introduction to Ordinary Differential Equations; Prentice Hall India
10. E L Ince, Ordinary Differential Equations; Dover Publications
11. G F Simmons and S G Krantz, Differential Equations; McGraw Hill

L = Lecture, T = Tutorial, P = Practical, C = Credit

CY101 CHEMISTRY [2 0 2 3]

Course Learning Outcome:

After successful completion of the course, students will be able to

- understand the relevance of fundamental and applications of chemical sciences and chemistry in the field of engineering
- know the principles of green chemistry and apply the concept of green chemistry so as to reduce the pollution
- apply the core concepts in materials science to solve engineering problem

Syllabus:

Water and its Treatment: Introduction, Sources of water impurities, Hardness of water, Degree of hardness, Softening of water, Water treatment processes, Problems with boiler feed water and its treatments Specifications for drinking water (BIS standards)

Fuel: Calorific Value, Types of fuel, Selection of fuels, Analysis of coal:- proximate and ultimate analysis, Flue gases:- Orsat apparatus, Alternative fuels:- Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG), Ethanol, Bio-diesel

Lubricants: Classification and functions of lubricants, Properties:- lubricating oil and greases, Selection of lubricants

Polymers and Composite materials: Introduction to Polymers and Polymerization, Elastomers, classification and uses, Biopolymers:-Cellulose and starch, Advanced polymeric materials, Composites:- Introduction, classification and applications

Green Chemistry: Overview, Set of Principles of Green Chemistry, Industrial applications.

Engineering Materials: Adhesives:- characteristics, classification, and uses, Fullerenes:- structure, properties and applications, Nanorods:- brief introduction, Organic Electronic Materials:- introduction, types and applications, Liquid Crystals:- Introduction, classification and applications, Explosives:- Introduction, Classification, Characteristics, Disarmament, Weapons of Mass Destruction (WMD), peaceful uses of explosives

Overview of electrochemical systems

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 12 experiments to be incorporated.

References:

1. P.C. Jain and Monika Jain, Textbook of Engineering Chemistry, Dhanpat Rai Publishing Co.
2. Shashi Chawla, Textbook of Engineering Chemistry, Dhanpat Rai Publishing Co.
3. S.S. Dara, Textbook of Engineering Chemistry, S. Chand and Company.
4. Mike Lancaster, Green Chemistry: An Introductory Text, Royal Society of Chemistry.
5. J.C. Kuriacose and J. Rajaram, Chemistry in Engineering and Technology, Tata Mc Graw Hill.
6. Prasanta Rath, Engineering Chemistry, Cengage Learning.
7. Sunita Rattan, A Textbook of Engineering Chemistry, S.K. Kataria & Sons.

	3	1	2	5

Course Code	**2CS101**
Course Title	**Computer Programming**

Course Learning Outcomes (CLOs):
At the end of the course, students will be able to –

1. recognize the importance and apply C language constructs in program development,
2. analyse the problem and select the most appropriate method to solve it,
3. evaluate the correctness of the developed solution.

Syllabus: **Teaching hours:**

Unit I 5

Introduction to Computers: Introduction to Computers and the Internet in Industry and Research, The Internet and World Wide Web, web Resources, Hardware and Software, Computer Organization, Programming Languages, Introduction to the C Programming Language, Typical C Program Development Environment and steps. Test-Driving a C Application in Linux, Running a C program Using GNU for debugging.

Unit II 9

Introduction to Programming: Memory Concepts, datatypes, operators and expressions, Decision Making, Bitwise Operators, Flowchart, Algorithms, Pseudocode, Test-cases, Repetition Statement, Counter-Controlled Repetition, Sentinel-Controlled Repetition, Nested Control Statements. Introduction some Simple C Program, I/O handling.

Programming with C: keywords, syntax and library functions, datatypes, declarative, imperative and decision statements. Control structures.

Unit III 10

Functions: Math Library Functions, User defined functions, Function Call Stack and Stack frames, Passing Arguments by Value and By Reference, Scope Rules, Recursion, Recursion vs. Iteration.

Arrays: Defining Arrays, Sorting Arrays, Searching Arrays, Multidimensional Arrays, Variable-Length Arrays, Passing Arrays to Functions.

Unit IV 11

Pointers: Pointer Variable Definitions and Initialization, Pointer Operators, Passing

Arguments to Functions by Reference, Pointer Expressions and Pointer Arithmetic, Relationship between Pointers and Arrays, Arrays of Pointers, Pointers to Functions. Introduction to dynamic memory allocation.

Characters and Strings: Fundamentals of Strings and Characters, Character-Handling Library Functions, String-Conversion Functions, Standard Input/Output Library Functions for string, String-Manipulation Functions of the String-Handling Library, Comparison Functions of the String-Handling Library.

Unit V 10

Structures: Structure Definitions, Defining Variables of Structure Types, Operations That Can Be Performed on Structures, Initializing Structures, Accessing Structure Members, Using Structures with Functions

File Processing: Files and Streams, Creating a File, Reading and writing Data from a File.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Above concepts are to be implemented in C-language atleast with emphases on logic development and debugging, 10 experiments are to be carried out.

Tutorial Work:

The tutorial work will be based on the topics covered in the syllabus. Minimum 10 tutorials should be carried out.

Suggested Readings^:

1. Deitel and Deitel , C How to Program, Pearson
2. E. Balagurusamy, 'Programming in ANSI C", McGraw Hill
3. Yashwant Kanitker, Let Us C, BPB Publications
4. V. Rajaraman, Fundamentals of Computers, Prentice Hall of India
5. Joyce Farrell, Programming Logic and Design Comprehensive, Cenage Learning
6. David Gries, The Science of Programming, Springer
7. Dromey R.G., How to solve it by computers, Prentice Hall of India
8. Jean-Paul Tremblay, Richard B. Bunt, Introduction to Computer Science, McGraw Hill
9. Kernighan., Ritchie, ANSI C Language, Prentice Hall of India
10. Sedgewick R., Algorithms in C, Addison Wesley
11. Schaum Ourline Series, Programming in C, , McGraw-Hill
12. E. Balagurusamy, Pointer in C, McGraw Hill

L= Lecture, T= Tutorial, P= Practical, C= Credit

2EE102 ELECTRICAL WORKSHOP [0 0 2 1]

Course Outcomes (CO)

At the end of the, a student will be able to –

1. identify and propose appropriate electrical and electronic components for relevant applications,
2. select and make use of various laboratory equipment,
3. build simple domestic and industrial wiring systems,
4. apply basic maintenance and troubleshooting skills to house hold electrical appliances,
5. extend the awareness about safe practices in electrical systems.

Syllabus

Unit	Content	Teaching Hours
1	**Wiring Techniques** Designing of domestic and industrial wiring, selection of wire, load calculations	2 Entre
2	**Introduction to Electronic Components** Study of various electronic components like, power and signal diodes, zener diodes, BJTs, FETs, LED, LDR, Photo diode, Photo transistor, SMD components, general purpose ICs, use of bread board	4 Skill dev
3	**Lab Equipment** CRO, DC regulated power supply, function generator, multimeter, single-phase and three-phase auto-transformer (variac)	4 Skill dev
4	**Introduction to Electrical Components** Study of different types of switches, solid state and electromagnetic relays, contactors, rheostats, different types of capacitors, resistors, variable inductor (choke) etc.	4 Skill dev
5	**Soldering Techniques** Basics of soldering techniques, effectiveness of soldering and problem associated with soldering, general purpose board soldering	2 Skill dev, Entre
6	**Basics of Household Electrical Equipment** Rewiring / replacement of fuse, switch board layout, functioning	4 Skill dev

	of switch, fan regulator, tube light, electric iron, electric heater	
7	**Electrical Safety and Protection** Safety, electric shock, safety protections in electrical laboratory, methods of earthing, protective devices - fuses, MCB, ELCB and relays	4 Skill Dev, employ
8	**Designing of Electrical Panel** Basic design steps and criteria, selection of various components, layout of panel, ferruling, crimping, lugging, annunciation, display, mimic, meter mounting etc.	4 Entre
9	**Introduction to DC Machine** Study of various parts of DC machine. Operation of DC machine as DC motor	2 Skill Dev

References

1. Mr. S. Samaddar, Textbook of Electric Wiring, New Central Book Agency (P) Ltd., Calcutta
2. Surjit Singh, Textbook of Electrical Design Estimating and Costing, Dhanpat Rai & Sons
3. Sengupta R., Textbook of Principles and Reliable Soldering Techniques, New Age International (P) Ltd
4. B. L. Theraja, A. K. Theraja, Textbook of Electrical Technology Vol – III, S. Chand Publishers., New Delhi
5. K. B. Bhatia, Textbook of Fundamentals of Maintenance of Electrical Equipment Khanna Publishers
6. Er. Mehta S. D., Textbook of Electronic Product Design Vol – I, S. Chand Publishers., New Delhi
7. Dr. S. K. Bhattacharya, Dr. S. Chatterji, Textbook of Projects in Electrical, Electronics, Instrumentation and Computer Engineering, S. Chand Publishers., New Delhi
8. National Electrical Code: Bureau of Indian Standards, Govt. Of India, 2011
9. Operating Manuals of Various Equipment

2EE101 ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course Outcomes (CO)

COs are clear statements of the expectations for student achievements in the course.

At the end of the course, a student will be able to –

1. interpret the importance of electrical energy and relate its usage in various applications,
2. illustrate the role of circuit elements in different system conditions,
3. distinguish the operational aspects of ac-dc systems and comprehend the principles of electromechanical energy conversion,
4. recognise the functions of electronic devices and basic circuits,
5. apply the concepts of number based conversion and Boolean algebra for digital logic design.

Syllabus

Unit	Content	Teaching Hours
Unit - 1	**Review of dc Circuits** Kirchhoff's laws, solution of star-delta circuits, Joule's law of electric heating, relationship between various energy units, charging and discharging of capacitor, series-parallel magnetic circuits, fringing effect, comparison between electric and magnetic circuit, Concept of induced emfs, series-parallel connection of inductors, rise and decay of current in inductive circuit.	10 Skill Dev
Unit - 2	**Single-phase AC Circuits** Generation of alternatingemf, instantaneous, rms, peak, average values and related other terms, vector representation of AC quantities, Steady state analysis of R, L, C series and parallel circuits, power triangle, resonance in series and parallel circuits.	08 Skill Dev
Unit - 3	**Three-phase AC Circuits** Generation of three-phase emf, star connection, delta connection, relationship between line and phase quantities, power measurement in three-phase circuit, variation in wattmeter reading with power factor.	07 Skill Dev
Unit - 4	**Electromechanical Energy Conversion** Concept of electro-mechanical conversion, energy balance, elementary concept of electrical machines, types of rotating electrical machines.	04 Skill Dev
Unit	**Analog Electronics** Half and full wave rectifiers, special purpose diodes, regulator, BJT and its	08

- 5	applications, amplifier, oscillator, overview of opto-electronics devices, opto-couplers, transducers, Operational amplifier, Comparator, Timer IC and multivibrators.	Skill Dev
Unit - 6	**Digital Electronics** Number systems and its arithmetic, binary codes, Boolean-algebra & simplification of Boolean expression; logic gates, concept of universal logic; implementation of Boolean expressions using logic gates, application of digital circuits (e.g. adder, subtractor, multiplexer, de-multiplexer, analog to digital converter, digital to analog converter	08 Skill Dev

References

1. B.L.Theraja, A.K. Theraja, Textbook of Electrical Technology Volume I –, S. Chand & Co.
2. A. E. Fitzgerald, Arvin Grabel, David E. Higginbotham, Textbook of Basic Electrical Engineering –TMH Publishing Co.
3. U. A. Patel, Textbook of Elements of Electrical Engineering, Mahajan Publishing House, Ahmedabad.
4. J. Nagrath, Basic Electrical Engineering, TMH Publishing Co. Ltd.
5. Vincent Del Toro, Textbook of Principles of Electrical Engg., Prentice Hall of India Pvt. Ltd., New Delhi.
6. Mr. S. Samaddar, Textbook of Electric Wiring, New Central Book Agency (P) Ltd., Calcutta.
7. Surjit Singh, Textbook of Electrical Design Estimating and Costing, Dhanpat Rai & Sons.
8. Robert Boylestad, Louis Mashlsky, Electronics Devices and Circuit theory, Peerson
9. M. Morris Mano, Digital logic and computer Design, PHI

ME101 Engineering Graphics [2 0 4 4]

Course Learning Outcomes:

After successful completion of the course, student will be able to

- Understanding the fundamental principles of engineering graphics and related drawing standards
- explain the various methods of producing and presenting graphic information.
- communicate graphically using traditional means and the computer aided tools.
- develop capability to visualize and represent geometry in two dimensions and in three dimensions.
- appreciate role of engineering graphics and modeling for various disciplines of engineering.

Syllabus:

Introduction to Engineering Drawing
Importance and Applications of Engineering Drawing for various branches of engineering, Drawing instruments, BIS Code of Practice, Lines, Lettering and Dimensioning, Scales, Basic Geometrical Construction, Sheet Layout

Engineering Curves
Equations of conic curves and cycloid and their relevance to construction.
Construction of conics by Focus Directrix Method, Construction of Ellipse by Arcs of Circle Method, Parabola by Rectangle Method, Rectangular and oblique Hyperbola. Construction of Cycloid, Epicycloids and Hypocycloid. Construction of Involutes. Constructions of Archimedean spiral and helix.

Solid Geometry
Concept of Orthographic Projections and Projections of Points, Projections of straight lines inclined to one and both reference planes, Projections of Planes inclined to both reference planes, Projections of solids and sections of solid.

Developments of Surfaces by parallel line method and radial line method.

Interpenetration of Solids
Determination of lines / curves of intersection for interpenetration of Prism to prism, Cylinder to cylinder, Cylinder to cone, Cone to cylinder.

Orthographic Projections
Conversion of pictorial views in to orthographic Projections. Sectional orthographic Projections.

Isometric Projections
Conversion of orthographic views into isometric projections / views.
Computer Aided Drafting Tools
Basic Drawing Creation Tools- creating a line, circle, Arc, Donut, Ellipse, Point, Multi-Line, Polygon, Spline. Using editing tools such as Dividing and Measuring.

Modifying Commands and Views- Rectangular and Polar arrays, modify using BREAK, CHAMFER, COPY, EXPLODE, EXTEND, FILLET, MIRROR, MOVE, OFFSET, PEDIT, ROTATE, SCALE, STETCH, TRIM. Adding Text to Drawings, Dimensioning Tools.

Conventional Representation

Symbols for standard machinery components such as nuts, bolts, locking devices, riveted and welded joints, foundation bolts. Symbols used in electrical, electronics and civil engineering.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory Work will be based on the above syllabus consisting of minimum six drawing sheets.

References:

1. N D Bhatt, Engineering Drawing, Charotar publication
2. K. C. John, Engineering Graphics, PHI Publication.
3. Warren J Luzzader and Jon M Duff, Fundamentals of Engineering Drawing, PHI publication.
4. James D Bethune, Engineering Graphics with AutoCAD® , PHI Publication.
5. IS SP 46 : 2003. Engineering Drawing Practices for Schools and Colleges.

EE101 Elements of Electrical Engineering [3 0 2 4]

Learning Outcome:

The course is designed to introduce to a novice about the fundamentals of the electrical engineering. At the end of the course, it is expected that student will be able to express the behavior of basic electrical components like resistor, inductor and capacitor under DC and AC application. The students are exposed to single-phase and poly-phase systems and circuits and shall be able to comprehend the same. The student will be able to appreciate safety requirements and usage of safety devices. The learner will be able to understand and apply the basics of electrical engineering in their respective field of engineering.

Syllabus:

Review of DC Circuits

Resistor, temperature effect on resistance, Kirchhoff's laws, solution of series-parallel and star-delta circuits, Joule's law of electric heating, relationship between various energy units, types of capacitor, charging and discharging of capacitor, fundamentals of magnetic circuits, fringing effect, series-parallel magnetic circuits, comparison between electric and magnetic circuit

Electromagnetic Induction

Faraday's laws of electromagnetic induction, concept of induced emfs, coefficient of coupling, series- parallel connection of inductors, rise and decay of current in inductive circuit, hysteresis and eddy current loss

Single-phase AC Circuits

Generation of alternating emf, instantaneous, rms, peak, average values and related other terms, vector representation of AC quantities, Steady state analysis of R, L, C series and parallel circuits, power triangle, resonance in series and parallel circuits

Three-phase AC Circuits

Generation of three-phase emf, star connection, delta connection, relationship between line and phase quantities, introduction to rotating vector, power measurement in three-phase circuit, solution of balanced and unbalanced systems

Domestic and Industrial Wiring

Basic domestic wiring methods, types of cable, accessories, PVC conduit and PVC casing, salient features of industrial wiring, consideration on cross sectional area and insulation strength based on voltage and current rating, design calculations, protective systems, Indian standard wiring practices

Electrical Safety and Protection

Safety, electric shock, safety protections in electrical laboratory, methods of earthing, protective devices - fuses, MCB, ELCB and relays

Batteries

Different types of batteries, need of batteries, charging and discharging of batteries, methods of charging

Laboratory Work:

This shall consist of at least 10 practicals based on the above syllabus.

References:

1. Electrical Technology, Volume I – B.L.Theraja, A.K. Theraja; S. Chand & Co.
2. Basic Electrical Engineering – A. E. Fitzgerald, Arvin Grabel, David E. Higginbotham, TMH Publishing Co.
3. Elements of Electrical Engineering – U. A. Patel, Mahajan Publishing House, Ahmedabad.
4. Basic Electrical Engineering – I. J. Nagrath, TMH Publishing Co. Ltd.
5. Principles of Electrical Engg.– Vincent Del Toro, Prentice Hall of India Pvt. Ltd., New Delhi.
6. Electric Wiring – Mr. S. Samaddar, New central book agency (P) Ltd., Calcutta.
7. Electrical Design Estimating and Costing – Surjit Singh, Dhanpat Rai & Sons.

HM102, English (Foreign Language) [2 0 2 3]

Course Learning Outcome:
By the end of this course

- Student will be able to understand and speak a new language
- Student will be more aware about the world outside
- It will add to the knowledge of culture other than their own
- Multi-Linguistic skills will equip them with better communication skills too

Syllabus of English Language:
The course content will encompass following topics

Grammar

- Tenses
- Helping and Modal auxiliary verb
- Concords
- Prepositions
- Idioms
- Synonyms –Antonyms
- Confusables

Prose

- Open Window by Saki
- A Cup of Tea by Katherine Mansfield
- The Piece of String by Guy De Maupassant
- Text of Steve Jobs' Commencement address -2005
- How to be an Alien by George Mikes

Poems

- Ode to the skylark – by P B Shelley
- Where The Mind Is Without Fear - by Rabindranath Tagore.
- The Road Not Taken- Robert Frost
- On The Move - by Thom Gunn.

Methodology:

Readings, exercises, role plays, videos will be the basic tools for teaching

As the course on foreign language will be offered by different experts, depending on the availability of the experts and demand, the syllabus of the offered foreign language will be approved by the Dean time-to-time before start of the every semester.

References:

1. Leech Geoffery and Svartik Jan, 'A Communicative Grammar of English', Pearson pub.
2. Murphy Raymond, 'Grammar in Use Intermediate with Answers', Cambridge University Press
3. Selected text in the form of handouts.0

L	T	P	C
1	1	2	3

Course Code	**2HSI101/2HSB101**
Course Title	**English Communication**

Course Learning Outcomes (CLO):

At the end of the course, students will be able to -

- acquire adequate proficiency in English communication including reading and listening, comprehension, writing and speaking skills,
- apply the dynamics of communication skills.

Syllabus:

Vocabulary Building
Teaching hours: 4 hrs (L)
Origin of English Language, Types of English, The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.

Basic Writing Skills
Tutorial hours: 3 hrs (T)
Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely.

Identifying Common Errors in Writing Teaching hours: 2 hrs (L),
Tutorial hours: 2hrs (T)
Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Cliches.

Nature and Style of sensible Writing
Teaching hours: 3hrs (L)
Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion.

Writing Practices
Tutorial hours: 4 hrs (T)
Comprehension, Precis Writing, Essay Writing, Idea Expansion.

Oral Communication
Tutorial hours: 6 hrs (T)
Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm.

Persuasive Communication
Teaching hours: 6 hrs (L)

Communication at Workplace: Report, Application and email writing, Referencing, Interviews, Formal Presentations.

Laboratory Work

Practices related to tenses, prepositions, word formation/transformation concord, affixes, one-word substitutes, idioms etc. Vocabulary building, Presentations and Group Discussions.

Self-Study

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings:

(i) Selected Texts and excerpts.
(ii) Selected movies and TED talks
King's Speech

Babel

Episodes of Yes Prime minister

Episode of Sherlok

(iii) Practical English Usage, Michael Swan, OUP. 1995.
(iv) Remedial English Grammar, F.T. Wood, Macmillan. 2007
(v) On Writing Well, William Zinsser, Harper Resource Book. 2001.
(vi) Study Writing, Liz Hamp-Lyons and Ben Heasly, Cambridge University Press. 2006.
(vii) Communication Skills, Sanjay Kumar and PushpLata, Oxford University Press. 2011.
(viii) Word Power Made Easy, Norman Lewis.
(ix) Raymond Murphy, Essential English Grammar: A Self-Study Reference and Practice Book for Elementary Students of English with Answers, Cambridge University Press.
(x) Collins Academic Skills Vocabulary Organizer.
(xi) Collins Writing Skills B2+.
(xii) Real Life Real Listening-Collins.

CL101 Environment and Energy Studies [3 0 0 3]

Course Learning Outcome:

After successful completion of the course, student will be able to

- comprehend issues and challenges towards environmental conservation and sustainability
- understand various types of pollutants, environmental pollutions and control techniques
- understand the role of environmental impact assessment and environment management systems and select them for specific application
- recognize various energy resources and articulate their values for it's significant conservation

Syllabus:

Environment – The need of sustainability, Nature & Issues: Introduction to environment and the multidisciplinary nature of environment. Environment conservation and management as the key requirements of sustainability. Definitions, scope and importance, need for public awareness.

Environmental Pollution: Quantification of environmental pollution, various parameters and indexes. Types of environmental pollution and pollutants. Causes, effects and control measures of – Air pollution, Water pollution, Solid and e-waste management, Soil/land pollution, Noise pollution, Radioactive pollution and Thermal pollution. Role of an individual in prevention of pollution.

EMS and EIA: Introduction and basics of environmental management systems and environmental impact assessment.

Social issues and the environment: Environment ethics, issues and possible solutions. Urban problems related to energy, water conservation, rain water harvesting, water shed management, rehabilitation problems and concerns- case study of Sardar Sarovar dam, environment protection acts.

Human population and the environment: Population growth, variation and development. Environment – Population- human health, value education.

Energy – Sources, types and important aspects: Introduction to energy sources: How energy is produced and consumed, and ways in which it impacts society and the environment. Physical understanding of issues and problems involved with the generation, storage, transport, and usage of various forms of energy in technological society. Types of energy resources as Renewable and Non-renewable energy, fossil fuels and hydropower, nuclear, solar, and wind energy, and issues related to energy conservation in everyday life. Effects of waste products associated with energy generation and usage and energy conservation measures.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

1. S. Dara and D. Mishra, A textbook of Environmental Chemistry and Pollution Control, S. Chand & Company Ltd.
2. Suresh Dhameja, Environmental Studies, S. Kataria & Sons.

3. Robert Ristinen and Jack Kraushaar, Energy and the Environment, Wiley.
4. Gilbert Masters, Introduction to Environmental Engineering and Science, Prentice-Hall Publications.
5. Anindita Basak, Environmental Studies, Pearson Publications.

HM131, French Language (Foreign Language)

[2 0 2 3]

Course Learning Outcomes:

At the end of the 40 hours course, students will be evaluated on the basis of 4 competences:

- Writing (Filling forms, post cards, small emails, messages),
- Speaking (To present oneself in details, to be able to ask questions in certain given situations, Role Play),
- Written Comprehension (Small texts, post cards, messages),
- Oral Comprehension (Understanding the basic day to day conversations).

Pedagogy: Communicative and Action Oriented Approach

Supplementary:
Cultural activities of Alliance Française d'Ahmedabad.

COURSE CURRICULUM

Main guidelines

1) To introduce oneself
2) To ask information about someone
3) To count
4) To communicate in a class
5) To Greet
6) To take leave
7) To ask personal information
8) To ask politely
9) To give personal information
10) To ask the price
11) To ask about likings
12) To express about our likings
13) To talk about a city
14) To name and find out different places in a city
15) To ask and give an explanation
16) To thank and to reply
17) To write a message
18) To give impressions about a place
19) To talk about ones' activities
20) To say where we live
21) To talk about the weather
22) To fix or postpone a meeting
23) To talk briefly about oneself
24) To ask the time and the timings
25) Telephonic conversation
26) To talk about the family
27) To talk about seasons
28) To understand simple information about the weather
29) To appreciate
30) To precise the quantities
31) With relevant vocabulary and grammar points.

HM131, German Language (Foreign Language)

[2 0 2 3]

Course Learning Outcomes : On completion of the course, the student would be able to:

- understand & convey expressions associated with everyday routine and topics related to direct circumstances and common requirements in Germany (e.g. seeking and sharing personal information, handling simple conversations related to shopping, making reservations, ordering in restaurants, airports, banks, railway stations, universities and other all such public places).
- get an insight into the day-to-day socio-economic culture of Germany.
- appreciate a foreign culture and the importance of learning a foreign language.
- understand and put basic German grammar such as various types of verbs, nouns, adjectives, tenses and cases to practical & functional use.
- read, write, speak and understand elementary German and be able to hold simple, short conversations confidently.

Themes & Topics Covered:

- German Greetings & Good-bye's
- Introduction (Seeking introductions & introducing yourself thoroughly in German)
- Orientation: Learning directions & interpreting city plans (Finding your way in the city, inquiring about places, communicating with localities, making basic conversations in Post Offices, Airports, Railway Stations & public places)
- Learning Countries, States & Capitals
- Professions
- Making reservations: Hotels, Taxis & other such routine bookings
- Placing order in Restaurants & learning to find your way around routine requirements
- Learning time, dates, days of the week, numbers & occasions/festivals.

Grammar Covered: Nouns- In depth study of nouns, with emphasis on case-specific changes

1. Verbs- Regular, Irregular, Helping, Separable & Modal verbs. All with their conjugations
2. Subjects- Nominative and accusative. Correlation between a subject & a verb
3. Cases- Nominative, accusative & dative. Effect of each on nouns & the corresponding changes
4. Articles- Definite & indefinite articles. Its impact & ultimate effect on cases
5. Sentences: Imperative, declarative, exclamatory & interrogative. Positive & negative sentence construction shall also be covered (e.g: "Ja", "doch", as well as " nein", "nicht" & "kein" respectively)
6. Concepts such as adjectives, possessive pronouns, prepositions & adverbsSentence Construction

IC101 Introduction to IC Engineering [0 0 1 0]

Syllabus	**Hours**
UNIT 1: About Engineering	**1**
About engineering, History of engineering, Social relevance of engineering, Role of engineering in human life	
UNIT 2: Introduction to Instrumentation and Control Engineering Major constituents of IC Engineering: Test and Measurement, Control Engineering, Electronics, Industrial Automation, etc	**3**
UNIT 3: Aspects of IC Engineering Productivity, Profitability, Safety, Optimization, Environmental concern, Societal needs,etc.,	**2**
UNIT 4: Emerging Trends Building Automation, Internet of Things, Business Process Automation, Management Information Systems, Artificial Intelligence, Machine Vision	**3**
UNIT 5 : Interdisciplinary Approach IC Engineering as interdisciplinary branch, inter relation of IC engineering with other domains	**2**
UNIT 6: Career opportunities Role and Responsibilities of Instrumentation and Control Engineer in various verticals of industries, Entrepreneurship, Start up, Further studies	**2**
UNIT 7: Case Studies Role of IC Engineering in noteworthy industrial developments	**2**

Self-study Overview of different instrumentation and control engineering domains will be discussed in the class. It is expected that students put in at least two hours of work for every one hour of class room session.

References

(1) International Society of Automation portal - www. isa.org
(2) InTech Magazine
(3) https://www.controleng.com

MA201: Linear Algebra

[3 1 0 4]

Learning outcomes:

On completion of the course student

CLO1. will have basic knowledge of vector space.
CLO2. will have basic knowledge of matrix algebra..
CLO3. Will able to apply the knowledge of linear algebra in solving system of linear equations.

Unit:-1. Matrix theory: Review of algebra of matrices, Rank of matrix, Inverse of matrix by Gauss-Jordan method, Solution of system of algebraic simultaneous equations, Linearly dependent and Linearly independent functions, Caley-Hamilton Theorem (without proof), eigen values and eigen vectors, Eigen values and eigen vectors of orthogonal, symmetric, skew-symmetric matrices, Hermitian matrix, skew-Hermitian matrix, Unitary matrix, Normal matrix, Algebraic and geometric multiplicity, Diagonalization, Spectral theorem for Real symmetric matrices, Application of quadratic forms.

Unit:-2. Vector space and Linear transformations: Definition of vector space, subspaces, linear combination, Linearly dependent and linearly independent vectors, Basis of vector space, Dimension, Rank-Nullity theorem (statement and verification by examples), Definition of linear transformation, types of linear transformations (Rotation, Reflection, Expansion, Contraction, Projection), Matrix of Linear transformations, Change of basis and similarity.

References:

1. David C. Lay, Linear algebra and its application, (Latest edition), Pearson publication, New Delhi.
2. E. Kreyszig, Advanced engineering mathematics (Latest edition), John Wiley.
3. H. Anton, Elementary linear algebra with applications (Latest edition), John Wiley.
4. K Hoffman & Ray Kunze, Linear Algebra, PHI, New Delhi.
5. P. Sharma and M. Yeolekar, Engineering mathematics, Vol-II, (Latest edition), PHI publication, New Delhi.
6. S. Kumaresan, Linear algebra - A Geometric approach (Latest edition), PHI, New Delhi.

L	T	P	C
0	0	2	1

Course Code	**ME104**
Course Title	**Mechanical Workshop**

Course Learning Outcomes (CLO):
After successful completion of the course, students will be able to-

1. explain the safety measures required while working in the mechanical workshop,
2. interpret an engineering drawing for the given practice job,
3. select and make use of proper hand tools for a given job,
4. develop an understanding of various workshop practices.

Course Outline:

(a) Instruction / demonstration shall be given for each of the following shops/trades with regards to the materials, tools and equipment used: **10 hours**

1. Introduction to Mechanical Workshop Practice
2. Joining process
3. Plumbing
4. Fitting
5. Sheet metal work
6. Carpentry
7. Black smithy
8. Use of conventional and CNC machines

(b) Exercise and Term work: Each student is required to prepare a job in the following trades: **20 hours**

1. Arc Welding
2. Fitting
3. Carpentry
4. Black smithy

Suggested Readings:

1. H S Bawa, Workshop Practice -I and II by, TMH Publication.
2. K C John, Mechanical Workshop Practice by, PHI Publications.

L = Lecture, T = Tutorial, P = Practical, C = Credit

ME102 Mechanical Workshop Practices [0 0 2 1]

Course Learning Outcomes: After successful completion of the course, student will be able to

- comprehend safety measures required to be taken while work in the mechanical workshop.
- select proper tools and cutting data for a given material and manufacturing process.
- properly operate the equipment in the mechanical workshop.
- competent to read and use an engineering drawing for the given job.

Syllabus:

(a) Instruction / demonstration is given for each of the following shops/trades, new materials, tools and equipment used.

1. Joining process
2. Plumbing (metalic & non metalic pipe fittings)
3. Fitting /Assembly practice
4. Sheet Metal work
5. Electroplating
6. Carpentry/ Pattern Making
7. Blacksmithy
8. Painting

(b) Exercise and Term work: Each student is required to prepare simple exercises in the following so as to have a feeling of how the jobs / parts are prepared and use of tools / equipments.

1. Arc Welding / Soldering------02 Hrs
2. Fitting / Assembly. ----------05 Hrs
3. Carpentry Practice ----------02 Hrs
4. Blacksmithy Practice----------02 Hrs

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

1. H S Bawa, Workshop Practice -I and II by, TMH Publication.
2. Hasan Ali and Khan R A, Manufacturing Processes and Workshop Practice, Scitech Publication
3. K C John, Mechanical Workshop Practice by, PHI Publications.
4. B S Raghuvanshi, A course on workshop technology I and II, Dhanpatrai and sons.

CL102 Mechanics of Solids [3 1 2 5]

Course Learning Outcome:
After successful completion of the course, student will be able to

- describe force systems and to compute geometrical properties
- classify materials and characterise them
- analyse various structural elements subjected to different types of force systems
- compute stresses & strains for structural elements
- conduct experiment, infer and report outcomes

Syllabus:
Statics: Principles of statics, particle, rigid body, Coplanar, concurrent and non-concurrent parallel and non-parallel forces, composition and resolution of force, couples and their properties, combination of coplanar couple and forces, forces in truss, force in cable, rigid body assemblies, forces in space
Distributed forces: center of gravity, moment of inertia
Friction: Static and sliding friction, inclined plane friction, ladder friction, wedges, belt and rope friction
Principle of Virtual work
Strength and Elasticity: Stresses; Axial, normal, in-plane, tensile, compressive, shear, flexural, Thermal and hoop, complementary shear. Strain: Linear, shear, Lateral, Thermal and volumetric, Poission's ratio, Elastic constants and relation between them and bodies subjected to loads in three directions.
Shear force and Bending moment: Types of supports, support reactions, Bending moment and shear force diagrams in statically determinate beams subjected to different types of loading, Relation between bending moment, shear force and rate of loading
Stresses in beams: Theory of simple bending, bending stresses and their distribution, moment of resistance, modulus of section, composite beam sections, distribution of shear stress in different sections.
Torsion: Torsion of solid and hollow circular shafts, shear stress due to torsion, angle of twist, Torsional moment of resistance.
Principal Plane and stresses: Compound stresses, analysis of principal planes and principal stresses
Thin cylinder and spherical vessels under pressure
Mechanical Properties of Materials

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory work will be based on above syllabus with minimum 11 experiments to be incorporated.

Tutorial Work:
Tutorial work will be based on above syllabus with minimum 10 tutorials to be incorporated.

References:

1. Meriam and Karaige, Engineering Mechanics: Static, Wiley-India.
2. R. C. Hibbler, Mechanics of Materials, Pearson.
3. Beer, Johnston and Dewolf, Mechanics of Materials, Tata McGraw-Hill Education.
4. H. J. Shah and S. B. Junnarkar, Mechanics of Structure Vol. I, Charotar Publishing House Pvt. Limited.

Course Code	**2PY101**
Course Title	**Physics**

Course Outcomes (CO):

At the end of the course, students will be able to -

1.Acquire the knowledge of fundamental principles of physics and relate to the engineering science,
2.Apply the concepts of Physics for solving Engineering problems,
3.Relate principles of Physics for solving new and challenging problems of technology.

Syllabus: **Teaching hours**: **30**

Physics of Nanomaterials: Introduction to Quantum Physics: Particle in a three dimensional box, Introduction – Nanoscale; Nanomaterials: Methods for synthesis of nanomaterials, Properties of nanomaterials – Electrical, Magnetic, Optical, Mechanical, Characterization techniques – X ray Diffraction (XRD) - Single Crystal, Powder and Laue techniques, Low energy Electron Diffraction (LEED), Scanning Electron Microscopy, Tunnelling Electron Microscopy, Nanostructures; Carbon nanotubes Characteristics and applications, Nanotechnology and environment. — 06

Lasers and Holography: Introduction, Basics of Interaction of radiation with matter, Condition for light Amplification, Population inversion and metastable state, pumping, the principle pumping scheme: Three and Four level scheme, Construction and working of optical resonator, Optical amplifier, Applications of laser beam, Holography. — 06

Introduction to Fiber Optics: Introduction of fiber-optic system, Principle and construction of fiber cable, Acceptance angle and numerical aperture, Types of Optical fiber: Based on material & based on mode of propagation, Index profile, Fiber optic communication link, Fiber optic sensor, Advantages of fiber optic system. — 04

Nuclear and Plasma Physics: Introduction to nuclear physics, types of nuclear reactions, nuclear reaction cross sections, Radius of Gyration, particle accelerators – pinch of synchrotron radiation, nuclear fission as a source of energy, Nuclear radiation counters – Geiger Mullar Counter, scintillation counter. — 05
Basic concepts of Plasma physics: Introduction to Electrostatics and Electromagnetics, Curl, Divergence and Gradient of fields, Maxwell's equations, Motion of charged particle in E and B homogeneous field, Pinch effect, Magnetic trapping of plasma, Van Allen radiation belt.

Physics of Vacuum Techniques and Cryogenics: Creation of vacuum with different pumps-rotary pump, diffusion pump, Measurement of vacuum with different gauges; Need of vacuum in Plasma unit, Cryogenics – use of liquid Nitrogen and liquid Helium, Applications of cryogenics in refrigeration, space and medical field — 04

Engineering of Auditorium and Ultrasonics: Introduction, Defection due to

reflection of sound, Sabine's empirical formula, Reverberation theory, Eyring's equation, Acoustical defects and their remedies, Acoustic materials, Ultrasonic waves, Piezoelectric method, Properties and application of ultrasonic waves	05

Self- Study:

Self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from the self-study contents.

Suggested Readings:

1. M N Avadhnulu and P. Kshirsagar, A Text Book of Engineering Physics, S Chand.
2. T. Pradeep, Nano: The Essentials, New Central book Agency.
3. S. N. Goswami, Elements of Plasma Physics, Tata McGraw Hill publication.
4. B. L. Theraja, Physics for Engineers, S Chand Publication

L= Lecture, T= Tutorial, P= Practical, C= Credit

Course Learning Outcome:

After successful completion of the course, student will be able to

- develop an ability to understand bipolar junction transistor configurations, its characteristics and its biasing
- develop an ability to understand different types of diodes and rectifier circuits
- develop an ability to understand different applications circuits based on operational amplifier
- develop an ability to build the basic analog circuits and circuits based on operational amplifier

Syllabus:

Linear Wave Shaping: High pass RC circuit, High pass RC circuit as a differentiator, Low pass RC circuit, low pass RC circuit as a integrator**.**

Different Types of Diodes and its Characteristics and Rectifiers: Construction and Characteristics of different diodes, Diode applications, Half wave, Full wave and Bridge rectifier.

Clipping and Clamping: Clipping circuit, clamping circuit.

Bipolar Junction Transistor: Transistor Construction, Transistor Operation, Common-Base Configuration, Common-Collector Configuration, Common-Emitter Configuration, Transistor Amplifying Action.

DC Biasing of BJT: Introduction, Operating point, Fixed bias circuit, Voltage divider bias, Emitter- stabilized bias circuit, DC bias with voltage feedback, Transistor switching networks.

Operational Amplifier: Introduction, Block diagram of Op-Amp, Ideal Op-Amp, Open loop Op-amp configuration, Differential and Common mode operation, Op-amp basics, Practical op-amp circuits, Voltage series Feedback amplifier, Voltage Shunt Feedback amplifier, Op-amp parameters. Various parameters of op-amp, Measurement of input off set voltage, input offset current, input bias current, differential input resistance, input capacitance, offset voltage, adjustment range. Input voltage range, output off set voltage, CMRR, SVRR, gain, bandwidth, slew rate, output voltage swing, power consumption, frequency response of an Op amp.

Applications of an Op-amp: Summing, scaling and averaging amplifier, Instrumentation amplifier, Integrator, Differentiator, Voltage to current converter, Current to voltage converter, Non linear applications: comparator, zero crossing detector, Schmitt trigger, Precision rectifier, Half and full wave rectifier, Active filters.

BJT Transistor Modelling: Amplification in AC domain, BJT transistor modelling, The important parameters: Zi, Zo, Av, Ai. There Transistor Model, The Hybrid equivalent model.

BJT Small Signal Analysis: Common emitter fixed bias, Voltage divider bias, Emitter bias and emitter follower configurations, Common base configuration and collector feedback configuration, Collector DC feedback configuration, Approximate hybrid equivalent model.

Systems Approach - Effects of Rs and RL: Effects of Rs and RL: Two port systems, Effect of load impedance and source impedance, combined effect of RS and RL, BJT CE, CB, Emitter follower networks.

BJT Frequency Response: Low Frequency Response - BJT Amplifier, Miller Effect Capacitance, High Frequency Response - BJT Amplifier.

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. Robert Boylestad, Electronic devices and circuit theory, Pearson Education.
2. R.A.Gayakwad, Op amp & Linear Integrated Circuits, Prentice- Hall.
3. Millman-Halkias, Integrated Electronics- Analog and Digital circuits and systems, Mc-Graw Hill.
4. Albert Paul Malvino, Electronic Principles,McGraw-Hill Higher Education.
5. Sergio Franco, Design with operational amplifiers and analog integrated circuits, McGraw-Hill.

L	T	P	C
3	1	0	4

Course Code	**2MA305**
Course Title	**Applied Mathematics for Instrumentation and Control Engineering**

Course Learning Outcomes (CLO):

At the end of the course, students will be able to-

1. apply principles of probability and probability distribution
2. relate calculus of function of complex variables in engineering field
3. use Laplace transformation technique to solve ordinary differential equations
4. comprehend numerical methods in solving algebraic, transcendental and ordinary differential equations

Syllabus:
Teaching hours:

Unit I
10
Laplace Transforms: Definition, Linearity property, Laplace transforms of elementary functions, Shifting theorem Inverse Laplace transforms of derivatives and integrals, Convolution theorem, Application of Laplace transforms in solving ordinary differential equations related to engineering field

Unit II
10
Functions of Complex Variables: Analytic function, Cauchy – Riemann equation (Cartesian and Polar forms), Harmonic functions, Conformal mappings, Complex integration, Cauchy's theorem and integral formula, Singularities, Taylor's and Laurent's Series theorem, Evaluation of integrals using residues

Unit III
6
Iterative Methods: Motivation, errors, truncation error, rounded off error, absolute error, relative error and percentage error, Solution of algebraic and transcendental equation by bisection, False position, Secant, Newton-Raphson iteration and extended iteration methods, Rate of convergence of the iteration methods, Comparisons of iterative methods

Unit IV
3
Numerical Solution of ordinary differential equations: Taylor series method, Euler's Method, Runge-Kutta method of 4^{th} order

Unit V
5

Statistics: Measure of central tendency and dispersion, Correlation and Regression

Unit 11 **VI**

Theory of Probability and distribution: Permutations & Combinations, Definition of probability, Application of permutations and combination, Conditional probability, Bayes' Theorem, Markov chain, Concept of random variable, Probability density and distribution functions, Mean and Variance, Moments, Probability distribution, Binomial, Poisson and normal probability distributions

Tutorials:
This shall consists of at least 8 tutorials based on the syllabus.

Self-Study:
Self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from the self-study contents.

Suggested Readings^:

1. A. Papoulis and S. Unnikrishna Pillai, Probability, Random variables and Random Processes, Tata McGraw Hill
2. M.J. Ablowitz & A.S. Fokas, Complex variables – Introduction & Application, Cambridge University Press
3. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi.
4. S. C. Chapra and R.P. Canale, Numerical Methods for Engineers with Programming and Software Applications,, McGraw Hill
5. S.D. Conte and Carl de Boor, Elementary Numerical Analysis – An Algorithmic Approach,
   McGrwaw Hill
6. C.E. Froberg, Introduction to Numerical Analysis, Addison Wesley
7. H K Dass, Advanced Engineering Mathematics, S. Chand & Co.

L = Lecture, T = Tutorial, P = Practical, C = Credit
^ this is not an exhaustive list

L	T	P	C
3	0	2	4

Course Code **2IC303**

Course Title **Basic Electronics**

Course Learning Outcome:

At the end of the course, students will be able to -

- analyze analog circuits
- design and analyze the sequential logic circuits
- evaluate the performance of various electronic circuits

Syllabus	**Teaching Hours**
UNIT 1: Introduction to Analog & Digital electronics	**1**
UNIT 2: Field Effect Transistors (FET): Construction and characteristics of BJT, FET and MOSFET with their applications, MOSFETs for the digital IC fabrication, CMOS.	**12**
UNIT 3: Operational Amplifier Fundamentals of operational amplifier, Feedback configurations of operational amplifiers, Op-amp parameters.	**3**
UNIT 4: Optoelectronic Devices Overview of Photonics, Different Optoelectronic Devices.	**5**
UNIT 5: Sequential Logic Circuits Classification of sequential circuits, Flip-flops, triggering of Flip-flops, conversion of flip-flops, Analysis of clocked sequential circuits. State reduction and assignments Flip-flop excitation tables. Design procedure, Design of counters, and design with state equations.	**12**
UNIT 6 : Registers, Counters and Memory Unit Registers, shift registers, ripple counters, synchronous counters, timing sequences, memory unit.	**9**
UNIT 7: Algorithmic State Machines Components of ASM chart, Features of ASM chart. Examples of ASM chart.	**3**

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will consist of minimum 12 experiments based on the above syllabus.

References:

(1) Robert Boylestad, Electronic devices and circuit theory, Pearson Education.
(2) R.A.Gayakwad, Op amp & Linear Integrated Circuits, Prentice- Hall.
(3) Millman-Halkias, Integrated Electronics- Analog and Digital circuits and systems, Mc-Graw Hill.
(4) M. Morris Mano, Digital Logic and Computer design, PHI publication.
(5) Norman Balabanian and Bradley Carlson, Digital Logic Design Principles, Wiley Student Edition.
(6) Biswanath Paul, Industrial Electronics and Control, Prentice Hall India.

L	T	P	C
3	0	2	4

Course Code **2IC304**

Course Title **Circuit Theory**

Course Learning Outcome:

At the end of the course, students will be able to -

- develop an understanding of the fundamental principles & theorems of electrical networks
- analyze the performance of two port networks
- synthesize electrical networks

Syllabus	**Teaching Hours**
UNIT 1: Basics of Electrical circuits Electrical components, Classification of Networks, Sources of Energy	**4**
UNIT 2: Techniques of Network Analysis Kirchhoff's Laws, The number of Network Equations, Mesh Analysis, Nodal Analysis, Source Transformation, Duality.	**6**
UNIT 3: Network Theorems Superposition Theorem, Thevenin's Theorem, Norton Theorems, Maximum Power Transfer Theorem, Reciprocity Theorem, Millman's Theorem, Substitution Theorem, Compensation Theorem	**8**
UNIT 4: Two-Port Network Parameters Two-Port Network, Open Circuit Impedance Parameters, Short Circuit Admittance Parameters, Transmission Parameters, Hybrid Parameters, Relationship between parameters, Interconnection of Two-Port Networks.	**7**
UNIT 5 : Initial conditions and Transient Analysis Initial Conditions in Elements, Solution of a First order and Second order differential equations, Transients in R-L and R-C Circuits, Transients in RLC Circuits.	**5**
UNIT 6: Sinusoidal Steady State Analysis Characteristics of Sinusoidals**,** Forced response to Sinusoidal Functions, The Complex Forcing Function, Phasor Diagram.	**3**
UNIT 7: Transform Impedance and Transform Circuits	**4**

Representation of Electrical components in S-domain, Transform Methods in Network Analysis

UNIT 8: Network Functions **4**

Terminal Pairs of Ports, Network Functions for Two-Port Networks, Poles and Zeros of the Network Functions, Time-Domain behavior from the Pole-Zero Plot.

UNIT 9: Network Synthesis **4**

Impedance and admittance functions of R-C, R-L and L-C Circuits. Representation of Transfer Functions in Foster and Cauer forms.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

William H. Hayt, Jr , Jack E. Kemmerly, Steven M. Durbin, Engineering Circuit Analysis, Mc Graw Hill

U. A. Patel, Circuits and Networks, Mahajan Publication

K.M. Soni, Circuit Analysis and Synthesis, S.K. Kataria & Sons

IC301 **Control Theory** **[3 1 0 4]**

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand and apply the basic concept of mathematical modeling for the control system
- understand and analyze feedback characteristics of liner control system to reduce the disturbance
- understand and analyze time response of control system
- understand and analyze frequency response of control system
- analyze the stability of linear control system

Syllabus:

Introduction to Control Systems: Introduction, Examples of control systems, closed loop control versus open-loop control.

Mathematical Modeling of Dynamic Systems: Introduction, Modeling of Mechanical, Electrical and Electromechanical Systems and Determination of Transfer function, Systems Analogy, Block Diagrams and Signal Flow Graphs.

Feedback Characteristics of Control System: Feedback and non-feedback systems, reduction of parameter variation by use of feedback, disturbance reduction using feedback control.

Transient Response Analysis: Introduction, First order systems, second order systems, Steady state error for unity feedback system, type of system & error constant, transient response analysis.

Stability: Introduction, R-H criterion.

Root Locus Analysis: Introduction, root locus plots, summary of general rules for constructing root loci, root locus plots with matlab, special cases, root locus analysis of control systems, root loci for systems with transportation lag, root contour plots, stability analysis.

Frequency Response Analysis: Introduction Bode Diagrams, Polar Plots, Nyquist Plots, Nyquist Stability Criterion, Stability Analysis, Relative Stability, Closed loop Frequency Response, Experimental Determination of Transfer functions.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Tutorial:

Tutorial work will be based on above syllabus with minimum 10 tutorials to be incorporated.

References:

1. Katsuhiko Ogata, Modern Control Engineering, PHI Publication.
2. Nagrath & Gopal, Control System Engineering, New Age International Publication.
3. M.Gopal, Modern Control System Theory, New Age International Publication.
4. Norman S. Nise, Control System Engineering, Wiley Publication.

SS342 ICT Tools & Security [0 0 2 1]

Course Learning Outcome:

After successful completion of this course, student will be able to

- identify various modern ICT based tools and technologies
- understand features of the tools which are useful for academic/research/application development
- use ICT based tools for programme specific applications
- understand the vulnerabilities in the system and protect themselves from the attack

Syllabus:

Appropriate IT security aspect as per latest vulnerabilities and appropriate number of tools are to be identified and studied as per programme specific needs, to be decided by the respective Course Coordinator and to be approved by Dean, FoTE before commencement of the course.

IC302 Digital Logic Design [3 0 2 4]

Course Learning Outcome:

After successful completion of the course, student will be able to

- develop an ability of understanding and applying the knowledge of the number systems, basic elements of digital circuits
- develop an ability of understanding and applying the concepts of designing and analysis of combinational and sequential circuits
- develop an ability to implement the combinational and sequential circuits using integrated circuits

Syllabus:

Binary Systems: Binary Systems, number base conversion, octal and hexa-decimal numbers, Complements, Binary codes, binary storage and registers, binary logic.

Boolean Algebra and Logic Gates: Basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms of Boolean functions, digital logic gates.

Simplification of Boolean Functions: Map method, Two to six variable maps, NAND-NOR implementation and other two level implementation don't care conditions, tabulation method, determination and selection of prime implicants.

Combinational Logic Circuits: Adders, subtractors, Code converters, Analysis procedure, multilevel NAND-NOR circuits. EX-OR and equivalence functions. Binary and decimal parallel adder, magnitude comparator, Decoders, multiplexers, ROM and PLA.

Sequential Logic Circuits: Flip-flops, triggering of Flip-flops, conversion of flip-flops, Analysis of clocked sequential circuits. State reduction and assignments Flip-flop excitation tables. Design procedure, Design of counters, and design with state equations.

Registers, Counters and Memory Unit: Registers, shift registers, ripple counters, synchronous counters, timing sequences, memory unit.

Digital Integrated Circuits: Digital IC specification terminology, Logic families.

Algorithmic State Machines: Components of ASM chart, Features of ASM chart, Examples of ASM chart.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. M. Morris Mano, Digital Logic and Computer design, PHI publication.
2. A. Anand Kumar, Fundamentals of Digital Circuit, PHI publication.
3. Charles H Roth, Fundamental of logic design, Cengage Learning.
4. Norman Balabanian and Bradley Carlson, Digital Logic Design Principles, Wiley Student Edition.

SS 341 : - Economics for Engineers [2 - - 2]

Course Learning Outcome (CLO):

After successful completion of the course, students will be able to

- understand the basic economic theory and economic way of thinking
- analyze macro - economic policies
- evaluate the economic efficiency in engineering projects

Syllabus

Module: - 1 MICRO ECONOMICS

1. Basic Economic Concepts: Meaning and understanding of basic economic concepts

2. Demand and Supply: Meaning and Determinants of Demand and Supply, Law of Demand and Supply, Elasticity of Demand and Supply.

3. Production Function: Meaning, production with one variable input, the law of variable proportion, the laws of returns to scale. Economies of Scale

4. Cost Function: Different types of costs, the short run and long run cost functions.

5. Market Structure: Meaning and characteristics of different types of market –

Perfect Competition
Monopoly
Monopolistic Competition and
Oligopoly

Module-2 MACRO ECONOMICS

6. Introduction to Macro Economics: Basic Macro Economic Concepts, National Income Accounting, Concepts of National Income and Methods of National Income Computation

7. Inflation: Meaning, types, causes, effect and remedial measures.

8. Money and Banking: Meaning and Functions of money, Money Supply, Commercial Banks and Central Bank-Meaning and Functions

9. Public Finance: Government Expenditure, Receipts, Budget and Deficits.

Self -Study: The self -study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Suggested Books:

(1) Micro Economics Robert S Pindyck, Daniel L Rubinfeld, Prem L Mehta - Pearson

(2) Principles of Economics N.Gregory Mankiw, Thomson South Western , Pearson

(3) Modern Economics – H.L.Ahuja – S.Chand & Company

(4) Macro Economics – Rudiger Dornbush, Stanley Fisher, Richard Startz – Tata Mc-Graw-Hill

(5)Principles of Macro Economics, C.Rangarajan and B.H.Dholakia, The McGraw Hill

(6) Economics , Samuelson and Nordhaus, Tata McGraw Hill

(7) Managerial Economics: Principles and Worldwide Applications, Dominick Salvatore, Adapted by Ravikesh Srivastava, Oxford University Press

List of Journals/Periodicals/Magazines/Newpapers: Economist, Indian Economic Review, Asian Economic Review, American Economic Review, Economic and Political Weekly (EPW), Economic Times, Business Standard etc.

Websites Recommended: www.finmin.nic.in
www.rbi.org.in www.planningcommission.nic.in etc.

Subject: MA305 Mathematics for Instrumentation and Control Engineers

[4 1 – 5]

Learning outcomes:

After successful completion of the course, the students will be able to:

- understand basic principles of Probability, sample space, conditional probability.
- know basic discrete & continuous distributions & how to work with to them.
- understand cumulative distribution function, expectation and distributions for functions of random variables.
- know analytic function conformal transformations, Cauchy's Theorem & Cauchy's integral formula. Residue theorem their applications in evaluating integrals.
- have knowledge of Fourier series & Fourier transform.
- have knowledge of Laplace transform & application to ordinary differential equations,
- have knowledge of Z-transform
- solve ODE and PDE

Probability : : Reorientation, Permutations & Combinations, Definition of probability, Application of permutations and combination to Probability problems, Conditional probability, Bayes' Theorem, Markov chain.

Random variable and probability distribution: concept of random variable, density and distribution functions, mean and variance, moments, characteristic functions**,** probability distribution **,B**inomial, Poisson and normal probability distributions.

Functions Of Complex Variables: Reorientation, Analytic function, Cauchy – Riemann equation (Cartesian and Polar forms), Harmonic functions, Conformal mappings, Complex integration, Cauchy's theorem and integral formula, Singularities, Taylor's and Laurent's Series theorem, Evaluation of integrals using residues.

Fourier Series: Periodic functions, Dirichlet's conditions, Fourier series, Euler's formulae, Fourier expansion of periodic functions with period 2π Fourier series of even and odd functions, Fourier series of periodic functions with arbitrary periods. half range Fourier series.

Fourier Transforms: Fourier integral theorem (only statement), Fourier Sine and Cosine integrals, Complex form of Fourier integral, Fourier Sine and Cosine transforms, solution of boundary value problems using Fourier transforms.

Laplace Transforms: Motivation, Definition, Linearity property, Laplace transforms of elementary functions, Shifting theorem Inverse Laplace transforms of derivatives and integrals, Convolution theorem, Application of Laplace transforms in solving ordinary differential equations.

Z-transforms: Defination, properties, inverse transforms.

Ordinary Differential Equations: Definition. Formation of Differential equation. Equations of first order & first degree. Linear differential equation of higher order. Rules for finding complementary function. Rules for finding particular integrals - Method of undetermined coefficients; Method of variation of parameter. Cauchy's & Legendre's equation. Simultaneous linear differential equation. Related application

Partial Differential Equations: Formation of Partial differential equations, Directly integrable equations, Langrange's equation. Method of separation of variables. Applications to the Wave equation, one-dimensional heat and Laplace equation

Self Study :

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Tutorials :

This shall consist of solution of at least 8 tutorials (TA) based on the above syllabus.

Books :

1. A. Papoulis and S. Unnikrishna Pillai, Probability, Random variables and Random Processes, 4 ed, Tata McGraw Hill.
2. M.J. Ablowitz & A.S. Fokas, Complex variables – Introduction & Application, Publisher: Cambridge University Press – 1998.
3. Dr.B.S.Grewal- Higher Engineering Mathematics, Publisher: Khanna Publishers, New Delhi.
4. Dr.K.R.Kachot- Higher Engineering Mathematics Vol. III (Second Edition) Mahajan Publishing House, Ahmedabad.
5. H K Dass, Advanced Engineering Mathematics, S. Chand & Co.

IC304 Network Analysis and Synthesis [3 0 2 4]

Course Learning Outcome:
After successful completion of the course, student will be able to

- develop an understanding of the fundamental principles & theorems of electrical networks
- analyze different electrical networks & determine various parameters using different techniques
- learn the method of synthesizing an electrical network form the given impedance/ admittance function
- verify the concepts of network analysis & synthesis practically

Syllabus:
Network Convention: Reference direction for current and voltage, Active element convention, Dotconvention, Topological Description.
Network Equations: The no of network equations, source transformation, loop variable analysis, Node variable analysis, Determinants, Minors, and Gauss Methods, Duality, State variable analysis.
Initial Conditions in Network: Initial condition in elements, Geometrical Interpretation of Derivatives, Procedure for Evaluating initial conditions, Initial state of network.
Solutions of Differential Equation by Classical and Transform Methods: Second order equation, Higher order equation, Network excited by external energy sources, response as related to s-plane locations of the roots.
Impedance Functions and Network Theorems: Concept of complex frequency, Transformimpedance and transform circuits, series and parallel combinations of elements, superposition and reciprocity, Thevenin and Norton theorem, Millman's theorem, Substitution theorem, compensation theorem.
Network Functions: Terminal pairs, network functions for the one port and twoport, calculation of network function, poles and zeroes of network function.
Two Port Parameters: Relationship of Two port variables, Short Circuit Admittance parameter, Theopen circuit impedance parameter, Transmission parameters, The Hybrid parameters, Relationships between parameter sets, parallel connection of two-port networks.
Sinusoidal Steady State Analysis: The sinusoidal steady state, the sinusoid and $e^{\pm jwt}$, solution using$e^{\pm jwt}$, solution using real and imaginary part, phasor and phasor diagram.
Positive Real Functions: Properties of positive real function and its testing procedure.
Network Synthesis: Synthesis of R-C, R-L and R-L-C networks.

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. Van Valkenbug, Electronic Network analysis, Pearson Education.
2. Van Valkenbug, Introduction to modern Network synthesis,Prentice Hall of India.
3. G.K.Mithal, Network analysis, Khanna Publisher.

L	T	P	C
2	0	0	2

Course Code	**2HS341**
Course Title	**Principles of Management**

Course Learning Outcomes (CLO):

At the end of the course, students will be able to-

1. interpret the various theories and processes of management
2. relate with different functional areas of management
3. appreciate the role and need of managers in different organisations

Syllabus:
Teaching hours:

Unit I
8

Nature of Management: Concept, Significance, Role & Skills, Levels of Management, Concepts of POSDCORB (Planning, Organizing, Staffing, Directing, Coordinating, Reporting and Budgeting). Overview of Decision making. Evolution of Management thoughts, Contribution of F.W Taylor, Henri Fayol and Contingency Approach. Overview of Indian thoughts on Management, Management by Objectives (MBO)

Unit II
4

Planning: Meaning, Importance, Elements, Process

Unit III
6

Organizing: Concepts, Structure (Formal & Informal, Line & Staff and Matrix), Meaning, Advantages and Limitations of organizing. Departmentation: Meaning, Basis and Significance, Span of Control: Meaning, Factors affecting span of Control, Centralization vs. Decentralization, Delegation: Authority & Responsibility relationship

Unit IV
6

Directing, Co-ordination and Controlling: Leading : Concept of leadership, Directing: Meaning and Process, Co-ordination as an Essence of Management, Controlling: Meaning, Process and Technique

Unit V
6

Functional Management: Introduction to different functional aspects of management- Finance, Operations, Marketing, Human Resource and Strategic Management

Self-Study:

Self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from the self-study contents

Suggested Readings^:

1. Koontz & Weihrich , Essentials of Management; Tata McGraw Hill
2. Tripathy & Reddy , Principles of Management; Tata McGraw Hill
3. Kreitner & Mohapatra, Management ; Biztantra
4. Robbins , Decenzo & Coulter, Fundamentals of Management; Pearson Education
5. Stoner, Freeman & Daniel R Gilbert, Management; Pearson Education
6. Robbins & Coulter, Management; Prentice Hall (India) Pvt. Ltd

L = Lecture, T = Tutorial, P = Practical, C = Credit

^ this is not an exhaustive list

EE422 APPLIED ELECTRICAL TECHNOLOGY [3 0 2 4]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand construction and operating principle of various electrical machines
- acquire knowledge on characteristics of Electrical machines for different operating conditions
- select DC machines and transformers for specific application
- control various electrical machines as per the application
- understand generation, transmission and distribution of electrical power

Syllabus:

Transformers

Working principle & construction transformer, theory of an ideal transformer, emf equation, phasor diagram of transformer on no load and on load, exact and approximate equivalent circuit of transformer, no-load test, separation of core losses, short circuit test, regulation of transformer, condition of maximum efficiency, auto-transformer, parallel operation of transformer, three phase transformer, star-star, delta-delta, star-delta & delta-star connections, current transformer

DC Generators

Principle & construction of DC generator, armature windings, types and characteristics of generators, emf equation of generator, losses in DC generator, power stages, condition for Maximum efficiency.

DC Motors

Principle, comparison of generator and motor action, significance of back emf, voltage and torque equation of motor, losses and efficiency of DC motor, condition of maximum power, speed regulation, characteristics of a series, shunt and compound motors, comparison of a series & shunt motor, DC shunt motor three point starter, applications

Induction Motors

Construction & working principle of induction motor, production of rotating field, mathematical proof, slip, frequency of rotor current, relation between torque and rotor power factor, starting torque of squirrel cage & slip ring motor, effect of change in supply voltage, rotor emf and reactance under running conditions, torque under running condition, relation between torque and slip, full load torque and maximum

torque, measurement of slip, power stages in induction motor, rotor output, induction motor as a generalized transformer, rotor output, equivalent circuit of a rotor, equivalent circuit of an induction motor, maximum power output, corresponding slip, starter for three phase induction motor, applications

Single Phase Motors

Capacitors start and run motor, shaded pole single phase motor, AC series motor, universal motor, speed control of universal motor, applications

Stepper Motor- Introduction, principle of operation, types of stepper motors, construction and working, comparison with other types of motors, applications

Power Generation- Schematic arrangement of steam power station, hydro-electric power station, nuclear power station, choice of site for steam power station, hydro-electric power station, nuclear power station, disadvantages and causes of low power factor, typical AC power supply scheme, concepts of overhead and underground power transmission, AC distribution system, equipment used in transformer substation

Self study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

This shall consist of at least 10 experiments based on the above syllabus.

References:

1. E. Fitzgerald, Textbook of Electric Machinery, TMH Publications
2. B.L.Theraja, Textbook of Electrical Technology Vol. III, S. Chand & Company
3. V.K.Mehta, Textbook of Principles of Power Systems, S. Chand & Company

L	T	P	C
3	0	2	4

Course Code **2IC404**

Course Title **Control System Design**

Course Learning Outcome:
At the end of the course, students will be able to -
Analyse the control system using state space modeling
design state feedback based controller and observer
design controller using conventional methods

Syllabus **Teaching Hours**

UNIT 1: Control system design by using conventional methods

Review of root locus, Preliminary design consideration, Lead compensation **16**

Lag compensation, Lag-Lead Compensation, Parallel Compensation, Compensator design using frequency response

UNIT 2: Controller Modes

ON-OFF, multiposition, floating point controller, Introduction to proportional, integral and derivative controller modes, Introduction to PI, PD, PID, Realization of controller with analog and digital controller **10**

UNIT 3: Analysis of control system in state space

Overview of Concept of state variable and state model, State transition matrix, Solution of state equations, Controllability and observability, Duality principle, equivalence between transfer function & state variable representation. **10**

UNIT 4 : Design of a control system in state space **9**

Introduction, pole placement, necessary and sufficient conditions for arbitrary pole placement, State feedback controller, design of state feedback system, State observers, Separation principle

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 12 experiments to be incorporated.

References:

Modern Control Engineering by Katsuhiko Ogata, PHI Publication.
Control System Engineering by Nagrath & Gopal, New Age International Publication.
Modern Control System Theory by M.Gopal, New Age International Publication.
Control System Engineering by Norman S. Nise, Wiley Publication.
Modern Control System by Dorf and Bishop, Prentice Hall Publication.

L	T	P	C
3	0	2	4

Course Code **2IC403**

Course Title **Electrical and Electronics Measurement**

Course Learning Outcome:

At the end of the course, students will be able to -

- elaborate the concepts of different electrical and electronics measurements
- elaborate testing and measuring instruments for various applications
- analyze and develop various ac and dc bridge circuits

Syllabus	**Teaching Hours**
UNIT 1: Introduction:	
Types of instruments: Indicating, recording, integrating etc., Instruments characteristics, Errors in measurements, Statistical evaluation of measurement data and errors, the decibel, problems.	**4**
UNIT 2: Analog DC and AC meters:	
Electromechanically meter movements, Analog DC ammeters, Analog DC voltmeters, Analog AC ammeters and Voltmeters, Analog multi-meters, Special purpose analog meters, Use of basic meters, meter errors, problems.	**4**
UNIT 3: Digital Meters:	
Various types of DVMs, digital multi-meters.	**4**
UNIT 4 : Oscilloscope:	
Oscilloscope subsystem, Display subsystem, Vertical deflection subsystem, Dual trace feature, Horizontal deflection subsystems, oscilloscope probes, oscilloscope controls, Front panel of an oscilloscope, oscilloscope photography, Digital storage oscilloscope, Power scope.	**10**
UNIT 5: Time & Frequency Measurement:	
Time Measurements, Frequency measurement, Harmonic Analysis and spectrum	**3**

analyzers, problems.

UNIT 6: Power & Energy Measurement:

Power in AC circuits, single-phase power measurements, Poly-phase power and measurements, Electrical energy measurements, Power measurements problems. **4**

UNIT 7: Resistance and Measurement of Resistance:

Resistance and resistor, resistor type, color coding of resistor, measurement of resistance, Wheatstone Bridge, Making balanced Wheatstone Bridge measurement, Low value resistance measurement, problems. **4**

UNIT 8: Measurement of Capacitance, Inductance, and Impedance:

Capacitance and capacitors, capacitor circuit models and losses, capacitor types, color coding of capacitor, Inductor and Inductance, Inductor structure, Transformers, Impedance, Capacitance and Inductance, Capacitance and Inductance measurement, complete impedance measurement, problems. **8**

UNIT 9: A.C. Signal Sources:

Sweep Frequency generators, Pulse generators, Function generators, Oscillators. **4**

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

Student reference manual for Electronic and Instrumentation measurement, Wolf & Smith, PHI Publication.

Electronic Instrumentation and Measurement, David A. Bell, Oxford Publication

Electronic Instrumentation, H S Kalsi, Tata-McGraw Hill Publication

Modern Electronic Instrumentation and Measurement Techniques, A. D. Helfrick and W. D. Cooper, PHI Publication

A course in Electrical and Electronics Measurement and Instrumentation, A. K. Sawhney, Dhanpat Rai Publication

L	T	P	C
3	0	2	4

Course Code **2IC405**

Course Title **Linear Integrated Circuits**

Course Learning Outcome:

At the end of the course, students will be able to -

- utilize different signal conditioning ICs for various applications.
- analyze the signal conditioning IC based circuits
- design various signal conditioning circuits.

Syllabus **Teaching Hours**

UNIT 1: Opamp applications and special purpose Opamps

Summing, scaling and averaging amplifier, Voltage follower, Integrator, Differentiator, Differential amplifier, Logarithmic Amplifier, Exponential amplifier, Instrumentation amplifier, Voltage to current converter, Current to voltage converter, Comparator, Zero crossing detector, Schmitt trigger, Precision rectifier, Half and full wave rectifier, Active filters, Oscillators , Instrumentation amplifiers . **15**

UNIT 2: Timers :

Astable and monostable operation, applications of 555 timers : Missing Pulse detector, PWM generation, Ramp Generation. **5**

UNIT 3: Power Supply Design:

Introduction, Performance parameters, Filtering, Function of a bleeder resistor in filter circuit, Voltage multipliers, Regulated power supply, SMPS, Comparison of linear power supply and SMPS, Switch mode converters. **4**

UNIT 4 : Isolation Amplifier :

Isolation amplifiers, basic need of isolation, commercially available monolithic isolation amplifier AD284J, applications of the isolation amplifier. **5**

UNIT 5: Motor Driver ICs:

Basic H-Bridge motor driver, motor driver ICs, motor current sense techniques, driver ICs for brushless motors and servo motors. **4**

UNIT 6: Converters : A/D Converters : Delta Sigma Converters, Frequency to **5**

voltage and voltage to frequency converters, Applications of converters.

UNIT 7: Miscellaneous ICs: 7

Instrumentation Amplifiers, Temperature sensor ICs, thermocouple signal conditioning ICs, pressure sensors and MEMS based ICs , Display Drivers.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

Michel Jacob, Application and Design with Analog Integrated Circuits, PHI Publication.

Botkar K R, Integrated Circuits, Khanna Publication.

Walter G. Jung, Op-Amp Applications Handbook, Elsevier Publication.

John Webster, The Measurement, Instrumentation and Sensors Handbook, CRC Press.

Datasheets of the related Integrated Circuits.

Robert Boylestead, Electronic Devices and Circuit Theory , PHI Publication.

IC401 Microprocessors and Micro Controllers [3 0 2 4]

Course Learning Outcome:

After successful completion of the course, student will be able to

- develop an understanding of the fundamental principles of microprocessor and microcontroller architecture
- develop the ability of microprocessor and microcontroller programming
- develop the ability to program using various simulation tools
- familiarize with various interfacing methods for microcontroller and microprocessor
- interface various sensors and actuators with microcontrollers
- develop the ability to design an embedded system using microcontroller through team project

Syllabus:

8086 Architecture: Introduction to 8085 Microprocessor, 8086 Architecture-Functional diagram. Register Organization, Memory Segmentation. Programming Mode!. Memory addresses. Physical memory organization. Architecture of 8086, signal descriptions of 8086- common function signals. Minimum and Maximum mode signals. Timing diagrams. Interrupts of 8086.

Instruction Set and Assembly Language Programming of 8086: Instruction formats, addressing modes, instruction set, assembler directives, macros, simple programs involving logical, branch and call instructions, sorting, evaluating arithmetic expressions, string manipulations.

I/O Interface: 8255 PPI various modes of operation and interfacing to 8086. Interfacing keyboard, display, stepper motor interfacing, D/A and A/D converter.

Communication Interface: Serial communication standards, Serial data transfer schemes.

Introduction to Microcontrollers: Overview of 8051 microcontroller. Architecture. I/O Ports. Memory organization, addressing modes and instruction set of 8051, programming of microcontroller

8051 Real Time Control: Interrupts, timer/ Counter and serial communication, programming Timer Interrupts, programming external hardware interrupts, programming the serial communication interrupts, programming 8051 timers and counters.

Interfacing with 8051: Interfacing with keyboards, LEDs, 7 segment LEDs, LCDs, Interfacing with ADCs. Interfacing with DACs, etc.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. D.V. Hall, Micro processors and Interfacing, Tata-McGraw Hill.
2. Kenneth.J.Ayala, The 8051 microcontroller, Cengage learning 2010.
3. M.A.Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education.
4. Barrey B. Brey, The Intel microprocessors, Pearson Prentice Hall.

IC406 Seminar [0 0 1 1]

Course Outcome: Learning

After successful completion of the course, student will be able to

- collect relevant and contemporary material on the given topic
- prepare and present the comprehensive report on the given topic
- incorporate thought in the topic apart from the conventional and existing methods

A student is required to select an advanced topic relevant to any of the subjects under course of study. He/She will prepare seminar report and will defend his/her work before the examiners/faculty coordinator.

IC402 Signals and Systems [3 0 0 3]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand the representations and classifications of the discrete time signals and systems
- analyze the linear time invariant systems in time domain
- apply fourier transformation for discrete time signals and linear time invariant systems
- understand and apply the concepts of filtering and signal distortion

Introduction of Signals & Systems: Signals and systems, Overview of specific systems, Classification of signals, Basic operations on signals, Elementary signals, Systems viewed as interconnections of operations, properties of systems.

Time-Domain Representations of Linear Time-Invariant Systems: Introduction, Convolution, Impulse response representation for LTI systems, Properties of the impulse response representation for LTI systems, Block diagram representation, State-variable descriptions for LTI systems.

Fourier Representations for Signals: Introduction, Continuous-time periodic signals, Continuous-time non periodic signals, Discrete-time periodic signals, Discrete-time non periodic signals, Properties of Fourier representations.

Applications of Fourier Representations: Introduction frequency response of LTI systems, Fourier transform representations for periodic signals Convolution and modulation with Mixed Signal Classes, Fourier transform representation for Discrete-time signals, Sampling, Reconstruction of continuous-time signals from samples, Fourier series representations for Finite-duration non periodic signals.

Filtering and Signal Distortion: Time response, Frequency response, Linear distortion and equalization, Ideal low-pass filters, Band-pass transmission, Phase delay and group delay, Nonlinear distortion spectral density and correlation, Energy spectral density, Correlation of energy signals, Power Spectral Density, Correlation of Power Signal, Spectral Characteristics of Periodic Signals, Spectral Characteristics of Random Signals And Noise, Noise Equivalent Bandwidth.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

1. Simon Haykin, Signals and Systems, Wiley Publication.
2. S. Shalivahanan, Digital Signal Processing, TMH Publication.
3. Simon Haykin, Analog and Digital Communications, Wiley Publication.
4. Oppenheim & Wilsky, Oppenheim& WiskSignals & Systems, Printice Hall India Publication.

L	T	P	C
3	0	0	3

Course Code	HS001
Course Title	Entrepreneurship Development

Course Outcomes (CO):

At the end of the course, students will be able to-

1. understand and formulate entrepreneurship process
2. analyze financial and marketing feasibilities
3. evaluate business models

Syllabus:

Teaching Hours :45

Unit I **8**

Basic Entreprenurial Concepts: Entrepreneurship: Definition and structure. Entrepreneurial culture, the concept of Entrepreneurship. Entrepreneurial Traits: Entrepreneurial Skills, Qualities and Characteristics of an Entrepreneur, Nature and Importance of entrepreneurs. Entrepreneurship as a career choice. Contribution of entrepreneurs to the Development of the Nation.

Unit II **8**

Entrepreneurship Development: entrepreneurial Environment, Meaning and Process of entrepreneurial Development. Entrepreneurial Development Training, Importance, Objectives and Methods of Training.

Unit III **8**

Project Management: Search for Business Idea, Concept of Project and classification. Project Identification and Formulation. Project Design & Network Analysis. Project Report, Project Appraisal.

Unit IV **8**

Financial Analysis: Investment Process, Break even analysis, Budget and Planning Process Sources of Development Finance, Financial Institutions.

Unit V **8**

Establishing Small Scale Industry: Location, Steps of Setting up a Small Scale Industry, Selection of Organization.

Unit VI **5**

Marketing Environment: Marketing Segmentation, Market Research, Market Planning.

Self-Study :

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self -study contents.

Suggested Readings ^ :

1. Desai Vasant, Dynamics of Entrepreneurial Development and Management.Himalaya Publishing House
2. Sankar Raj, Essentials of Entrepreneurship Tata McGraw Hill Pvt. Ltd.

L = Lecture, T = Tutorial, P = Practical, C = Credit ^ this is not an exhaustive list

PROCESS CONTROL –II	L	T	P	C
(Subject Code: 2IC402)	3	0	2	4

Programmable Logic Controllers:

Introduction, Importance of PLC, Fixed and modular Hardware, CPU unit architecture, Hand held programming terminals, Industrial computer and monitors, Programming standards of PLC, PLC operation, Ladder logic, Logic functions, Basic relay instructions, Timer counter instructions, Comparison, data handling, input-output instructions, Processors classification and functions, Designing I/O systems, PLC applications based on case studies.

Distributed Control System:

Evolution of DCS, Design and specification architecture, merits and demerits, Direct digital control, supervisory control and distributed digital control system, Evolution of hierarchical system structure, Functional levels, Database organization, System implements concepts, Field stations, Intermediate stations, Central computer stations, Monitoring and command facilities, Data communication links, LAN and protocols, Real time operating system, Communication software, Process oriented languages, Application softwares.

Supervisory Control & Data Acquisition:

Introduction of Buses and Networks in process automation, Hardware selection for field bus system, Sorting out protocols, Overall field bus trends, Field bus advantages and disadvantages, Global system architecture, Field bus design installation, economics and documentation, Ethernet and TCP/IP systems.

Text/References:

1. Distributed computer control for industrial automation by Popovic & Bhatkar.
2. Programmable Logic Controllers: Principles and Applications by Webb and Reis.
3. Inst. Engg's Handbook on Process Software & Digital Networks by Bela G. Liptak.

IC405 System Analysis Packages [0 0 2 1]

Course learning outcome:
After successful completion of the course, student will be able to

- use technical computing software for matrix operations, data analysis and polynomial functions.
- use technical computing software to build a linear dynamic system
- perform time and frequency domain response analysis of linear dynamic system

Syllabus:

Introduction: Introduction to the tool, learning of the working environment.

Matrix Manipulations and Common Functions: Matrix formation, Matrix sum, multiplication, transpose and diagnolization, Exponential function, logarithmic function, trigonometric function.

Programming Structure: IF and else if, for, while statements. Creating and executing a function files.

Graphic Visualization: Basic plot functions, multiple plots on same graph, log-log plot, bar and stem chart, three dimension plots.

Data Analysis: Sorting, curve fitting, polynomial functions.

Differential Calculus: Differential equation solution, applications, symbolic mathematics.

Control System Toolbox: LTI models creation, model conversion, model dynamics, model connections, time Response frequency response.

GUI Tools: Control system analysis, data analysis.

Introduction to Scilab: Use of Scilab in Matrix and Vector operations, Plotting, Polynomials, Scrip and Files, etc.,

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. Etter, Devid C and D.Hull, Introduction to MATLAB 6, Pearson Education.
2. Stanley, Technical Analysis and Applications with MATLAB, India Edition, Cengage Learning.
3. Agam Kumar Tyagi, MATLAB and SIMULINK for Engineers, Oxford Higher Education.

Course Code	2CL102
Course Title	Environmental Studies

Course Learning Outcomes:

At the end of the course, students will be able to –

1. appraise the multidisciplinary nature of environment and sustainability
2. explain types of environmental pollution and its control measures
3. outline social issues related to environment

Syllabus: Teaching Hours: 15

Unit 1: Multidisciplinary Nature of Environment Hours: 04

Environment and its multidisciplinary nature, Ecosystems, biodiversity and its conservation, concept of sustainability, Environmental Impact Assessment, public awareness towards environmental conservation, Environmental legislation, carbon credit and carbon trading

Unit 2: Environmental Pollution, Global Warming and Climate Change Hours: 07

Types of environmental pollution and pollutants, causes, effects and control measures of – air pollution, water pollution, soil/land pollution, noise pollution, radioactive pollution. Role of an individual in prevention of pollution. Case studies on pollution, Effects – acid rain, ozone layer depletion and greenhouse effect. Sources, types and effects of waste, waste disposal and management, e-waste management

Unit 3: Social Issues related to Environment Hours: 04

Environment ethics- issues and solutions. Energy and water conservation, rain water harvesting, water shed management, rehabilitation problems and concerns, environmental protection acts.

Self-Study:

The self-study contents will be declared at the commencement of semester.

Tutorial Work:

Tutorial work will be based on above syllabus with minimum 05 Assignments to be incorporated.

Suggested Readings:

1. Dara, S. S., & Mishra, D. D. A textbook of Environmental Chemistry and Pollution Control. S. Chand & Company Ltd.
2. Bharucha, E., Textbook of Environmental Studies, Universities Press.
3. Dhameja, S. Environmental Studies. S. Kataria and Sons.
4. Ristinen, R., & Kraushaar, J. Energy and the Environment, Wiley Publications.
5. Masters, G. Introduction to Environmental Engineering and Science. Prentice-Hall Publications.
6. Basak, A. Environmental Studies. Pearson Publications.

L= Lecture, T= Tutorial, P= Practical, C= Credit

IC511 Advanced Microcontrollers and its Applications
[3 0 2 4]

Course Learning Outcome:
After successful completion of the course, student will be able to

- understand the architecture of PIC microcontroller
- program PIC microcontroller using various techniques
- design and develop PIC microcontroller based embedded circuits

Syllabus:
PIC Architecture: Overview of PIC series microcontrollers, block diagram, file register set, memory segmentation, hardware input/output ports, memory addresses, support devices.
Instruction Set and C Language Programming of PIC Series Microcontroller: Instruction formats, addressing modes, instruction set, C directives, PIC series microcontroller programming structures, simple programs involving logical, branch and call instructions, sorting, evaluating arithmetic expressions, string manipulations, software design using various compilers.
PIC Hardware Features: Overview of PIC series microcontroller parallel ports, PIC series timer and counter with programming, PIC series interrupts, Compare capture and PWM (CCP) modules, In-circuit serial Programming (ICSP).
Peripheral Interface: A/D and D/A interfacing, EEPROM interfacing, interfacing with input switch, keyboard, output displays like LED, LCD and seven segment LED.
Communication Interface: Serial communication standards, serial programming using USART, SPI bus and I^2C protocols.
PIC Series Microcontroller Applications: Various motor control like DC, stepper and servo motor, temperature control application, analog sensor applications, interfacing with sensors like ultrasonic, RFID, GPS, infrared, USB and memory card interface.

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. Han Way Huang, PIC Microcontroller: An Introduction to Software and Hardware Interfacing, Cengage Learning Publication.
2. M.A.Mazidi, PIC Microcontroller & Embedded Systems: Using Assembly and C for PIC18, Pearson Education Publication.
3. Martin P Bates, Programming 8-bit PIC Microcontrollers in C with Interactive Hardware Simulation, Newnes Publication.
4. Ramesh Gaonkar, Fundamentals of Microcontrollers and Applications in Embedded Systems, Penram International Publishing.

IC521 Advanced Microprocessors and its Applications [3 0 2 4]

Course Learning Outcome:
After successful completion of the course, student will be able to

- understand the architecture of ARM microprocessor
- program ARM microprocessor using various programming techniques
- design ARM processor based embedded applications

Syllabus:
Introduction: The RISC design philosophy, the ARM design philosophy, embedded system hardware, embedded system software.
ARM Processor Fundamentals: Registers, Current Program Status Register (CPSR), pipeline, exceptions, interrupts, and the vector table, core extensions, architecture revisions, ARM processor families, block diagram of ARM processor, pin layout for ARM processor.
Introduction to the ARM Processor Instruction Set: Data processing instructions, branch instructions, load-store instructions, software interrupt instructions, program status register instructions, loading constants, ARMv5E extensions, conditional execution.
Introduction to Thumb Instruction Set: Thumb registers usage, ARM-thumb interworking, branch instructions, data processing instructions, single register load-store instructions, multiple-register load-store instructions.
C Programming and Assembly Programming Overview: Writing C programs, function creation, writing assembly code, profiling and cycle counting, instruction scheduling, register allocation, conditional execution, looping constructs.
ARM Processor Modules: General purpose input-output module, timer-counter module, D/A converter module, A/D converter module, serial peripheral interface (SPI) module, inter-integrated circuits (I2C) module, PWM module.
Applications of ARM Controller: Different types of switch interface with ARM processor, LCD and LEDs interfacing with ARM processor, application of ARM processor in control systems, various types of sensor data processing using ARM processor, application of ARM processor in mobile phone system and camera system.

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. Andrew Sloss, ARM System Developer's Guide, Morgan Kaufman Publication.
2. Tervor Martin, The Insider's Guide to the Philips ARM7 Based Microcontrollers, Hitex Publication.
3. Steve Furber, ARM System on Chip Architecture, Addison-Wesley Professional Publication.

IC504 Applied Electronics [3 0 2 4]

Course Learning Outcome:

After successful completion of the course, student will be able to

- design various signal conditioning circuits
- design a motor driver circuit to drive dc motor
- apply the concept of isolation for logic circuit and high-power circuit
- analyze the temperature and pressure based signal conditioning circuits
- design fixed and variable regulated power supplies

Syllabus:

Field Effect Transistors (FET): Construction and characteristics of FET and MOSFET with their control applications.

Power Supply Design: Linear regulator, series pass regulator, current fold back circuit and over voltage protection circuit.

Timer LM555: Astable and monostable operation, applications of 555 timers.

Isolation Amplifiers: Isolation amplifiers, basic need of isolation, commercially available monolithic isolation amplifier AD284J, applications of the isolation amplifier.

Analog multiplier: Basic technique for analog multiplier, block diagram of common monolithic multiplier, typical monolithic multiplier circuits, introduction to common monolithic multipliers, applications of multiplier like squaring, square rooting, division, rms measurements, rectifier, phase detector, frequency doublers, rms to dc converters, multifunction converters.

Function Generators: Basics of voltage controlled oscillator (VCO), functional block diagrams of various monolithic function generators, designing of circuits using various monolithic function generators.

Analog Multiplexer: Basic need of multiplexing in the process industry, fundamentals of pass transistor and introduction to transmission gates, block diagram of commercially available analog multiplexer.

Monolithic Filters: Characteristics and terminology of various types of filters, Bessel, Butterworth and Chebyshev filters, state variable filter fundamentals, introduction to switched capacitor fundamentals, block diagram of Switched capacitor IC, design circuits using Switched capacitor IC.

Converters: Basic concept of frequency to voltage and voltage to frequency conversion, block diagram of frequency to voltage converters, speed measurement using frequency to voltage converters.

Advanced A/D converter: Basic need of monolithic display drivers and converters, block diagram of monolithic delta-sigma ADCs, applications of ADCs.

Monolithic Instrumentation Amplifiers: Introduction and terminology related to instrumentation amplifier. Application of instrumentation amplifier to amplify the low value signals.

Motor Driver ICs: Basic H-Bridge motor driver, motor driver ICs, motor current sense techniques, driver ICs for brushless motors and servo motors.

Miscellaneous ICs: Temperature sensor ICs, thermocouple signal conditioning ICs, pressure sensors and MEMS based ICs.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. Michel Jacob, Application and Design with Analog Integrated Circuits, PHI Publication.
2. Botkar K R, Integrated Circuits, Khanna Publication.
3. Walter G. Jung, Op-Amp Applications Handbook, Elsevier Publication.
4. John Webster, The Measurement, Instrumentation and Sensors Handbook, CRC Press.

IC501 Control System Components [3 0 0 3]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand the fundamental principles of components used in control systems
- understand various component characteristics
- familiarize with various components used in process control loop
- familiarize with various components used in various applications

Syllabus:

Process Parameter Transmitter: Overview of pneumatic transmitter, electronic transmitter, smart transmitter.

Tachogenerator and Tachometer: AC and DC tachogenerator, contact less tachometers, tachometers.

Synchro and Gyroscope: Introduction, theory of operation, synchro construction, types, synchro as a differential generator, error detector, theory of operation of gyroscope, horizontal & vertical gyroscope, construction, measurement of pitch, roll, yaw, angular to electrical conversion, equation of motion, transfer function of gyroscope.

DC and AC Servo Motors, Stepper Motors: DC servo motor: field controlled DC servomotor, armature controlled DC servomotor, AC servomotor: introduction, construction, characteristics, theory of operation, transfer function, steeper motor : introduction, permanent magnet stepper motor, variable reluctance type stepper motor, application of stepper motor.

Control Valve and Valve Sizing: Function of the control valve in the system, pressure drop requirement, capacity calculation, valve range ability & flow characteristics, sliding gate type valves, ball valve, single port, double port and three way globe valve, split body valve, venturi valve, diaphragm valve, butterfly valve, pinch valve, mechanical feature of the control valve, noise problem, safety considerations and special purpose valves.

Actuators and Relays: Selection of actuators, spring diaphragm actuator, piston actuators, rotary valve actuator, pneumatic hydraulic actuator, rotary pneumatic, electro pneumatic actuators, force balance and motion balance petitioners, pneumatic relays, electro-mechanical relays, reed relays , characteristics of relay.

Gears and Cams-Followers: Classification of gears, types of gears, working, peculiarities, terminology used in gears, backlash in gear, speed-torque, teeth ratio, types of cams & followers, 2D-3D cams, cams and followers including mechanical function generator.

Hydraulic Systems: Types of hydraulic control system, pump controlled & valve controlled hydraulic systems and its application, gear pump, vane pump, ball pump, spool type pilot valve, centrifugal pump.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

1. W. G. Andrew & H. B. William, Applied Instrumentation In The Process Industries, Gulf Professional Publishing.
2. M. D. Desai, Control System Components, PHI Publication.
3. B. G. Liptak, Instrument Engineers' Handbook, CRC Press.

IC503 Digital Signal Processing [3 0 2 4]

Course Learning Outcome:
After successful completion of the course, student will be able to

- understand and analyze LTI systems in z-domain and frequency domain
- apply FFT algorithms
- develop various structures of discrete time systems
- design IIR and FIR digital filters
- understand functionality and develop programming skill of digital signal processors

Syllabus:

The Z-Transform and Analysis of LTI Systems: Pole and zeros, Pole location and time-domain behavior for causal signals, System function of LTI system, Analysis of LTI system in z – domain, One-sided z- transform

Frequency- Domain Analysis of LTI Systems: Frequency domain characteristics of LTI systems, Frequency response of LTI systems.

Fast Fourier Transform Algorithms: FFT algorithms, Radix-2 FFT algorithm, Radix-4 FFT algorithm, Implementation of FFT algorithms, Applications of FFT algorithms, Quantization effects in the computation of DFT

Implementation of Discrete Time Systems: Structures for FIR systems, Structures for IIR systems, Representation of numbers, Quantization of filter coefficients, Round-off effects in digital filters.

Design of Digital Filters: Practical frequency selective filters, Design of linear-Phase FIR Filters using Windows, Frequency sampling method, Comparison of design methods, IIR filter design by Approximation of derivatives, Impulse invariance, Bilinear transformation, Characteristics of analog filters, Frequency transformation in analog and digital domain.

Digital Signal Processors: Architecture of P-DSP, Multiplier accumulator, Bus structure and memory access, Multiported memory, VLIW architecture, Special addressing modes in P-DSP, Pipelining, On-chip peripherals and memory, Programming.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:
Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. John G. Proakis & Dimitrics G. Manolakis, Digital Signal Processing Principles, Algorithms and Applications, Pearson Publication.
2. Emmanuel C. Ifeachor & Barrie W. Jervis, Digital Signal Processing a practical approach, Pearson Publication.
3. Alan V. Oppenheim, Ronald W. Schafer & John R. Buck, Discrete-time Signal Processing, Pearson Publication.
4. B. Venkataramani & M. Bhaskar, Digital Signal Processors, Architecture, Programming and Applications, Tata McGraw Hill Publication.
5. A. Anand kumar, Digital Signal Processing, PHI Publication.

IC531 Embedded Controller based Design [3 0 2 4]

Course Learning Outcome:
After successful completion of the course, student will be able to

- understand the basic working of AVR microcontrollers
- program AVR controllers in C and assembly language
- interface and analyze the AVR based circuits
- design and develop embedded systems based on AVR microcontrollers

Syllabus:
Introduction to AVR Microcontrollers: overview of the AVR family, ATmegaxxx series pin configuration.
AVR Architecture: General purpose registers, data memory, status register, data format and directives
Assembly Language Programming: Introduction, instruction set, program counter, program ROM space, RISC architecture.
Arithmetic and Logic Instructions: Arithmetic instructions, logic and compare instructions, rotate and shift instructions, BCD and ASCII conversion.
Branch, Call and Time Delay Loop: Branch instructions and looping, CALL instructions and stack, AVR time delay, instruction pipeline.
I/O Port Programming: I/O port programming, I/O bit manipulation.
Introduction C language programming: Data types and time delay, I/O programming, logic operations, data conversions, memory allocations.
Timer and Counter: Timer and counter programming in C.
Interrupt: AVR Interrupts, programming timer interrupts, external hardware interrupts, interrupt priority, interrupt programming in C.
ADC and DAC Interfacing and Programming: ADC characteristics, ADC interfacing, ADC programming, sensor interfacing and signal conditioning, DAC interfacing, DAC programming.
Interfacing of Input Output Devices: Interfacing and programming for LED's, push buttons, switches, buzzer, LCD, keyboard, DC motor, stepper motor, servo motor, relay, opto-isolator, LM35, IR sensor, ultrasonic sensor.

Self-Study:
The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:
Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. Muhhamad Ali Mazidi, The AVR Microcontroller and Embedded System Using Assembly and C, Pearson Publication.
2. Michael Margolis, Arduino Cookbook, O'reilly Publication.
3. Dhananjay V Gadre, Programming and Customizing The AVR Microcontroller, McGraw-Hill Publication.

IC506 Mini Project-I [0 0 2 1]

Course Learning Outcome:

After successful completion of the course, students will be able to

- practice acquired knowledge within the chosen area of technology for project development
- identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach
- reproduce, improve and refine technical aspects for engineering projects
- work as an individual or in a team in development of technical projects
- communicate and report effectively project related activities and findings

Syllabus:

Mini project may be carried out in one or more form of following:
product preparations, working/non-working models, prototype development, fabrication of set-ups, laboratory experiment development, process modification/development, simulation, software development, integration of software and hardware, statistical data analysis, survey, creating awareness in society.

The student is required to submit a report based on the work. The evaluation of the project shall be on continuous basis.

IC502 - Transducers and Measurement [3 0 2 4]

Course Learning Outcome:
After successful completion of the course, student will be able to

- classify the measurement system
- compare the measurement systems on the basis of static and dynamic characteristics
- understand the working principle of various measurement systems for pressure, temperature, level, flow, displacement, strain and force
- analyze, select and apply appropriate measurement system for given application

Syllabus:
Introduction to Measurement System: Elements of measuring system, classification of transducers.

Static and Dynamic Characteristics of Instruments: Desirable and undesirable static characteristics, dynamic behavior of instrument, first and second order instruments.

Static Errors and Reliability: Terminology related to errors, limiting errors, statistical analysis, error estimates, curve fitting, reliability of instrument.

Displacement, Speed, Acceleration, Vibration Measurements: Electrical transducers, optical transducers, pneumatic transducers, ultrasonic transducers, magetostrictive transducers, digital displacement measurement, tachometers, accelerometers, vibration measurements

Strain Measurement: Stress-strain relations, resistance strain gauges, temperature effect and compensation, fibre optic strain gauge

Force, Weight and Torque Measurements: Various types of force and weight measurement, load cells, industrial weighing systems, torque measurement and dynamometers

Pressure Measurement: Manometers, pressure measurement with force summing devices-diaphragms, bellows and bourdon tubes, pressure measurement with secondary transducers – mechanical, resistive, inductive, capacitive, photoelectric, vibrating elements, low pressure measurement, protecting devices and pressure switches.

Temperature Measurement: Change in dimension type temperature transducers, electrical type temperature transducers-RTD (Resistance Temperature Detectors), thermistors, thermocouple and integrated circuit based, concept of cold junction compensation, three and four wired bridge circuit, fiber optic type temperature transducer, quartz and ultrasonic thermometer, radiation pyrometer, thermowell.

Flow Measurement: Types of flow based on Reynold number, head type flowmeters like orifice plate, venture tube, flow nozzle, dahl flow tube, pitot tube, rotameter, and other head type flow-meters. Force and velocity based flow-meters like positive

displacement flow-meters, turbine type, electromagnetic, ultrasonic, vortex shedding, anemometers, mass flow meters, coriolis flow-meters, open channel flowmeters.

Level Measurement: Mechanical level indicators, optical level measurement methods, electrical level measurement methods, radiative and other type of methods.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. Arun K. Ghosh, Introduction to Measurements and Instrumentation, PHI Publication.
2. C.S. Rangan, V.S. V. Mani and G.R. Sarma, Instrumentation: Devices and Systems, Tata McGraw Hill Publication.
3. D. Patranabis, Principles of Measurements and Instrumentation, PHI Publication.
4. A.K.Sawhney, A Course in Mechanical Measurements and Instrumentation, Dhanpat Rai Publication.

IC505 Virtual Instrumentation [0 0 2 1]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand the basics of virtual instrumentation
- understand the concepts of graphical programming techniques
- apply the knowledge of different programming techniques for virtual instrumentation

Syllabus:

Graphical System Design (GSD): Introduction, GSD model, design flow with GSD, virtual instrumentation, graphical system design, graphical programming and textual programming.

Introduction to Virtual Instrumentation Tool: Software environment, creating and saving a VI, front panel toolbar, block diagram toolbar, data types, data flow program.

Modular Programming: Introduction, modular programming, creating sub VIs from section of a VI, opening and editing sub VIs, placing sub VIs on block diagrams, saving sub VIs, creating a stand-alone application.

Repetition and Loops: Introduction, for loops, while loops, structure tunnels, terminals inside or outside loops, shift registers, feedback nodes, control timing, communicating among multiple loops, local variables and global variables.

Arrays and Clusters: Introduction, creating one-dimensional array controls, creating two dimensional arrays, creating multidimensional arrays, arrays functions, creating cluster controls and indicators, clusters operations, assembling clusters, disassembling clusters, conversion between arrays and clusters.

Plotting data: Introduction, types of waveforms, waveform graphs, waveform charts, waveform data type, xy graphs, intensity graphs and charts, digital waveform graphs.

Structures: Introduction, case structures, sequence structures, customizing structures, timed structures, formula nodes, event structures, math script.

Strings: Introduction, creating string controls and indicators, string functions, editing, formatting and parsing string, formatting strings, configuring string controls and indicators

Laboratory Work:
Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

- Jovitha Jerome, Virtual Instrumentation Using LabVIEW, PHI Publication.
- Lisa K. Wells & Jeffrey Travis, LabVIEW for everyone, PHI Publication.

- Sanjay Gupta and Joseph John, Virtual Instrumentation Using LabVIEW, Tata McGraw-Hill Publication.
- Gary Johnson, LabVIEW Graphical Programming, McGraw Hill Publication.

S562, Law for Engineers

[2 - - 2]

Course Learning Outcome

By the end of the course, students will be able to

4. Understand the Indian Legal System and Basics of different laws.
5. Understand, explore, and acquire practical insight of legal system and its application in engineering profession.

Syllabus

Unit I
Introduction to Indian Legal System: Constitution of India, Sources of Law and Judicial system

Unit II
1.Contracts and its Elements: Employment contracts, Contract Interpretation, Service Contract, Contract of Indemnity, Law of Agency
2.Employment agreement

UNIT 3
1Legal Documentation: Drafting of legal documents including Non-Disclosure Agreements (NDA), Request for Proposal (RFP), collaboration agreements, joint venture agreements, tendering and sub-contracting

UNIT 4
1.Intellectual Property Rights (IPR): Overview
2.Trademarks, Copy Rights, Patents with special emphasis in Biotechnology Inventions, software, circuits and design
3. Protection in Foreign Countries

UNIT 5
1. Cyber Laws, E-Commerce and E-Governance

UNIT 6 Introduction to Labour Laws
1. Labour Laws: Provident Fund, ESIC, Gratuity, Bonus, Perquisites, Contract labour
2. Health, Safety and welfare of construction workers.

UNIT 7
Taxation: Income Tax, Service Tax, VAT, Excise Duty

UNIT 8

Alternate Dispute Resolution (ADR) in Domestic and International dealings

UNIT 9
Introduction to Criminal Law
RTI Act

References

1. Karnika Seth, Computer Internet and New Technology Laws, Lexisnexis, First Edition 2013.

2. Prafulla C Pant, The Arbitration And Conciliation Act, 1996, Butterworths India, New Delhi.

3. Joseph Minattur, Indian Legal System, Indian Law Institute, New Delhi.

4. J. Beatson, Anson's Law Of Contract, Oxford University Press.

5. V. S. Datey , Indirect Taxes: Law And Practice, Taxmann Publications (P) Ltd, Latest Edition

6. Dr. Vinod K. Singhania And Dr. Monica Singhania , Student's Guide To Income Tax, Taxmann Publications (P) Ltd, Latest Edition.

7. S.C. Srivastava, Industrial Relations And Labour Laws, Vikas Publishing House Pvt. Ltd.

SS561, Creativity and Innovation

[2 0 0 2]

Course Learning Outcome:

By the end of this course students will be able to:

- Understand the importance of R directed thinking complementing L directed thinking
- Infer and discover processes and methods of creative problem solving
- Enhance and correlate their creative and innovative thinking skills
- Understand various disruptive innovations and techniques
- Analyze and apply various tools of creativity to some basic problems

Syllabus:

1. INTRODUCTION:

- Introduction to Creativity and Innovation
- Creativity V/s. Innovation
- Creativity as thinking skill
- Critical Thinking V/s. Creative Thinking
- Lateral Thinking
- Engineering and Creativity
- Creativity in Problem Solving

2. TOOLS FOR CREATIVITY:

- Brain storming
- Mind mapping
- SWOC Analysis
- Fishbone diagram
- Six thinking hats
- Borrowing brilliance
- Da Vinci's seven principles
- Provocation and movement
- Examples and case studies

3. WHOLE NEW BRAIN

- L directed thinking V/s. R directed thinking
- From agriculture age to Industrial age to Information age to Conceptual Age
- Need to high touch – design, story symphony, empathy, play, meaning

4. SKILLS FOR DISRUPTIVE INNOVATORS

- Introduction
- Associating
- Questioning
- Observing
- Networking
- Experimenting
- Putting skills into practice
- Case studies

5. MEDICI EFFECT

- Introduction
- Intersection
- Creating medici effect
- Making intersectional ideas happen
- Case studies

6. TRIZ INNOVATION

- Introduction
- Ideality
- Resources
- Contradictions
- Pattern of innnovation
- Case studies

7. BIO MIMICRY

- Introduction
- Design of various products inspired by nature like Green building, bullet train, Nike Clothing, Velcro, Adhesive Tape, Turbine, self-heating plastic, friction reducing swimming suit, automated robot, screen display, deep blue

8. JUGAAD INNOVATION:

- Introduction
- Jugaad tactics: Seek Opportunities in Adversity, Do more with less, Think and act Flexibly, Keep it simple, Include the margin, Follow your heart.
- Case studies

9. CASE STUDY BY IDEO DESIGN THINKING MODEL

Self-study content will be declared at the commencement of the course.
Approximately 10% of the assessment will be upon this content.

References:

1. Daniel H. Pink, A whole new mind, Pearson publication, New Delhi
2. Benyus, J.M.1997. Biomimicry:Innovation Inspired by Nature, HarperCollins,New York
3. Technical Innovation Center Inc, USA Altshuller G (1997) 40 Principles. TRIZ Keys to Technical Innovation. Technical Innovation Center Inc, USA Andrews P
4. Kelly, Tom (2001): The Art of Innovation, Lessons in Creativity from IDEO, America's Leading Design Firm, Doubleday, NY
5. Tina Seelig, Ingenius, A Crash course on Creativity Hayhouse, U.K
6. Edward de Bono, Lateral Thinking, Be more creative and productive, Penguin India
7. Edward de Bono, Teach Yourself to Think, Penguin India
8. Edward de Bono, Six Thinking Hats, Little Brown and Company
9. Jonah Lehrer, Imagine, How creativity works, Canongate, Edinburgh, London
10. John Adair, The Art of Creative Thinking, Kogan Page India, New Delhi
11. Jeff Dyer, Hall Gregersen & Clayton M. Christensen, The Innovator's DNA, Harvard Business Publishing
12. Daniel Goleman, Emotional Intelligence, Bloomsbury Publishing India P.Ltd.]
13. Howard Gardner, Five Minds for the Future, Harvard Business Review Press
14. Malcolm Gladwell, Blink: The Power of Thinking Without Thinking, Hachette Book Group USA
15. Navi Radjou, Jaideep Prabhu, Simone Ahuja, Jugaad Innovation, Wiley Publisher

Website References:

- Ideo.com
- Asknature.org
- Edwdebono.com
- Triz40.com

IC613 Data Communication and Industrial Networking [3 0 0 3]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand the concepts of communication model and methods for industrial applications
- identify the appropriate standard for particular application
- apply the knowledge of various open and proprietary communication protocols
- demonstrate the applications of the communication protocols in field of process automation

Syllabus:

Introduction to Networks in Process Automation: Open system interconnection (OSI) model, communication basics, network topology, media access methods, cables.

Serial Communication: RS-232 standard, RS-232 troubleshooting, RS-485 standard, RS-485 troubleshooting, current loop and RS-485 converters, difference between RS-232 and RS-485 standards.

Modbus and Modbus plus Protocols: Communication model for industries, overview of Modbus, transmission modes, data types, function codes and frame design, overview of Modbus transmission control protocol/internet protocol (Modbus TCP/IP), Modbus Plus, troubleshooting of Modbus and Modbus Plus protocol, comparison of Modbus variants, introduction of tools.

Fieldbus: Fieldbus technology vs conventional communication methods, fieldbus devices, problems with fieldbus, wiring and installation practice with fieldbus, termination methods, installation of the complete system, troubleshooting of fieldbus system.

Networking Protocols: Industrial Ethernet, actuator sensor interface (AS-I), controller area network (CAN), DeviceNet, highway addressable remote transducer (HART) protocol.

Foundation Fieldbus: Overview of foundation fieldbus, physical layer and wiring rules, data link layer, application layer, user layer, error detection and diagnostics, high-speed Ethernet (HSE).

ProfiBus: Overview of profibus variants, protocol stack and communication model, system operation, troubleshooting, comparison and applications of various standards, emerging technologies for industrial data communication

OPC for Process Control: Overview of open platform communications (OPC), software architecture, OPC DA3.0 data access, case studies.

Wireless Communications and Networking: IEEE802.11 standard for wireless local area networks, bluetooth technology.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

References:

- John Park, Steve Mackay, Edwin Wright, Practical Data Communications for Instrumentation and Control, Elsevier Publication.
- Bela G. Liptak, Instrument Engineer's Handbook on Process Software & Digital Networks, CRC press.
- Deon Reynders, Steve Mackay, Edwin Wright, Practical Industrial Data Communications: Best Practice Techniques, Elsevier Publication.
- A. Behrouz Forouzan, Data Communications & Networking, Tata McGraw-Hill Publication.

IC612 Digital Design for Instrumentation [3 0 2 4]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand architecture and working of different types of programmable logic devices
- develop VHDL code for different types of combinational and sequential circuits
- implement applications related to instrumentation on programmable logic devices

Syllabus:

Design Concepts: Digital Hardware, Design process, Design of digital hardware.
Introduction to Logic Circuits: Logic gates and networks, Synthesis using AND, OR, and NOT gates, NAND and NOR logic networks, Introduction to computer aided design (CAD) tools, Introduction to very high speed integrated circuit hardware description language(VHDL).
Programmable Logic Devices: Programmable Logic Array(PLA), Programmable Array Logic(PAL), Complex Programmable Logic Devices(CPLDs), Field Programmable Logic Arrays(FPGA), Applications of CPLDs and FPGAs.
Optimized Implementation of Logic Functions: Karnaugh map, strategy for minimization, minimization of product of sums forms, incompletely specified functions.
Number Representation and Arithmetic Circuits: Addition of unsigned numbers, fast adders, design of arithmetic circuits using VHDL, arithmetic assignment statements, multiplication.
Combinational Circuit Building Blocks: Multiplexers, decoders, encoders, code converters, arithmetic comparison circuits, VHDL for combinational circuits.
Flip-flops, Registers, Counters: Basic latch, gated SR latch, gated D latch, master slave and edge triggered D flips-flops, T flip-flop, JK flip-flop, registers, counters, reset synchronization, BCD counter, registers and counters in VHDL code, Using VHDL sequential statements for registers and counters.
Synchronous Sequential Circuits: Basic design steps, mealy state model, design of finite state machines using CAD tools, serial adder example.
Applications related to Instrumentation: Analog to digital converter interface, digital to analog interface, data acquisition, control algorithms, memory implementation, pulse width modulation generation, stepper motor speed control.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. Stephen Brown, Zvonko Vranesic, Fundamentals of digital logic design with VHDL, TATA McGraw-Hill Publication.
2. Charles H Roth, Fundamental of logic design, Jaico Publishing House.
3. Volnei A Pedroni, Circuit Design with VHDL, MIT press.
4. Douglas L. Perry,VHDL: Programming by Example, Tata McGraw-Hill Publication.
5. Kevin Skahill, VHDL for Programmable Logic, Pearson Education.
6. J.Bhaskar, VHDL Primer, PHI Publication.

IC623 Fuzzy Control [3 0 0 3]

Course Learning Outcome:

After successful completion of the course, student will be able to

- learn basics of fuzzy set theory
- implement fuzzy based decision making systems
- design and implement fuzzy based control system

Syllabus:

Introduction: Fuzzy control from an industrial perspective, benefits of fuzzy control, limits of fuzzy control, use of fuzzy control, applications, Knowledge based system for process control: process monitoring, fault diagnosis, planning & scheduling, supervisory control

Knowledge based controller (KBC**):** Preliminary concept, introduction to knowledge presentation in KBC

Theory of Fuzzy logic: Introduction: fuzzy sets: fuzzy set theory vs. probability theory, classical set theory. fuzzy set theory, properties of fuzzy sets, operations of fuzzy sets, Fuzzy relations: classical relations, fuzzy relations, operations on fuzzy relations, the extension principle, approximate reasoning: introduction, linguistic variables, fuzzy propositions, fuzzy if then statements, inference rules, the compositional rule of inference, Representing a set of rules: properties of rules, completeness of a set of rules, consistency of a set of rules, continuity of a set of rules, interaction of a set of rules

Fuzzy Knowledge Based Controller design (FKBC)**:** Structure of FKBC: fuzzification, knowledge base, inference engine, defuzzification, Rule base: choice of variables and content of rules, choice of term set, derivation of rules, Data base: choice of membership functions, choice of scaling function, inference engine, choice of fuzzification procedure, choice of defuzzification procedure

Applications of Fuzzy Control: Controller tuning using fuzzy logic, fuzzy logic based controller design for inverted pendulum and robots, design of fuzzy decision making systems

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions

will be asked from self study contents.

References:

1. Jang, T. Sun and E. Mizutani, Neuro-Fuzzy and Soft computing, A computational Approach to learning and machine intelligence, Prentice Hall Publication.
2. Kevin Passino, Fuzzy control, Addison Wesley Publication.
3. D.Driankov, H. Hellendoorn and M. Reinfrank, An Introduction to Fuzzy Control, Springer Publication.

IC601 Industrial Electronics [4 0 2 5]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand the operation of various power electronic devices, optoelectronic devices and power supplies
- design and develop a power supply for low power applications
- simulate, analyse and develop different application circuits based on thyristors
- understand the principle of operation and applications of various techniques used for industrial heating and welding
- realize the role of power electronics in utility-related applications

Syllabus:

Power Supplies: Introduction, performance parameters, filtering, function of a bleeder resistor in filter circuit, voltage multipliers, regulated power supply, SMPS, comparison of linear power supply and SMPS, switch mode converters.

Thyristors: Silicon controlled rectifier, SCR terminology and two transistor model, static and dynamic characteristics of SCR, turn-on methods of a thyristor, different triggering circuits for SCRs, turn-off methods of thyristor, different methods of forced commutation, thyristor ratings, comparison of SCRs & transistors, SCR crowbar, power semiconductor devices–Diac, Triac, Power transistor, Power MOSFET, IGBT, MCT, comparison between power transistor, power MOSFET and power IGBT.

Series and Parallel Operation of Thyristors: Series operation, need for equalizing network, triggering of series connected thyristors, parallel operation, methods for ensuring proper current sharing, triggering of parallel connected thyristors, string efficiency, derating.

Phase Controlled Converters: Classification of controlled converters, single phase halfwave controlled rectifier, single phase fullwave controlled rectifier, single phase half controlled bridge rectifier, symmetrical and asymmetrical configurations, single phase full controlled bridge rectifier, three phase controlled converters-halfwave converter, semiconverter and full converter.

Heating & Welding Control: Introduction, various types of industrial heating, principle of induction heating, theory of induction heating, applications of induction heating, principle of dielectric heating, applications of dielectric heating, welding, scheme for AC resistance welding, welding cycle, types of resistance welding.
Optoelectronics Devices & Applications: Photo emitters, Lasers, LCDs, photoconductive sensors, photodiodes, phototransistors, LASCR, optocouplers, Solid-state relays, optical fiber and various industrial applications of above devices.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work: Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. M. D. Singh & K. B. Khanchandani, Power Electronics, Tata McGraw Hill Publication.
2. B. Paul, Industrial Electronics & Control, PHI Publication.
3. C. D. Simpson, Industrial Electronics, Prentice-Hall Publication.
4. Sivanagaraju, Reddy, Balasubba, Prasad & Mallikarjuna, Power Electronics, PHI Publication.
5. Asghar M. S. Jamil, Power Electronics, PHI Publication.

IC632 **Mechatronics** **[3 0 2 4]**

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand principles and working of devices and elements for mechatronics and robotics
- select and apply various sensors and actuators for mechatronic and robotic systems
- perform modeling, simulation, systems level analysis and design for mechatronics and robotics

Syllabus:

Introduction: Mechatronics-History, definition, multi-disciplinary scenario, industry needs, objectives, mechatronic systems, components and modules, examples of mechatronic systems.

Elements of Machine: Guide ways, slide ways, ball screw and nut, roller screw, spindles, bearings.

Modeling and Simulation of Mechatronics and Robotic Sub-systems and Systems: Introduction, models of electromechanical systems, rigid body models, basic equations of dynamics of rigid body, simple dynamic models, elastic system modelling, electromagnetic forces, dynamic principles of electrical and magnetic circuits, Earnshaws's theorem, electromechanical stability, modeling mechanical systems for mechatronics applications, modeling and simulation of MEMS (Micro Electro Mechanical Systems) devices and systems, modeling and simulation of work envelope and application systems.

Mechatronics and Robotic Sensors: Overview of sensors & characteristics in mechatronics context, time & frequency fundamentals, linear and rotational sensors, acceleration, force, torque and power, flow, temperature, distance, proximity, light detection, image & vision Systems, integrated micro-sensors, sensor selection for mechatronic systems.

Mechatronics and Robotic Actuators: Electromechanical actuators, electrical machines, piezo-electric actuators, hydraulic and pneumatic actuators, MEMS actuators, their design and fabrication.

Mechatronic and Robotic Systems and Related Controls: Mechatronic systems with control, role of modelling and controls in mechatronic systems, mechatronic system and motion controllers, mechatronic and robotic systems case study examples like industrial manufacturing operations, automotive, robotics.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:
Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. Ganesh Hegde, Mechatronics, John & Bartlet Publishers.
2. Godfrey Onwubolu, Mechatronics: Principles and Applications, Butterworth Heinmann Publishers.
3. John Billingsley, Essentials of Mechatronics, Wiley-Interscience Publishers.
4. Robert Bishop, Mechatronics: Introduction, CRC Press.
5. Robert Bishop, Mechatronics Handbook, CRC Press.

IC604 Mini Project-II [0 0 2 1]

Course Learning Outcome:

After successful completion of the course, students will be able to

- practice acquired knowledge within the chosen area of technology for project development
- identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach
- reproduce, improve and refine technical aspects for engineering projects
- work as an individual or in a team in development of technical projects
- communicate and report effectively project related activities and findings

Syllabus:

Mini project may be carried out in one or more form of following:

product preparations, working/non-working models, prototype development, fabrication of set-ups, laboratory experiment development, process modification/development, simulation, software development, integration of software and hardware, statistical data analysis, survey, creating awareness in society.

The student is required to submit a report based on the work. The evaluation of the project shall be on continuous basis.

IC602 Process Control [4 0 2 5]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand the need of process control
- develop mathematical model of the given process
- select the proper controller and apply the tuning rules to achieve optimum performance
- select advanced control strategy to enhance the performance

Syllabus:

Introduction to Process Control: Objectives of process control, terminology, overview on process control elements

Mathematical Modeling of Physical System: First order systems, first order systems in series, interacting and noninteracting systems, second order systems, system with transportation lag, linearization

Controller Modes: ON-OFF, multiposition, floating, proportional, integral, derivative, PI, PD, PID, realization of controller with analog and digital controller, selection criteria for controllers

Transient Response of Control System: Proportional controller response for set point and load change, proportional-integral and proportional-integral-derivative response for set point and load change.

Frequency Response of Control System: Frequency response of the system with proportional controller, integral, derivative, PI and PID controller, stability analysis in frequency domain

Controller Tuning: Need of controller tuning, criteria for good control, tuning methods – Ziegler-Nichols and Choen-Coon, process identification for controller tuning.

Advanced Control Strategies: Need of advance control strategies, cascade control, feedforward-feedback control, ratio control, dead time compensator, compensator for inverse response system, Internal Model Control (IMC), split range control, selective control, inferential control, reset windup, adaptive control, applications of advanced control strategies in various unit operations.

MIMO Process Control: Introduction to multi input-multi output process control, problems of MIMO process control, stability of MIMO system, relative Gain Array (RGA) analysis, decoupler design.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. Donald R Coughanowr and S.E.Leblanc, Process Systems Analysis and Control, McGraw Hill Publication.
2. Curtis Johnson, Process Control Instrumentation Technology, PHI Publication.
3. Seborg, Edgar, Millichamp and Doyle, Process Dynamics and Control, Wiley Publishers.
4. Bela G. Liptak, Instrument Engineers Handbook, Process Control, Elsevier.

IC603 Virtual Instrumentation Applications [0 0 2 1]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand and apply the basics of state machine and file management
- understand and apply the concepts of different advanced toolbox for virtual instrumentation
- design applications for virtual instrumentation

Syllabus:

State Machine: Introduction, Enumerated types and definitions, Sequence-style, Test executive-style, Classical-style, Queued-style, Advantages and disadvantages of using state machines programming concepts.

Files I/O: Basics of files Input/output(I/O), choosing file I/O format, data directory, file I/O VIs, Creating a relative path, report generation in word and excel.

Virtual Instrument Software Architecture (VISA): Introduction, instrument I/O assistant, VISA programming terminology.

Data Acquisition: Introduction, transducers, signals, data acquisition (DAQ) hardware configuration, DAQ hardware, analog input, analog output, digital I/O, DAQ software architecture, DAQ assistant, channels and task configuration, selecting and configuring a data acquisition device.

Image Processing: Introduction, control palette, functions palette, getting measurement ready images, image processing and analysis.

Signal Processing: Signal generation, signal processing and digital filtering.

Control Design and Simulation: Introduction, modeling and simulation, time response, frequency response, built-in P, PI and PID control.

Laboratory Work:

Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

References:

1. Jovitha Jerome, Virtual Instrumentation Using LabVIEW, PHI Publication.
2. Rick Bitter, Taqi Mohiuddin, Matt Nawrocki, LabVIEW-Advanced Programming Techniques, CRC press.
3. Gary Johnson, LabVIEW Graphical Programming, 2nd Edition, McGraw Hill Publication.

CH001 Air Pollution Control Engineering [3 0 0 3]

Course Learning Outcome:
After successful completion of the course, student will be able to

- understand the fundamentals of air pollution, the major collection mechanism and equipments/instruments for a given gaseous or particulate pollutants
- select and apply the most appropriate air pollution control system
- understand the fundamentals of indoor and odour pollution
- understand different methods for controlling emissions from stationary and mobile sources
- apply the concept of air pollution control engineering to the professional society and general public

Syllabus:
Introduction to Air Pollution : Air pollution in India and the world, sources and classification of air pollutants, global concern of air pollutants, effects of air pollutants.
Meteorological Aspects of Air Pollution: Temperature lapse rates and stability, meteorological factors influencing air pollution, plume behavior, dispersion of air pollutants and estimation of plume rise.
Sampling and Measurement of Air Pollution: Types of pollutant sampling and measurement, ambient air sampling, stack sampling, analysis of air pollutants.
Source Correction Methods: Raw material change, process change, equipment modifications.
Particulate Control Techniques: Collection efficiency, particulate control equipments like gravity settling chambers, cyclone separator, filters, electrostatic precipitator, wet scrubbers.
Control Technologies for Gaseous pollutants: Scrubbers, absorption and adsorption, control of specific gaseous pollutants like SO_x, NO_x.
Control of Volatile Organic Compounds: Environmental significance of organic compounds and its control.
Odor and Its Control Techniques: Sources and characteristics of odor, measurement and control of odor.
Indoor Air Pollution: Indoor air pollutants and its effect, factor influencing indoor air quality, control of indoor air pollutants.
Air Pollution Legislation and Regulations: Air quality criteria and emission standards.
Control of Air Pollutants from Various Sources like Stationary and Mobile source
Recent Trends in Air Pollution Control Techniques

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

1. Richard W. Bouble, Donald L. Fox, D. Bruce Turner, Arthur C. Stern, Fundamentals of Air Pollution, Academic Press.
2. C. S. Rao, Environmental Pollution Control Engineering, New Age International.
3. M N Rao, H V N Rao, Air Pollution, Tata McGraw Hill.

4. J. R. Mudakavi, Principles and Practices of Air Pollution Control and Analysis, I. K. International.
5. S. C. Bhatia, Textbook of Air Pollution and its Control, Atlantic Publishers & Distributors.
6. R. K. Trivedy, P. K. Goel, An Introduction to Air Pollution, BS Publications.

HS016, Applied Literature **[3 0 0 3]**

Course Learning Outcome

Students completing this subject will:

- be able to explore the importance of textual traditions in shaping responses to other places, peoples, cultures;
- gain a knowledge and understanding of the social, political and intellectual forces contributing to imperial, third world and migrant writing;
- develop a knowledge and appreciation of the subject matter, styles and narrative conventions

Syllabus

Non-fictional Prose Works (Excerpts)

New Branded World by Naomi Klein

From the Gutenberg Elegies: The Fate of Reading in the Electronic Age by Sven Birkets

Decolonising the Mind by Ngugi wa Thiong'o

Idea of India by Sunil Khilnani

Wings of Fire by APJ Kalam

Poems

Night of the Scorpion by Nissim Ezekiel

Little Red-Cap, by Carol Ann Duffy

Hunger by Jayanta Mahapatra

The Dacca Gauzes by Agha Shahid Ali

The Howl by Allen Ginsberg

If you forget me by Pablo Neruda

Still I rise by Maya Angelou

If by Rudyard Kipling

"Hope" is the thing with feathers by Emily Dickinson

All You who Sleep Tonight by Vikram Seth

The Unknown Citizen by W. H Auden

Song of Myself, I, II, VI & LII by Walt Whitman

Short Stories

Short Story: "Seventeen Syllables" by Hisaye Yamamoto

Short Story: “The Gift of the Magi” by O. Henry

Criticism

Towards a Feminist Poetics by Elaine Showalter

Movies

The Prestige

To Sir, With Love

The Namesake

Sherlock – TV series

Troy

Jobs

References:

- Widdowson, Peter. *Literature*. London: Routledge, 1999.
- Miller, J. Hillis. *On Literature: Thinking in Action*. London: Routledge, 2002.
- Mulhern, Francis, *Culture/Metaculture*. London: Routledge, 2000.
- During, Simon, *The Cultural Studies Reader*. London: Routledge, 1993.
- Leitch, Vincent B. *The Norton Anthology of Theory and Criticism*. Norton: New York, 2001.
- Stam, Robert; Alessandra Raengo, *A Companioin to Literature and Film*. Blackwell: Oxford, 2004.

IC764 Advanced Factory Automation [3 0 0 3]

Course Learning Outcomes (CLO) :

At the end of the course, students will be able to

- ascertain need, benefits and applicability of motion controllers and drives
- select the right drive system including motor
- appreciate the different types of sensors used in machine control
- understand different types of motion profiles and coordinated motion

Syllabus :

Introduction: Components of Machine Control, Human Machine Interface, Motion controllers, Drives, actuators and feedback

Motion Profiles: Kinematics, Common Motion profiles, Multi-axis Motion

Drive Train Design: Inertia & Torque Reflection using various transmission mechanisms like gear-box, lead-screw, pulley-Belt, etc., Torque required for motion during different part of trajectory, Motor Torque –Speed Curves for AC Servo & Induction motor, selection of Motor, Transmission mechanism, etc.

Electric Motors: AC Servo Motors, AC Induction Motor Overview, Mathematical Model of AC Servo and AC Induction Motor.

Sensors & Control Devices: Optical Encoders – Incremental & Absolute Encoder, Serial Encoder Communication, Detection Sensors – Limit, Proximity, Photoelectric, Ultrasonic, Concept of Sinking & Sourcing, Pushbuttons, Selector switches, Motor Control Circuit Devices.

AC Drives : Drive Electronics: Converter & DC Link, Inverter, Basic Control Structure : Cascaded Velocity Position loop, single loop PID position control, Cascaded loop with feed forward control, Inner Loop of AC Servo and Induction motor, Simulation model of Vector control for AC Servo & Induction Motor, Tuning of PI and PID, tuning of Cascaded Loop control with feed forward loop.

Motion Controller - Programming & Application: Move Modes: Linear, Circular and Contour, Motion Controller and PLC Functionality, Single Axis Motion : Jogging and Homing, Multi Axis Motion : multiple Motor driving single axis, coordinated motion of two or more axes, Following using Master-slave synchronization, Tension Control and kinematics.

Suggested Readings:

1. Industrial Motion Control, Hakan Gurocak, Wiley Publication
2. Modern Control Technology: Components & Systems, Killian, Delmar Publication, 2nd Edition
3. Industrial Servo Control Systems: Fundamentals And Applications, George W. Younkin, CRC Press
4. Servo Motors and Industrial Control Theory, Riazollah Firoozian, Springer Publication

L= Lecture, T= Tutorial, P=Practical, C=Credit

IC704 Industrial Drives and Controls [3 0 2 4]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand the operation of various power converters and electric drives
- design and develop a power converter like inverter and chopper
- simulate, analyze and develop different application circuits based on power converters and drives
- select and implement appropriate method of speed control of electric drives
- realize the role of power converters and electric drives in industrial applications

Syllabus:

Choppers: Introduction, Basic classification – step down, step up and step up/down, Basic chopper operation, Control strategies, Chopper configuration, Thyristor chopper circuits, Jones chopper, Morgan chopper.

Inverters: Introduction, Classification of inverters, Series inverters, Parallel inverters, Single-phase SCR half and full bridge inverters, Performance parameters of inverters, PWM inverter, Three-phase inverter.

Cycloconverters: Introduction, Basic Principle of operation, Single-phase to single-phase cycloconverter, Three-phase half-wave cycloconverter.

Introduction to Electric Drives: Introduction, Basic principle of operation, Classification of electric drives, Different types of loads.

D.C. Drives: Introduction, Basic machine equations, schemes for DC motor speed control, Single-phase DC drives, Three-phase DC drives, Chopper drives.

A .C. Drives: Introduction, Basic principle of operation, Speed torque characteristics, Speed control of induction motor, Stator voltage control, Static rotor resistance control, Stator frequency control, V/f control, Stator current control, Slip power recovery scheme, Static Scherbius drive, Static Kramer drive.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory Work will consist of minimum 12 experiments based on the above syllabus.

References:

1. M. D. Singh and K. B. Khanchandani, Power Electronics, Tata McGraw Hill Publication.
2. C. D. Simpson, Industrial Electronics, Prentice-Hall Inc. Publication.

3. Sivanagaraju, Reddy, Balasubba, Prasad and Mallikarjuna, Power Electronics, PHI Publication.
4. Asghar M. S. Jamil, Power Electronics, PHI Publication.
5. G.K. Dubey, Fundamentals of Electric Drives, Narosa Publishing House.

IC701 **Instrumentation Systems** **[3 0 0 3]**

Course Learning Outcome:
After successful completion of the course, student will be able to

- interpret and prepare the instrumentation system documents and drawings
- understand the role for safety in industry
- select and install the appropriate field device for given applications
- understand function of various general devices used in industries

Syllabus:

Instrumentation and Control Systems Documentation: Importance of documents and drawings for engineering, procurement and construction activities, Process Flow Sheets, Mechanical Flow Sheets, Piping and Instrumentation Drawing (P&ID) Instrument Index Sheets, Instrument Specification Sheets, Loop Wiring Diagram, Panel Drawings, Specifications, Installation Details, Purchase and Procurement related documents, Instruments Specifications & Standards, Vendor Drawing and other Instrumentation project related documents. Software packages for drawings and documentation.

Piping and Instrumentation Drawing (P&ID): Introduction, Flow Sheet Symbols, Flow Sheet Codes & Line Symbols, Instruments Symbols & Identification, Graphic Symbols for Distributed Control/ Shared Display Instrumentation, Logic And Computer Systems, Graphic Symbols For Logic Diagram, Static Switching Control Devices, Graphical Symbols For Pipe Fittings, Valves & Piping, Case studies of industrial P&IDs.

Safety and Interlocks: Overview of Safety- personal and equipment, Hazardous area classification, Purging and pressurization system, Intrinsic safety approaches - Zener barrier, Interlock and Trip System, Safety devices - pressure relieving devices, safety switches, smoke detectors and flame detector, Ingress Protection (IP) code for instruments, Annunciation and alarm system, ISA standard for alarm management, Introduction to Safety Integrity Level (SIL) and its classification

Selection, Calibration, Installation and Maintenance of Field Devices: Selection criteria for flow, temperature, level and pressure instruments, Range selection, Instrument calibration, Traceability with standard laboratories, Installation guidelines for various field instruments, Redundancy for devices, Importance of maintenance, different approaches of maintenance, Introduction to Instrument Asset Management System (IAMS)

Instrument Air Supply System: Overview, Sizing of the system, Compressor systems, Compressor cooling and its control, Oil removal, Dryers and its selection. Distribution systems, control room air supply

General Devices and Accessories: I/P Converter, P/I Converter, Air filter regulators, Connectors, Piping, Cables

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

References:

1. Frederick Meier and Clifford Meier, Instrumentation and Control Systems Documentation, ISA Publication.

2. W. G. Andrews, Applied Instrumentation-Vol III, Gulf Publication.

3. Gregory K. McMillan and Douglas M. Considine, Process Industrial Instruments and Controls

   Handbook, McGraw Hill Publication.

4. Bela Liptak, Instrument Engineers' Handbook – Process Measurement and Analysis, CRC Press

IC705 Minor Project [0 0 4 2]

Course Learning Outcome:

After successful completion of the course, students will be able to

- practice acquired knowledge within the chosen area of technology for project development
- identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach
- reproduce, improve and refine technical aspects for engineering projects
- work as an individual or in a team in development of technical projects
- report project related activities effectively to peers and mentors

Syllabus:

The student(s) shall carry out project based on one or more of the following aspects: prototype design, product preparations, working models, fabrication of set-ups, laboratory experiments, process modification/development, simulation, software development, integration of software and hardware, data analysis, survey etc.

The student is required to submit project report based on the work.

IC703 Nonlinear and Digital Control [3 0 2 4]

Course Learning Outcome:

After successful completion of the course, student will be able to

- understand the basics of Nonlinear and digital control system
- analyze nonlinear system
- design controller for discrete time system

Syllabus:

Introduction to Nonlinear Control System: Nonlinear system elements, Continuous and discontinuous nonlinearities, Behavior of nonlinear control systems

Stability Analysis: Phase plane analysis, Describing function based analysis, Linearization techniques, Stability using Lyapunov method, Input-output stability, L stability, L stability of state models, L_2 gain, related examples.

Digital Control System: Digital control of continuous time system, Overview of sampled data control system. Discrete-time system and Z-Transformation, State space description of dynamic system, Discrete time observer and controller, related examples

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory Work will consist of minimum 12 experiments based on the above syllabus.

References:

1. Hasan Khalil, Nonlinear Control, Pearson Education
2. Hasan Khalil, Nonlinear Systems, Pearson Education
3. I.J. Nagrath and M. Gopal, Control System Engineering, New Age International Publication
4. M. Gopal, Digital control and state variable methods, New Age International Publication

SS701 Organizational Behaviour [3 1 0 4]

Course Learning Outcomes (CLO):

After studying the course the students will be able to:

- Analyze and evaluate performance behavior at individual, group and organizational levels.
- Develop the ability to lead and motivate others to succeed.
- Develop critical analytical skills that will help them diagnose situations pertaining to human behavior and generate effective solutions for the same.
- Understand and apply principles of organizational dynamics relating to systems, culture, structure and change processes

Syllabus

I. Introduction to Organizational Behaviour

5. Concept of Organizational Behaviour (OB)
6. History , Nature and scope of OB
7. Key elements in OB
8. Inter-disciplinary contribution to OB
9. Managerial Roles

II. Individual Behaviour, Values & Personality

- Concept of Individual Differences
- Values commonly studied across culture
- Fundamentals and Determinants of Personality
- Big Five Dimensions
- Personality Traits

III. Learning & Perception

- Fundamentals of Learning
- Learning Theories - Classical Conditioning Theory, Operant Conditioning Theory, Social Learning Theory
- Behavior Modification
- Definition of Perception, Perceptual Process, Common Perceptual Errors

IV. Motivation

- Basic concept of Motivation
- Theories of Motivation – Maslow,Herzberg's Two Factor Theory, ERG, McClelland , Equity and Vroom's Expectancy Theory

V. Leadership

- Introduction
- Leadership Theories - Trait Theories, Behavioral Theories and Situational Theories

VI. Group Dynamics

6. Defining and classifying groups
7. Stages of group development
8. Group Properties – Roles, Norms, Status, Size and Cohesiveness
9. Group Decision making

VII. Managing Change in Organization

- Definition, Forces of Change,

- Causes for Resistance to Change, Overcoming Resistance to change
- Lewin's Change Model

VIII Organizational Culture

5. Meaning, Strong Culture vs. Weak Culture
6. Creating & sustaining Culture
7. Socialization

IX. Conflict, Power & Politics

- Nature & types of conflict, Causes and outcome of conflict
- Responses to conflict
- Bases of Individual Power
- Organizational Politics

Self-study content will be declared at the commencement of the course. Approximately 10% of the assessment will be upon this content.

References:

4. Robbins, S.P.Judge, T.A. &, Sanghi, Seema. (2010). *Organizational Behavior*, Pearson.

- Pareek, U.(2011).*Understanding Organizational Behavior*, Oxford University Press.
- Luthans,F.(2006).*Organizational Behaviour*, Tata McGraw Hill.
- Sekaran,U. (1989).*Organizational Behaviour: Text and Cases*, Tata Mc Graw Hill
- Kreitner, R. &Kinicki, A.(2012). *Organizational Behavior*, McGrawHill/Irwin
- Davis,K. &Newstorm, J.W. (1989).*Organizational Behaviour*, Tata McGraw Hill
- Slocum,J.W&Hellreigal, D. (2010).*Fundamentals of Organizational Behaviour*, Cengage Learning.

IC714 Power Plant Automation [3 0 0 3]

Course Learning Outcome:
After successful completion of the course, student will be able to

- assess various operational aspects of power plant and compare thermal, nuclear and hydro power plants
- analyze various control systems of thermal power plant
- analyze various subsystems and health monitoring system of thermal power plant
- understand optimization strategies for thermal power plants

Syllabus:

Introduction: Plant overview, Classification of power plants - thermal, hydro, combined cycle and nuclear, overview of super critical thermal power plant

Power Plant Process Control: Boiler process, Operation, Drum level control, Fuel-to-Air ratio control, Super-heated steam temperature control, Steam pressure control, Furnace pressure control, Flue gas temperature control, Sequential control operation

Turbine Supervisory Control: Overview of steam turbine, Operation, Turbovisory system, Coordinated controls of boiler and turbine

Power Plant Subsystem Automation: Coal handling system, Ash handling system, Feed water treatment system

Power Plant Instruments: Flue gas monitoring instruments, Water and steam quality measurement instruments, Smoke detecting instruments

Plant Optimization: Performance measurement of power plant, Excess O_2 optimization, Water side optimization, Performance optimization with multivariable control.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions

will be asked from self-study contents.

References:

1. Arora and Domkundwar, Power Plant Engineering, Dhanpatrai and Sons Publication

2. Bela G. Liptak , Instrumentation Engg's Handbook on Process Control, CRC Press

3. Krishnaswamy K, Bala M, Power Plant Instrumentation, PHI Publication

4. Max Jervis, Power Station Instrumentation, Butterworth-Heinemann Publication

IC702 **Process Automation** **[3 0 2 4]**

Course Learning Outcome:
After successful completion of the course, student will be able to

- understand the fundamentals of programmable logic controller
- develop program using standard programming languages
- understand the SCADA, DCS and Industrial Networking
- develop an application orientated project using PLC

Syllabus:
Programmable Logic Controller: Introduction, Importance of PLC, Type of PLC's and basic architecture of CPU,PLC operation and various standards, Different modules of PLC Discrete input-output module, Analog and digital input-output modules ,intelligent and communication input-output module, Programming standards of PLC, PLC operation, Ladder logic, Logic functions, Basic relay instructions, Timer counter instructions, Comparison, Arithmetic and logical instruction ,data handling, input-output instructions.
Advanced Programming Languages: Programming of PLC using structured text, Instruction list, Function block diagram, Sequential Flow chart.
Distributed Control System: Evolution of DCS, Design and specification architecture, merits and demerits, Direct digital control, supervisory control and distributed digital control system, Evolution of hierarchical system structure.
Supervisory Control & Data Acquisition: Introduction of SCADA, Selection criteria of SCADA, Hardware selection for SCADA.

Introduction to Industrial Networking: Interface Standard, Modbus and Modbus plus Protocols, HART, AS-interface (AS-i), DeviceNet overview, ProfiBus PA/DP/FMS protocol, Foundation Fieldbus, Industrial Ethernet overview, TCP/IP overview

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:
Laboratory Work will consist of minimum 12 experiments based on the above syllabus.

References:

1. Frank D. Petruzella, Programmable logic controller, Tata-Mcgraw Hill publication
2. John W. Webb and Ronald A. Reis, Programmable Logic Controllers: Principles and Applications, PHI Publication
3. W. Boltan, Programmable Logic Controllers, Elsevier Publication
4. John R. Hackworth and Frederick D. Hackworth Jr., Programmable Logic Controllers Programing methods and application, Pearson Publication
5. Stuart A. Boyer, SCADA: Supervisory control and data acquisition system, ISA Publication

6. Ronald L Krutz, Securing SCADA system, Wiley Publication

7. Bela G. Liptak, Instrument Engineers' Handbook: Process Software and Digital Networks, CRC Press
8. Steve Mackay, Edwin Wright, Deon Reynders, and John Park, Practical Industrial Data Networks: Design, Installation and Troubleshooting, Elsevier Publication

IC801 Major Project [0 0 30 25]

Course Learning Outcome:

After successful completion of the course, students will be able to

- use various tools and techniques to study existing systems
- critically analyse existing systems, thereby select and justify parameters to be improved
- start and manipulate proposed engineering solution as per industry / research / societal need
- achieve precision in uses of the tools related to their experiments/fabrication
- reorganize and refine various components of technology to optimize the resources at large
- appraise the potential of technology for scalability and wide spectrum of applications
- report project related activities effectively to peers, mentors and society
- follow and value health, safety and ethical practices during project

Syllabus:

The major project shall be based on the recent trends in technology, system/process analysis, construction/fabrication/production techniques, design methodologies etc. The student(s) shall carry out a comprehensive project at relevant Academic/R&D/Industrial organization based on one or more of the following aspects: prototype design, product preparations, working models, fabrication of set-ups, laboratory experiments, process modification/development, simulation, software development, integration of software and hardware, data analysis, survey etc.

The student is required to submit comprehensive project report based on the work.

CL001 Disaster Risk Management [3 0 0 3]

Course Learning Outcome:

After successful completion of the course, student will be able to

- develop understanding about concept of risk, vulnerbility and disasters
- select and apply tools & techniques for disaster risk assessment
- comprehend role of Engineers from various Engineering branches for disaster risk management
- develop ability for contributing to resilient societies through skills, methods and tools pertaining to disaster risk management

Syllabus:

Introduction to Disaster Risk Management (DRM): Concept, Types of Disasters, Linkages between Disasters and Development, Importance & Significance of DRM.

Risk and Vulnerability: Risk, Vulnerability, Risk Assessment, Disaster Risk Modelling; Emerging Risks due to Development, Climate Change Adaptation, etc.

Disaster Risk Management: Phases, Mitigation, Preparedness, Prevention, Response, Relief and Recovery, Humanitarian Assistance, DM Institutional Framework, Incident Command System, Disaster Management Plan,

Community Based Disaster Management (CBDM): Concept of CBDM, Community Health and Safety, Do's and Don'ts before, during and after disasters.

Disaster Communication: Disaster Communication, Early Warning and Disaster Monitoring, Role of GIS and Remote Sensing in Disaster Risk Management.

Role of Enginners from various branches in Disaster Risk Management: Use of Skills, Methods, Tools and Techniques for understanding the challenges and determining solutions for DRM and Climate Change Adaptation.

Disaster Risk Management Programmes: DRM Programmes, Practices and Case Studies.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

1. Sahni Pradeep, Ariyabandhu Madhavi Malalgoda, Disaster Risk Reduction in South
   Asia, PHI Learning Pvt.Ltd.
2. Sinha Prabhas C., Disaster Relief: Rehabilitation and Emergency Humanitarian Assistance, SBS Publishers.
3. Wisner Ben, Blaikie Piers, Cannon, Terry & Davis, Ian, At risk natural hazards, people's vulnerability and disasters, Routledge.
4. Singh R.B. (Ed.), Natural Hazards and Disaster Management Vulnerability & Mitigation, Rawat Publications.
5. Blodgett Robert & Keller Edwards, Natural Hazards: Earth's processes as hazards
   disasters and catastrophe, Pearson Prentice Hall

EE002 Electrical Power Utilization and Safety [3 0 0 3]

Course Learning Outcome:

After successful completion of this course, students will be able to

- understand the importance of power factor and suggest a suitable method for improving it
- suggest and apply suitable electric heating, welding, refrigeration and air conditioning for a system
- analyze and design illumination scheme, electrification, earthing system and protection system for an application

Syllabus:

Electric Heating and Electric Welding: Advantages of electric heating, Resistance heating, Types of furnaces, Induction heating, Types of induction furnaces, Dielectric heating, Types of welding- arc and resistance.

Refrigeration and Air conditioning: Introduction to refrigeration and air-conditioning, Principles of a refrigerator, Domestic refrigerator, Electrical circuit of refrigerator, Need of voltage regulator, Water cooler, Air conditioner, Thermo-electric refrigeration, Air purification, Central air conditioning systems.

Illumination Scheme: Basic terms used in illumination scheme, Electric lamps, Recommended levels of illumination, Types of lighting schemes, Design of lighting schemes, Factory lighting, Street lighting, Flood lighting.

Electrical Installation, Estimating and Costing: Types of load, Load assessment, Electrical supply systems, Wiring systems, Permissible voltage drops and conductor size calculations, Estimating and costing for residential and commercial service connections (single phase and three phase).

Power Factor: Effects of power factor, Causes of low power factor, Disadvantages of low power factor, Methods of improving power factor.

Electrical Safety Concepts and Criteria: Electrical shock mechanisms, Factors influencing the electric shock, Body current thresholds (tolerable body current limit), Thevenin's concepts and accidental equivalent circuits (step and touch potentials), Protection against electric shock.

Earthing Systems: Purpose of earthing, IS rules for earthing of electrical installations, Factors governing the resistance of earth electrode, Methods of earthing, Measurement of earth resistance, Methods of reducing earth resistance.

Protective Devices: Fuse, Miniature circuit breakers (MCB) and Earth leakage circuit breakers (ELCB).

Self Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

References:

1. E. Openshaw Taylor, Utilisation of Electrical Energy, Universities Press.
2. H. Partab, Art and Science of Utilisation of Electrical Energy, Dhanpat Rai & Co.
3. J. B. Gupta, Utilization of Electric Power and Electric Traction, S. K. Kataria & Sons, New Delhi.
4. G. C. Garg, Utilization of Electric Power and Electric Traction, Khanna Publishers, Delhi.
5. R. K. Rajput, Utilisation of Electrical Power, Laxmi Publications (P) Ltd., New Delhi.
6. N. V. Suyranarayana, Utilisation of Electric Power Including Electric Drives and Electric Traction, New Age Publishers, New Delhi.
7. J. B. Gupta, A Course in Electrical Installation Estimating and Costing, S. K. Kataria & Sons, New Delhi.
8. Dr. J. G. Jamnani, Elements of Electrical Design, Mahajan Publishing House.

L	T	P	C
3	**0**	**0**	3

Course Code	**2HSO14**
Course Title	**Banking and Finance**

Course Learning Outcomes:

After the successful completion of the course, students will be able to

1. Understand various concepts of banking and financial system
2. Analyze the financial products and services
3. Evaluate the mechanism of banking and financial system

Syllabus:
Teaching Hours: 45

nits	**Teaching Hours**
Unit I	**15**
Indian Financial System: The Financial System, Nature, Evolution and Structure, the Functions of Financial Intermediaries, Financial Instruments, the Role of Financial System in Economic Development, the Indian Financial System. The Origin and Growth of Banking of Banking, Functions of Commercial Banks, Banking in the New Millennium.	
Unit II	**1**
Banker Customer Relationship: Types of Accounts, Types of Relations, KYC Norms, Banker – Customer relationship, Rights and Duties of Banker/ Customer, Importance provisions of NI Act	
Unit III	**3**
Sources &Uses of Funds: Bank Balance sheet, Sources & Uses of Funds in a Bank. Form of Balance Sheet of Banking Companies. Different Schedule under Banking Regulation Act. – Provisioning norms of CRR & SLR	
Unit IV	**3**
Deposit Management: Importance of Deposit, Types of Deposit in India, USA & Europe. NRI Deposits, Cost of Deposit & its impact on Profitability, concepts of Fixed & Floating Rate of Interest, Deposit Insurance.	
Unit V	**5**
Cheques: Special Features Negotiability, Validity, Crossing & Endorsement.	
Unit VI	**2**

Cash Management: Importance of Cash Management issues, Cash at Counter, Vault & Currency Chest.	
Unit VII	**2**
Lending Activities: Lending activity, Basic requirements for lending.	
Unit VIII	**2**
Credit Policy: Need for Credit Policy, Components of Credit Policy, Credit Policy Pursued by the Government, Bench Marks Exposure Norms, Credit Culture.	
Unit IX	**2**
Retail Banking: Basics of Retail Banking, Forms of Retail Banking and Emerging issues	
Unit X	**2**
Corporate Banking: The nature of corporate banking, Developments in corporate banking, Consortium finance, Multiple banking arrangements, and Loan syndication	
Unit XI	**6**
Feebased Services: Feebased Services L/C,B/G, Subsidary services, Bancassurance, Demat Account, Safe Deposit Locker , Mutual Funds, Merchant Banking Activities – Management of Public issues, Reasons, Eligibility norms, Regulatory framework, Marketing of issues, Post issue activities	
Unit XII	**2**
Plastic Money: Different types of plastic money, Concept of a credit card, Distinction between Credit card, Charge card and Debit card, Mechanics of a credit card transaction, Credit card as an augmented retail financial product, Credit card business in India, The merging scenario CRM, (AWB, ATM, Mobile Banking Internet Banking) Delivery Channels (Payment & settlement services)	

Reference Books:

1. Management of Banking & Financial Services - Paul, Justin / Suresh, Padmalatha. Pearson – 2007
2. Financial Institutions and Markets, 4th e Bhole, LM. Tata McGraw Hill 2004
3. Indian Financial System, Theory and Practice, 4th e, Khan, M Y. Tata McGraw Hill 2004

ME004 Cryogenics [3 0 0 3]

Course Learning Outcome: After successful completion of the course, student will be able to

- describe various methods to produce low temperature and phenomena at cryogenic temperature.
- understand the working principle of different cryogenic refrigeration and liquefaction system.
- understand the functions and working principles of insulations and various low temperature measuring and storage devices.
- understand the application of cryogenic technology in engineering research and industry.

Syllabus:

Low Temperature Properties – Mechanical, thermal, electrical and magnetic properties of engineering materials, properties of cryogenic fluids.

Gas Liquefaction Systems – Thermodynamically ideal system, Joule Thomson effect adiabatic expansion, simple, pre-cooled and dual pressure Linde Hampson systems, Claude system, Kapitza system, Heylandt system, other liquefaction system using expanders, comparison of liquefaction systems, liquefaction systems for hydrogen and helium

Cryogenic Refrigeration Systems – Ideal isothermal and isobaric source systems, Joule Thomson systems, pre-cooled Joule Thomson system, expansion engine system, Philips refrigerator, G M refrigerator, Pulse Tube refrigerator.

Measurement Systems for Low Temperatures – Temperature, pressure flowrate and liquid level measurement at low temperatures.

Cryogenic Fluid Storage – Basic storage vessel, construction of storage vessels for oxygen, hydrogen, nitrogen, helium, safe devices, drawing of the vessel.

Insulations – Gas filled powder and fibrous, vacuum, evacuated powder and fibrous, multiplayer insulations, mechanism of thermal insulation, apparent thermal conductivity, and selection of insulation

Cryogenic Fluid Transfer Systems – Different types of transfer lines, process of cryogenic transfer, components of transfer lines.

Application of Cryogenic Systems – Super-conducting bearing, motors, super-conducting magnets, space technology, blood and tissue preservation, cryo probes used in cryo surgery.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

1. R.F. Barron,Cryogenics systems, Mc Graw Hill Publication.
2. T.Flynn, Cryogenic Engineering, Springer Publication

L	T	P	C
3	0	0	3

Course Code	**2HS0E55**
Course Title	**Elements of Marketing Management**

Course Outcomes (CO):

At the end of the course, students will be able to-

1. understand the basic concepts of marketing management
2. analyze the significance of product, place, price and promotion of marketing-mix
3. evaluate the marketing strategies

Syllabus:
Teaching Hours: 45

Unit I **6**

Basic Marketing Concepts: Concept of marketing, core marketing concepts, importance and scope of marketing, company orientation towards market place

Unit II **8**

Product: Product and product mix, importance of product, product objective, product strategy planning for new product

Unit III 6

Marketing Environment: Demographic, Economic natural, Technical, Political, legal, social cultural

Unit IV **6**

Consumer Buying Behaviour: Influences on buyer behaviour, buying decision process,Market segmentation – levels, pattern and procedure

Unit V **8**

Distribution Channel: Importance and factors of distribution channels, typs of channels, channels of distribution – consumption good, industrial goods, nature and type of retailers Function and type of wholesalers, selecting distribution, channels

Unit VI **6**

Pricing: Nature and Importance of pricing, objectives of pricing. Considerations in price determination approaches to pricing

Unit VII **3**

Promotion: Promotion and its elements, objectives of promotion, promotion mix

Unit VIII **2**

Marketing Research: Nature and scope, process of market research, uses and limitations

Self -Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self -study contents.

Suggested Readings^:

1. Kotler Philip, Marketing Management, PHI Publication.

2. Saxena Rajan, Marketing Management Tata McGraw Hill Pvt. Ltd.
3. Agarwal R.D., Organization and Management, Tata McGraw Hill Pvt. Ltd.

L = Lecture, T = Tutorial, P = Practical, C = Credit

^ this is not an exhaustive list

L	T	P	C
2	0	2	3

Course Code	**CE002**
Course Title	**Internet and Web Technologies**

Course Learning Outcome (CLO):

At the end of the course, students will be able to -

- understand the architecture of web based applications and underlying technologies
- design an efficient web based applications using appropriate web technologies
- develop web based application using appropriate scripting languages

Syllabus:	**Teaching Hours:**
Unit I Internet Structure, Protocols and Access: Internet Protocol Model overview, Internet Addresses, Internet Protocol, Transport Layer, Upper layer Protocols, Internet Access, Internet Applications, About World Wide Web ,Future of Internet and Internet related applications WWW and Web Servers, IIS Configurations and settings, Apache Configuration, Introduction to PWS, Planning a Website. XHTML: Introduction, Forms, Internal Linking, Image Maps, meta, frameset	7
Unit II Cascaded Style Sheet: Inline styles, Embedded Style Sheets, Linking Style Sheets, Text Flow and Box Model. JavaScript: Introduction, Control Structures, Functions, Arrays, Objects.	8
Unit III Dynamic HTML: Object Model and Collection, Event Model, Filters and Transitions, Data binding and Tabular Data Control. XML: XML namespaces, DTDs and schemas, DOM , SAX, XSL, SOAP.	5
Unit IV ASP: Introduction, ASP Objects, FSO, Data Access Object. Building Interactive Animation: Working with Flash and Dream Weaver	6
Unit V Wireless Internet and m-business: Introduction to Wireless Internet, WAP, m-business. e- business and e-commerce. E- Business Models, Building an e-business Application, e-marketing, Security	4

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Suggested Readings^:

1. Deitel Deitel Nieto, Internet and World Wide Web: How to Program, Pearson Education
2. Minoli, Internet and Intranet Engineering, McGraw Hill Education

L= Lecture, T= Tutorial, P= Practical, C= Credit
^This is not an exhaustive list

L	T	P	C
3	0	0	3

Course Code	**2HS0E54**
Course Title	**INTRODUCTION TO ACCOUNTING**

Course Learning Outcomes:

After the successful completion of the course, students will be able to

1) Understand various concepts of financial and cost accounting

2) Analyze the financial and cost statements

3) Evaluate the financial performance of enterprises

Syllabus: **Teaching Hours: 45**

Section I

Financial Accounts

Unit I **7**

Accounting equation,

Unit II **5**

Journal,

Unit III **4**

Cash book

Unit IV **3**

Ledger

Unit V **2**

Trial Balance

Unit VI **3**

Profit & Loss Account

Unit VII **2**

Balance Sheet

Section II

Cost Accounts

Unit VIII **5**

Cost classification (direct cost, indirect cost, variable cost, fixed cost) Prime cost, conversion cost,

Unit IX Full cost	**4**
Unit X Cost - Volume – Profit Analysis	**2**
Unit XI Absorption costing	**4**
Unit XII Activity based costing	**1**
Unit XIII Budgetary control	**1**
Unit XIV Standard costing	**2**
Total	**45**

Reference Books:

Accounting for Managers by Jawaharlal TMH

Accounting Principles by Anthony &bn . Reece, AITB

ME001 Robotic Engineering [3 0 0 3]

Course Learning Outcome:

After successful completion of the course, student will be able to

- apply the concept of robotics to select the type of manipulator best suitable to the application
- formulate the mathematical relations for kinematic analysis of robotic manipulator.
- integrate the structural design, actuator selections, drive system, sensor and control system necessary to implement a robot in a specific job task

Syllabus:

Robot technology:

Fundamentals of Robots: Introduction, fundamentals of robot technology, classification, applications, Systems overview of a robot, basic components, control system and components

Robot motion analysis and control:

Robot arm kinematics, Forward & inverse kinematics solutions, Trajectory design.

Langrange-Euler formulation, Newton-Euler formulation, Generalized D'Alembert equation of motion, robot arm dynamics.

Actuators and sensors in Robot- AC/DC motors, stepper motors and servo motor, direct drive robot, Hydraulic and pneumatic systems.

Internal sensors, Position, Velocity, Acceleration, Proximity sensors, Touch and Slip sensors, Force and Torque sensors, External sensors, contact and non contact type like Vision, ranging, laser, acoustic, tactile etc. sensor selection and control.

Robot programming & languages.

Types of End Effectors and Design
End effectors , Classification , Force analysis and Gripper design.

Introduction to Mobile robots, Robot Intelligence and Task Planning, Modern Robots, Future Application and Challenges.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

1. Richard D. Klafter, Thomas A Chmielewski and Michael Negin, Robotics Engineering: An integrated approach, Prentice Hall
2. Mittal and Nagrath , Robotics & Control , Tata McGraw-Hill Publishing Company Ltd., New Delhi
3. John Craig , Introduction to Robotics, mechanics and control, Pearson Education, New Delhi
4. M.P. Groover, Mitchell Weiss, Roger N. Nagel & Nicholas Godfrey, Industrial Robotics. Tata McGraw Hill Education Pvt. Ltd
5. Ashitava Ghoshal, Robotics Fundamental Concepts & Analysis, Oxford University Press.

L	T	P	C
2	0	2	3

Course Code	CE006
Course Title	Operating Systems

Course Learning Outcome (CLO):

At the end of the course, students will be able to -

- understand the components and functionalities of a typical operating system
- identify synchronization needs of various system resources for optimal utilization
- experiment with various control and scheduling activities of operating system components

Syllabus: **Teaching Hours:**

Unit I

Introduction: Evolution of operating systems, operating system services, types of operating system, different view of operating system, Review of types of I/O polled, interrupt driven and DMA. Process Scheduling: Concepts of Process, attributes of process, process control block, data structures. Processes and threads, process status, scheduler: long term, medium term, short term scheduler, matrix of evaluation, scheduling algorithms. 7

Unit II

Inter process Communication(IPC):Need of IPC, concurrency, Race conditions, critical section, mutual exclusion problem, solution approaches, algorithmic approaches, critical region, condition for critical region, semaphore : Binary ,counting, the queuing implementation. Monitors, message passing: synchronous vs asynchronous message exchange. Classical IPC Problems: Dinning Philosopher Problem, Sleeping Barber Problem, Reader's & Writer Problem, procedure control. 6

Unit III

Deadlock - Deadlock problem, deadlock characterization, dealing with dead lock, deadlock prevention, deadlock avoidance. Memory Management - Paging: Principle of operation, page allocation, h/w support for paging, multiprogramming with fixed no. of task, multiprogramming with variable no. of task, segmentation, virtual memory : concept of demand paging, page replacement algorithms, thrashing. 7

Unit IV

Input Output Management-Principles of input/output: Input / Output devices, device controllers, direct memory access, principles of input/output s/w : goals of the input/output s/w, concepts of interrupt handler and device driver, devices as files, the inode structure and 5

organization.

Unit V

File Systems: file structure, file types, file access, file attributes, file operations, memory mapped files and directories: hierarchical directory system, pathnames, directory operations, contiguous allocation, linked list allocation, linked list using index, Inodes, Concepts of Shared files.	5

Self-Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Suggested Readings^:

1. William Stalling, Operating System – Internals, Prantice Hall
2. Andrew S. Tanenbaum, Modern Operating Systems, Prentice Hall
3. Peterson, Operating System Concepts, Addition-Wesley Longman Publishing Co
4. Milan Milenkovic, Operating System – Design & Concepts, Mc Graw Hill
5. Stephen Prata, Advanced Unix - A Programmer's Guide, BPB Publications
6. Yashwant Kanitkar, Unix Shell Programming, BPB Publications
7. Sumitabha Das , Unix System V.4 Concepts & Applications, Pub. TMH
8. Maurice Bach, The Unix Operating System, Prentice Hall

L= Lecture, T= Tutorial, P= Practical, C= Credit

^This is not an exhaustive list

ME011 RENEWABLE ENERGY SOURCES [3 - - 3]

Course Learning Outcome:

After successful completion of the course, student will be able

- To understand the importance of Renewable Energy Sources in the present era.
- To describe various methods for power generation by using different type of Non-conventional and renewable energy sources.
- To apply the knowledge of converting energy resources like solar, wind , biomass, tidal, wave, ocean thermal, and geothermal energy for power generation.
- To understand the working and applications of fuel cells and usage of bio-fuels.

Syllabus:

Energy scenario of India and World, Need of Renewable Energy sources

Solar energy, extra-terrestrial and terrestrial radiations, radiation geometry, variation of insolation and its measurement, computation of solar radiation on horizontal and tilted surfaces, solar flat plate collectors, their configuration, material of construction and general characteristics, concentrating collectors, receiver systems, heliostat, optical losses, types of solar energy storage, solar energy applications.

Wind energy, analysis of wind speeds, different types of wind turbines, use of meteorological data for site selection, materials of construction, performance characteristics, and applications

Biomass, energy plantation, biomass gasifiers, types, construction of biogas plants, scope and future

Tidal, wave and ocean thermal energy conversion plants, geothermal plants, small hydro plants, magneto hydrodynamic plants, fuel cells, use of non-conventional fuels, bio fuels and their applications

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Reference Books:

1. Non-conventional Energy Sources by G.D.Rai, Khanna Publishers
2. Renewable Energy Resources by John Twidell and Tony Weir, Taylor and Francis
3. Solar Energy Utilization by G.D.Rai, Khanna Publishers
4. Solar Energy by S P Sukhatme, Tata McGraw Hill Education Private Limited
5. Energy Technology by Rao and Parulekar, Khanna Publishers
6. Wind Energy Technology by Walker and Jenkins, Wiley-Blackwell

EC001 Satellite Communication [3 0 0 3]

Course Learning Outcome:

After successful completion of the course, the students will be able to

1. understand principle, operation and working of various sub systems of satellite
2. apply communication techniques for satellite applications
3. learn about various earth stations
4. understand role of satellite in various applications

Syllabus:

Overview of Satellite Systems: History, basic definition, present status, future trends

Orbital Mechanics and Launchers: Orbital Mechanics, Kepler's three laws of planetary motion, Orbital Perturbations, Launches and Launch Vehicles, Orbital effects in Communications System performance

Satellite Subsystems: Attitude and Orbit Control System, Telemetry, Tracking, Command and Monitoring, Power system, Equipment Reliability and Space Qualification

Satellite Link Design: Transmission theory, noise temperature, noise figure, G/T ratio for the earth stations, link design case study

Multiple Access Techniques: Digital Modulation Techniques, Frequency division multiple access- FDM/FM/FDMA, calculation of SNR, overdeviation & companding FDM/FM/FDMA, Time Division Multiple Access – channel, frame structure & design, Synchronization & timing Code Division Multiple Access- spread spectrum transmission & reception, estimating channel requirements Fixed assignments, Demand assignment, random access, practical example Multiple Access with on board processing

Earth Station Technology: Types of earth station, Earth station architecture, Earth station design considerations

Satellites for Communication: Geo stationary orbit satellite systems, non GEO systems- LEO & MEO systems, satellite mobile services, direct satellite broadcast, very small aperture terminal, case study

Applications of Satellites: Remote sensing satellites, Weather forecasting satellites, Navigation satellite, Scientific satellite, Military Satellite

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

References:

1. A.K.Maini, Satellite Communication, Wiley
2. T.Pratt, Satellite Communication, Wiley
3. Dennis Roddy, Satellite Communication, Wiley

HS005, Technical Writing
[3 0 0 3]

Course Learning Outcome

After successful completion of the course, student will be able to

1. Participate actively in writing activities (individually and in collaboration) that model effective scientific and technical communication in the workplace.
2. Understand how to apply technical information and knowledge in practical documents for a variety of a.) professional audiences (including peers and colleagues or management) and b) public audiences.
3. Practice the unique qualities of professional writing style, including sentence conciseness, readability, clarity, accuracy, honesty, avoiding wordiness or ambiguity, previewing, using direct order organization, objectivity, unbiased analyzing, summarizing, coherence and transitional devices.

An introduction to technical writing

- Technical writing vs. General writing b. Purpose, importance and characteristics of technical writing.
- Objectives of technical writing: Clarity, conciseness, accuracy, organization, ethics.
- Audience recognition and involvement: High tech audience, low-tech. audience, gender neutral language.

Memorandum:

- Objectives, difference between memos, letters and emails. Criteria and format for writing and memos.

Technical description:

- Criteria and process.
- Technical instructions for user's manual

Report Writing:

- Characteristics, types and writing of various reports: feasibility reports, inventory report, mishap report, progress report, laboratory report.

Letter- writing:

- Business letters, Job-applications, Resume.

Business Proposals:

- Types & formats.

Graphic representation of Technical Data

SOP writing

Promotional Writings

- Technical Brochure designing
- Content writing for Websites (For promotional and troubleshooting purposes)
- Writing Fliers and Newsletters

Academic Writing

- Summaries, abstracts and instructions

Case studies on Technical Writing.

Reference Books:

1. Sharon J. Gerson and Steven M. Gerson, , Technical writing – process and product ,Person Education Asia .
2. Andrea J. Ratherford ,Basic Communication Skills for Technology,Person Education Asia
3. Pfeiffer, W.S. and T.V.S. Padmaja. Technical Communication. Pearson
4. Muralikrishna and Sunita Mishra. Communication Skills for Engineers. Pearson

EC003 **Wireless Sensor Network** **[3 0 0 3]**

Course Learning outcomes:

After successful completion of the course, the students will be able to

1. understand Wireless Sensor Networks concepts, principles and applications
2. understand communication protocols and standards utilized in Wireless Sensor Networks
3. analyze protocols used in various types of Wireless Sensor Networks
4. identify appropriate techniques, standards and tools for Wireless Sensor Network hardware design

Syllabus:

Introduction of Wireless Sensor Networks: Introduction to adhoc networks, Sensor Network Technology- Hardware and Software, Applications of Sensor Networks, sensor network architectural elements, challenges in sensor network design

Wireless Transmission Technology and Systems: Bluetooth; IEEE 802.11; ZigBee; Radio-frequency identification (RFID)

Medium Access Control Protocols for Wireless Sensor Networks: Fundamentals of MAC Protocols, Performance Requirements, Types of MAC protocols - Schedule-Based and Random Access-Based Protocols,

Routing Protocols for Wireless Sensor Networks: Routing Challenges and Design Issues in Wireless Sensor Networks, Routing Strategies in Wireless Sensor Networks - Flooding and Its Variants, LEACH, Power-Efficient Gathering in Sensor Information Systems, Directed diffusion, Geographical routing

Transport Control Protocols for Wireless Sensor Networks: Traditional Transport Control Protocols-TCP, UDP; Feasibility of Using TCP or UDP for wireless sensor networks, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols- CODA (Congestion Detection and Avoidance), ESRT (Event-to-Sink Reliable Transport)

Middleware for Wireless Sensor Networks: Wireless Sensor Networks Middleware Principles, Middleware Architecture, Existing Middleware-MiLAN (Middleware Linking Applications and Networks)

Network Management for Wireless Sensor Networks: Network Management Requirements, Network Management Design Issues, Example of Management Architecture: MANNA, Naming, Localization Issues

Operating Systems for Wireless Sensor Networks: Operating System Design Issues, TinyOS – case study

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

1. Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks, Technology, protocols, and applications, Wiley
2. Edgar H. Callaway, Wireless Sensor Networks: Architectures and Protocols, CRC Press
3. Anna Hac, Wireless Sensor Network Design, Wiley
4. Holger Karl, Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, Wiley.

NIRMA UNIVERSITY
INSTITUTE OF PHARMACY
UNIVERSITY ELECTIVE
COURSE NAME: COSMETIC TECHNOLOGY

Learning Outcomes:
After successful completion of the course student will be able to :
 Acquire comprehensive knowledge about the various raw materials used in cosmetic
formulations
 Create and develop cosmetic formulations
 Analyze the cosmetic formulations for evaluating its efficacy and safety
 Understand the regulatory guidelines related to cosmetic formulations

Theory (Detailed Syllabus) L P C 3 - 3

1. Introduction: The scope, historical background and present status of herbal cosmetics.
2. Classification of Cosmetics.
3. Raw materials used for formulation of skin care and hair care cosmetics: Source and
description of raw materials of natural origin like fixed oils, waxes, gums, hydrophilic colloids, colours, perfumes, protective agents, bleaching agents, preservatives, antioxidants and other ancillary agents used in the cosmetic formulations.
4. Formulation and analysis of cosmetics: hair care, skin care and oral care products.
5. In vitro and in vivo models for efficacy testing for various cosmetic products.
6. Regulatory guidelines: Complaince of Drug & Cosmetic Act 1940 with reference to provisions for packaging and labelling (Rule 150 A, schedule S), permitted colors, flavors etc. BIS guidelines for cosmetic products and raw materials.

Total Lectures: 45

Books Recommended:
1. Sagarin Edward, Cosmetic Science and Technology Vol. I, II, III , Wiley India Pvt. Ltd., Canada,
1992
2. Sharma P.P., Cosmetic Formulation, Management and Quality Control, Vandana Publications Pvt.
Ltd., Vandana Publications, Delhi, 2010
3. Paye M, Barel A.O., Maibach H.I., Handbook of Cosmetic Sciences, Informa Press, Tylor and
Fransis, LLC, 2006
4. Panda H., Herbal Cosmetics Handbook, Asia pacific Business press, 2004
5. Veermeer B.J., Cosmeceuticals: Drugs vs. Cosmetics, Marcel Dekker, Editors: Peter Elsener,
Howard I. Maibach, Marcel Dekker Inc., New York, 2000.

COURSE NAME: DRUG LAWS

Learning Outcomes:

After successful completion of the course, the student will able to

 Understand the significance and relevance of Pharmaceutical laws in India related to

manufacturing, sale, import and export of drugs and cosmetics.

 Apply knowledge of laws in manufacturing of narcotic drugs, psychotropic substance, alcoholic

preparations, etc.

 Analyze invention and process for determining its suitability for patent filing.

 Evaluate and estimate drug pricing procedure in India.

Theory (Detailed Syllabus)

L P C 3 - 3

1 Introduction to Drugs & Pharmaceutical Industry

Classification of Drugs and Cosmetics, types of Pharmaceutical Industries. Importance of

Legislations in Pharmaceutical sector

2 Drugs and Cosmetics Act 1940, and its Rules 1945

Act and rules related to manufacturing, labeling, packing, sale, import and export of drugs

and cosmetic products.

3 Narcotic Drugs and Psychotropic Substances Act, 1985 and Rules

Act and rules for controlling the production of opium, manufacturing, sale, import and export

of narcotic drugs and psychotropic substances. Powers to make search, seizer and arrest.

4 Medicinal and Toilet Preparations (Excise Duties) Act, 1955 and Rules

Act and rules related to licensing, manufacturing, sale, warehousing & export of alcoholic

preparations at bonded and non-bonded laboratories.

5 Patent (Amended) Act 2005

Introduction to intellectual property rights (IPR), types of patents, procedures for grant of

patent, term and revocation of patent, patent agent.

6 Drugs and Magic Remedies (Objectionable Advertisement) Act, 1954 & Rules

7 An overview of Pharmaceutical Policy Act 2002, Drug (Price Control) Order 1995 and

National Pharmacy Pricing Authority (NPPA) of India

Note: The teaching of all the above acts should cover the latest amendments, administrative duties

and powers, offences and penalties, case studies.

Total Lectures: 45

Books Recommended :

1 Official Acts published in Gazettes of India by Govt. of India.

2 Malik Vijay, Law relating to Drugs and Cosmetic, 19th edition, 2008, Eastern Book Company, Lucknow

3 Jain N.K., Pharmaceutical Jurisprudence, 6th edition, 2005, Vallabh Prakashan, Delhi

4 Mithal B.M., A Textbook of Forensic Pharmacy, 10th edition, 2002, Vallabh Prakashan, Delhi

5 Kokate C.K., Gokhale S.B., Textbook of Forensic Pharmacy, 1st edition, 2006, Pharma Book Syndicate,

Hyderabad

6 Suresh B., Forensic Pharmacy: Pharmaceutical Jurisprudence, 11th edition, 2007, Birla Publications

India, Delhi

7 Gandhi N., Popli H., Pharmaceutical Jurisprudence, 1st edition, 2006, C. B. S. Publishers &

Distributors, Delhi

Energy and Law

Teaching Hours: 45 Credit: 3

I Introduction

Energy has become one of the most essential needs of our lives. It is critical in the process of evolution, growth and survival of human beings and also in the socioeconomic development of a nation. The economy of the nation is dependent on abundant and uninterrupted supply of energy in all sectors, particularly electricity. It has become as a 'strategic commodity'. Most of the countries do not meet its current energy requirements and it is believed that the energy demand will manifestly increase in the future. It is expected that the worldwide energy demand will be doubled by 2050. Thus it becomes a great concern for most of the countries how they will satisfy their huge rising energy demand. This energy demand should also be met in an environmentally friendly way. Meeting energy demands is not only aimed at achieving economic growth but is also aimed at alleviation of poverty, unemployment and to meet other goals. Every country, therefore, undertakes a strategic plan to meet its energy demands, and to address the energy poverty and also the environmental effects of energy growth. With wide variety of sources available to chose from, the outcome is really complex as the problems that come to the fore-front makes the analysis of the subject even more interesting to ponder upon the challenges that this basic need of life throws upon us.

II Course Learning Outcomes

After the completion of the course the students will be able to:

1. Identify the challenges that legal regulations face in specific sectors in terms of consumption, production and conservation of energy

2. Classify the role and responsibility of the various stakeholders to conserve and preserve energy using tools of audit and management

3. Analyze the impact of the consumption of energy by the stakeholders in context of societal norms

III SYLLABUS

0. Energy from Non- renewable sources (Coal, oil and natural gas)

A. The goal that India seeks to achieve is to secure availability of coal to meet the demand of various sectors of the economy in an eco-friendly, sustainable and cost effective manner. This unit seeks to study as to why coal is such an important sector under energy law regime and how is the production of this non-renewable source of energy regulated? What do we understand by the

concept of power generation? What are the main components of a thermal power plant and what sort of an effect does this energy production and use have on the climate?

How are coal blocks allocated? Discussion as to their allocation procedures and existing discrepancies with lessons to be learnt from the past scams will be explored in the light of the Coal Mines (Nationalisation) Act, 1973 and the most recent Coal Mines (Special Provisions) Bill, 2014. The coal mining industry is not free from hazards and it has been claimed by the ministry that the coal mine safety

legislation in India is one of the most comprehensive and pervasive statutory framework for ensuring occupational health and safety. Directorate-General of Mines Safety (DGMS) under the Union Ministry of Labour & Employment (MOL&E) is entrusted to administer these statutes. It is through this unit, it will be studied that whether or not the statutes framed under the Mines Act, 1952; Mine Rules, 1955, and Coal Mine Regulation, 1957 have effective provisions as to mines safety and occupational health?

B. The Petroleum and Natural Gas Regulatory Board Act, 2006 establishes the Petroleum and Natural Gas Regulatory Board to regulate the various activities in the production chain of petroleum products and natural gas. This Unit studies the need for Oil and Natural gas as a source of non-renewable energy and the alternatives that are available to this energy source. How the energy resource is generated and made available for consumers? Whether or not the laws relating to this energy source are adequate to address the issues relating to the pricing of oil and regulation of prices in the domestic market in accordance to the prices fluctuation in the international market? How does the Government of India make provisions for subsidies in this sector?

References:

1. J.P. Longwell, E.S. Rubin, J. Wilson, Coal: Energy for the future, 21 Progress in Energy and Combustion Science 4, 269–360 (1995)

2. Mark Z. Jacobson and Gilbert M. Masters, Exploiting Wind Versus Coal, 293Science 5534, 1438 (2001)

3. P.V. Zedtwitza and A. Steinfelda, The solar thermal gasification of coal; energy conversion efficiency and CO2 mitigation potential, 28 Energy, 441–456 (2003)

4. Thomas Thielemanna, Sandro Schmidta, J. Peter Gerlinga, Lignite and hard coal: Energy suppliers for world needs until the year 2100: An outlook, 72 International Journal of Coal Geology 1, 1–14 (2007)

STATUTES

1. The Coal Mines (Nationalization) Act, 1973

2. Notification dated 22/6/2010 from website of Central Board of Excise and Customs regarding levy of Clean Energy Cess on raw coal, lignite and peat w.e.f. 1.7.2010

3. The Coal Mines (Special Provisions) Bill, 2014

4. Coal Mines (Conservation & Development) Amendment Rules, 2011 and CM(C&D) Second Amendment Rules, 2011

5. Colliery Control Rules, 2004

6. Oil Industry Act, 1974

7. Petroleum Rules, 1976

8. The Oil Fields Act, 1948

9. The Petroleum Act, 1934

10. Safety in Offshore Operations Rules, 2008

1. Nuclear energy

Nuclear energy is being seen as the new-age source of energy. But the issue that exists here is regarding the determination of the fact that whether the potential danger of nuclear power plant is ignored by India to find a shortcut to meet its energy demand when it does not have effective laws to regulate the atomic energy sector?

How did the nuclear energy come to be used for civil purposes? What are the international atomic energy agencies? Do they effectively regulate the civil uses of nuclear energy? How has the past disasters and accidents been instrumental in framing stricter safety norms both in the international and domestic levels? What are the causes and effect of Indo-US nuclear deal? What are the factors that led to the enactment of Civil Liability for Nuclear Damage Act? Is this Act exhaustive, effective and constitutionally valid? How effective is atomic energy laws in India? Whether foreign direct investment should be encouraged in the atomic energy sector? What is the concept of power generation and thermo-nuclear fusion versus fission reaction in terms of nuclear energy?

References:

1. Saurabh Bhattacharjee, Looking through the prism of international environment and human rights law- International Civil Nuclear Liability Law and a call for Indian exceptionalism, 3 Int.J. Nuclear Law 4 (2012)

2. K. Konoorayar, Vishnu and V.S. Jaya, Atomic Energy Law in India: An Analysis, 1 KLRI Journal of Law and Legislation, Seoul, (2011)

3. Elli Louka, Nuclear Weapons:Justice and the Law, Edward Elgar Publishing Limited, Massachusetts, U.S.A (2011)

4. Prashant Hosur, Indo-US Civilian Nuclear Agreement, 65 Int'l J. 437, (2009-2010)

STATUTES

1. Atomic Energy Act, 1962

2. Civil Liability for Nuclear Damage Act, 2010

3. Atomic Energy (Factories) Rules, 1996.

4. Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987

5. IAEA Handbook on Nuclear Law (2003)

6. IAEA Nuclear Safety Review for the year 2013, Doc GC(57)/INF/3 (July 2013)

2. Hydropower

Hydropower is considered to be a very viable source of energy. However, due to uncertain monsoons in a country like India, there is a growing concern as to the reliability on hydropower as a source of energy. It has been seen that most of the potential is in Himalayan States as river-based projects and in other States on irrigation canals. The small hydropower programme is now essentially private investment driven. Projects are normally economically viable and private sector is showing lot of interest in investing in it. Through this unit a number of aspects in relation to hydropower would be analysed.

How can hydropower plants be classified and what are their functions? What are the main components of hydropower plants? What is the concept of power generation with respect to hydropower plants? How do hydro turbines function and what are its governing principles?

Do the laws relating to hydro power generation effectively deal with the issues relating to rural electrification? What is the solution to soil conservation and environment management which are

Page 4 of 15

impacted as a consequence of such hydropower generation? What are the infrastructural challenges to building hydropower projects?

References:

1. D. S. Subrahmanyam, Status of Electric power generation in India with special emphasis on Hydropower expansion, 01 INTERNATIONAL JOURNAL OF RENEWABLE ENERGY AND ENVIRONMENTAL ENGINEERING 01, ISSN 2348-0157, October 2013, IJREEE 010107 (2013)

2. S.C. Bhattacharya and Chinmoy Janaa, Renewable energy in India: Historical developments and prospects, 34 ENERGY 8, 981–991(2009)

3. Himanshu Nautiyal, S.K. Singal, Varuna, Aashish Sharma, Small hydropower for sustainable energy development in India, 15 RENEWABLE AND SUSTAINABLE ENERGY REVIEWS 4, 2021–2027 (May 2011)

STATUTES

1. Electricity Act, 2003

3. Solar energy

What is meant by Radiation geometry? What are the various solar thermal applications, in the light of flat plate collector, air heaters, power generation etc.? What are the theories and applications surrounding solar photo-voltaic power generation: theory and applications? What are the legal challenges in the tariff structure? Is solar energy ‘actually’ clean?

References:

• “E-book: Ministry of power, coal and new renewal energy” (January 22, 2015)http://mnre.gov.in/file-manager/UserFiles/ministry%20of%20power,%20coal%20and%20new%20renewal%20energy%20ebook%20english%20virsion/index.html#page/14.

• World Bank Report (2010) “Unleashing the potential of Renewable Energy in India”

• “Implementing National Solar Mission in India Need for an effective Legal and Institutional Response: Policy and Legal Recommendations” available from www.boell-india.orglast visited on 24th January, 2015

• Donald Zillman and Raymond Deeny, Legal Aspects of Solar Energy Development, Ariz. St. L.J. 25, (1976)

• Steven E. Ferrey, Solar Banking: Constructing New Solutions to the Urban Energy Crisis, 18 HARV. J. ON LEGIS. 483 (1981)

4. Wind energy

Tapping into the huge potential of wind by setting up infrastructure can be considered to make it one of the most favourable source of energy. Though present in abundance but in order to get the right amount of energy from this source requires one to first answer some pertinent issues. What is/are the source(s) of wind formation? What are the Site selection parameters to harness this form of energy? In case of innovation how does one seek protection for the

'novelty'? How to overcome issues in financing and set cost-efficient standards? What is the regulatory compliance with respect to Renewable Purchase Obligations?

References:

• Salvus Capital Advisors Pvt. Ltd and Sustainable Development Department, New Delhi Investment in Indian Wind Energy Sector: A research report(January 25, 2015) available at www.salvuscapital.com/iiwes.pdf.

• Global Wind Energy Council India Wind Energy Outlook 2012(January 25, 2015) www.wisein.org

• P R Krithika and Siddha Mahajan Background paper Governance of renewable energy in India: Issues and challenges TERI-NFA Working Paper Series No.14, (2014)

• Ernest Smith, Wind Energy: Siting Controversies and Rights in Wind 1 ENVTL. & ENERGY L. & POL'Y J. 281 (2005-2007)

5. Energy from biomass and biogas

Considered to be as one of the cleanest forms of fuels this source of energy is converted into the using different processes of biomass conversion. In the process gasifiers are used and plants have to set up for the same. This source of energy though is widely accepted but has suffered from the typical mindset that people have and also the stiff competition that it faces from the other sources. What are the tariff issues and role of Renewable Energy Certificates? Do these create conflicts? How can Open Access prevent the Legal Wrangle in the power generation under the Electricity Act, 2003? Does the use of this fuel have a positive impact upon climate change?

References:

• P.R. Shukla, Biomass Energy in India: Policies and Prospects(January 24, 2015) www.decisioncraft.com/energy/papers/ecc/re/biomass/bpi.pdf

• John Cobb, Mitigating the Unintended Consequences of Biofuel Tax Credits, 49 HARV. J. ON LEGIS. 451 (2012)

• Sarah M. Hayter, Climate Change Mitigation with Renewable Biomass: Shifting Legal Incentives away from Electricity and Towards Cogeneration, 31 Miss. C. L. Rev. 429 (2012-2013)

6. Geothermal energy

What are Geothermal resources? How can power be generated from the use of geothermal energy? How are tariffs and incentives regulated in this sector?

References:

 India Geo-thermal Energy (January 23, 2015) available at http://www.eai.in/ref/ae/geo/geo.html last visited on

 Ingvar B. Fridleifsson, Status of Geothermal Energy amongst the World's Energy Sources (January 24, 2015), https://pangea.stanford.edu/ERE/pdf/IGAstandard/EGC/szeged/O-7-03.pdf

 Peter Bayer et al,International legal status of the use of shallow geothermal energy, RENEWABLE AND SUSTAINABLE ENERGY REVIEWS 14 2611–2625 (2010)

 John Brooks, Legal Problems of the Geothermal Industry, 6 NAT. RESOURCES J. 511 (1966)

 L. Rybach, Geothermal energy: sustainability and the environment, 32, GEOTHERMICS, pp. 463– 470, (2003).

 Sukanta Roy and Harsh Gupta, Geothermal Energy: An Overview, (23January, 2015) www.environmentportal.in/files/file/geo%20energy.pdf

7. Preserving Energy: Energy Audit and Management

Though this whole idea seems to be a bit astonishing as to why should we conserve energy when there are so many sources available but the reason for the conservation is two-fold: save one's own cost and save unwanted depletion of sources. The Ministry of Power through its agency Bureau of Energy Efficiency has taken up the task to sensitize the need of conservation of energy and highlighted the various standards and procedure that is required to be followed in conserving energy through its models of audit and reporting. Integrated Resource Planning is one of the said methods which suggests such a step in this direction. But can the success found in US in adopting this model, be repeated here? Also given the various models of auditing and with the lack of compulsion or incentives, does the role of the authorities become less predominant and rather passive? What is the role of corporations and industries in conserving energy? Is climate change an inevitable process?

References:

• Ruth Hillary, Environmental Auditing: Concepts, Methods and Developments, 2, Issue 1, INTERNATIONAL JOURNAL OF AUDITING, 71–85, (1998).

• Angelina Liang, Shedding Light: The Role of Public Utility Commissions in Encouraging Adoption of Energy Efficient Lighting by Low-Income Households, 38 COLUM. J. ENVTL. L. 333 (2013)

• Odile J. Lim Tung, Appraisal of the Energy Efficiency Regulatory Framework in Mauritius, 31 J. ENERGY & NAT. RESOURCES L. 425 (2013)

• Amanda R Carrico, Energy and Climate Change: Key Lessons for Implementing the Behavioral Wedge, 2 GEO. WASH. J. ENERGY & ENVTL. L. 61 (2011)

• Edward A. Finklea and Mary P. Treiber, Residential Energy Conservation Measures: A Penny Saved Is a Penny Earned, 11 ENVTL. L. 639 (1980-1981)

V Additional References

1. P. C. SHARMA POWER PLANT ENGINEERING, (7th ed.) (2002).

2. V.L. PATEL AND R.N. PATEL., FLUID POWER ENGINEERING, (3rd ed.) (2007).

3. D.S. KUMAR, FLUID MECHANICS AND FLUID POWER ENGINEERING, (6th ed.) (1998).

4. S P SUKHATME AND J K NAYAK, SOLAR ENERGY, (3rd ed.) (2008).

5. PARAG DIWAN AND A.C. KHERENERGY LAW AND POLICY, (2008 ed.)

6. CHHATRAPATI SINGH ET AL, TOWARDS ENERGY CONSERVATION LAW, (1989 ed.)

7. ASIAN DEVELOPMENT BANK, ENERGY INFRASTRUCTURE: PRIORITIES, CONSTRAINTS AND STRATEGIES FOR INDIA, (2009 ed.)

8. Ministry of New and Renewable Energy Government of India and UNDP (India) Bioenergy in India

9. Position Paper on Open Access (January 24, 2015), http://indianpowersector.com/home/downloads-2/downloads/

10. Evolving measures for the effective implementation of Prepaid Metering in the country, (January 24, 2015) http://indianpowersector.com/home/downloads-2/downloads/

11. Prem K. Kalra and Rajiv Shekhar Urban Energy Management pp. 190-207 available at www.iitk.ac.in/3inetwork/html/reports/IIR2006/Urban_Energy.pdf (last visited on 23rd January, 2015).

12. IPPs in Renewable Energy – Opportunities and Pitfalls (January 23, 2015) http://www.eai.in/ref/wp/ipps-in-renewable-energy-opportunities-pitfalls

13. Stephen L Joseph, Legal Issues Confronting the Exploitation of Renewable Sources of Energy from the Oceans, 11 CAL. W. INT'L L.J. 387 (1981)

14. Edward H Comer, Future of Energy Law – Electricity, 31 UTAH ENVTL. L. REV. 429 (2011)

15. Babette Marzheuser-Wood, UK - The Carbon Reduction Commitment and Its Impact on Global Franchisors, 8 INT'L J. FRANCHISING L. 29 (2010)

16. Uma Outka, Renewable Energy Footprint, 30 STAN. ENVTL. L. J. 241 (2011)

Course Title: Financial Management

Credit Hours: 3

Course Number: UEIM007

Course Objectives

 To provide students with the basic understanding of financial management in an organizational context

 To help them understand the working of financial markets

 To enable them to use spreadsheets to perform financial analysis

Learning Outcomes

At the end of the course, students shall be able to:

1. Understand the significance of financial management to firm performance
2. Identify the variables important to making financial decisions
3. Perform primary investment decision analysis
4. Describe sources of funds and their costs
5. Perform basic financial analysis using spreadsheets

Syllabus

Module 1: Basics of Financial Management

 Introduction to Financial Management

 Role and Functions of the Finance function

 Time Value of Money

 Basics of Risk and Return

Module 2: Financial Markets and Instruments

 The Financial System

 Introduction to Financial Markets and Instruments

 Sources and Cost of Capital

Module 3: Major Financial Decisions

 The Investment Decision

 The Funding Decision

 The Distribution of Profit Decision

 Introduction to Working Capital Management

 Managing Risk

Module 4: Using Spreadsheets in Finance

 Introduction to Financial functions in Spreadsheets

 Spreadsheet Application Exercises

Suggested Readings

1. Chandra, P. (2010). Fundamentals of Financial Management. New Delhi: Tata McGrawHill.

2. Khan, M. Y. & Jain, P. K. (2012). Fundamentals of Financial Management. New Delhi:Tata McGraw Hill.

3. Pandey, I. M. (2011). Essentials of Financial Management. New Delhi: Vikas PublishingHouse.

4. Ross, S., Westerfield, R. & Jordan, B. (2012). Fundamentals of Corporate Finance. NewDelhi: Tata McGraw Hill.

5. Rustagi, R. P. (2011). Financial Management: Problems & Solutions. New Delhi:

Taxmann.

6. Wachowicz J. M. & Van Horne, J. C. (2009). Fundamentals of Financial Management.New Delhi: PHI Learning

COURSE NAME: HEALTH AND NUTRITION

Course Code: UEIP013

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

1. Remember the fundamentals of health and nutrition
2. Cite examples of food labelling
3. Describe significance of macronutrients and micronutrients
4. Discuss importance of functional foods
5. Explain indicators of nutritional status

L P C 3 -- 3

1. Introduction to the basic concepts of health and nutrition

2. Nutrition

- Macronutrients: Carbohydrates (including dietary fibers), fats and proteins
- Micronutrients: Vitamins, minerals, anti-oxidants, gut flora
- Significance of macronutrients and micronutrients for optimal health

3. Meal Planning

- Functional foods: Definition of functional foods, Role of functional ingredients and food in nutrition, Health attributes of functional foods
- Health attributes of nutrition: Diet and disease, Diet with respect to special population (elderly, pediatric and pregnant women),
- Indicators for maintenance of nutritional status: Nutrition Balance Indicator, Satiety Index, Fullness factor, Glycemic index and insulin index

4. Food Labelling (Food service management)

- Nutrition Facts Panel
- Serving Size
- Calories
- Ingredients list
- Quantitative indications

- Food additives
- The percent daily value
- Allergan labelling

Total Lectures **45**

Books Recommended

1. Nutritional Sciences: From fundamental to food. By Michelle McGuireand Kathy Beerman. Publisher: Yolanda Cassio. ISBN-13: 978-0840058201

2. Pressman, Alan H., Sheila Buff, and Gary Null. The Complete Idiot's Guide to Vitamins and Minerals. New York: Alpha Books.

3. Focus on Pathophysiology, Barbara A. Bullock and Reet L. Henze Lippincott Williams & Wilkins, Philadelphia
4. Lehninger Principles of Biochemistry, 3rd ed London : Macmillan Press Ltd.

5. Tortora G.J. and Anagnodokos, N.P. Principles of Anatomy and Physiology (Harper and Colling Publishers, New York)

6. Advanced Nutrition: Macronutrients, Micronutrients, and Metabolism By: Carolyn D. Berdanier, Lynnette A. Berdanier, Janos Zempleni. Publisher: CRC Press. ISBN 9781420055528
7. Functional Foods and Nutraceuticals By: Aluko, Rotimi E. Publisher: Springer

8. B. Srilakshmi. Food science. India, New Age International (P) Limited.

9. Kumud Khanna, Sharda Gupta, Santosh Jain Passi, Rama Seth, Ranjana Mahna & Seema Puri . Textbook of Nutrition and Dietetics. India, Elite Publishers.
10. C.Gopalan. Nutritive Value of Indian Foods, India, ICMR publications.

Course Title: Human Resource Management
Course Code: UEIM006
Credit Hours: 3
Programme: University Elective

Course Overview

Organisations exist to fulfill their purpose and achieve their respective business goals. This underlying theme guides all action within organisations and also becomes the integrating force that binds the various roles within organisations. In a dynamic environment, as the business realities continue to evolve, newer contexts emerge leading to a continuously evolving disciplinary emphasis.

Human Resource Management (HRM) deals with the design, development and implementation of strategies, systems and processes that help an Organization effectively deploy its human resources for achieving organizational purpose. Recruitment, training, performance management, reward and recognition and managing employee relationships are the many facets of this dimension of managing an enterprise.

This introductory course in human resource management will provide a conceptual overview and theoretical framework of HRM as a management discipline. The purpose is to acquaint the participants with its role in achieving Organization objectives and the role of Non-HR specialists in making HRM effective in organizations.

Course Learning Outcomes

By the end of the course, the students would be able to:

1. Describe roles and responsibilities of the HRM function
2. Identify different systems within HRM viz. Recruitment and Selection, Performance Management, Compensation Management, Employee Relationship Management and recognize their strategic contribution to business and organizations;
3. Distinguish between people management role of HR and non-HR specialist in organizations

Syllabus

An Introduction to Human Resource Management; HRD and HRM; Corporate Strategy and Human Resource Management; Human Resource Planning; Job Analysis, Recruitment & Selection; Performance Management; Compensation Management; Learning & Development; Employee Relationship Management; Industrial Disputes & Conflicts; Labour Legislation; HRM in Cross-cultural and Global Environments; Organisation Learning; Ethics and Ethical Issues in HRM; Skills and Competencies of a Human Resource Manager; Human Resource Management in Family owned

businesses and Not for profit organizations; Organisational Transformation and HRM; Contemporary Concerns in HRM

Suggested Readings:

- Pande, Sharon and Basak, Swapnalekha (2016), *Human Resource Management*, 2nd Ed., Pearson Education: New Delhi
- Dessler, Gary. Varkkey, Biju (2015), *Human Resource Management* , 13th Ed., Pearson Education: New Delhi
- Bohlander, George. Snell, Scott. & Vohra, Veena (2014), *Human Resources Management*, Cengage Learning: New Delhi
- Bernardin, John, H.(2007), *Human Resource Management – An Experiential Approach*, Tata McGraw Hill Publishing Company Limited: New Delhi
- Singh B.D.(2004), *Industrial Relations, Emerging Paradigms*, Excel Books: New Delhi

Appendix – A of Noti.
No. 73 dtd. 11/4/15

NIRMA UNIVERSITY
INSTITUTE OF LAW

University Elective Course
Academic year 2015-16

Information Technology and Cyber Law

Teaching Hours: 45

Credit: 3

I Introduction

The rapid growth of computer technology makes our life easier and attracts us to make every transaction by using electronic sources. All of us use computer every day through personal computer, laptop, mobile phone, notebook, *etc.* On the other hand unemployed persons are attracted to involve in unethical and unsocial activities, even in some of the cases, it extend to criminal activities. This course will disseminate the knowledge of computer technology which use cyberspace to transact the text, photo, documents, videos, money, etc. The course will also develop their ability to link internet technology with legal principles in fixing the tortious liabilities of the wrongdoer to compensate the victim and criminal liabilities of the offenders after following the due process of law. The Course will create ability among the students to apply Indian Information Technology Act in regulating E-Commerce, E-Governance, E-Banking and cybercrimes.

II Course Learning Outcome:

After the completion of the course the students will be able to:

1. Understand the information technology with technical & social perspectives.
2. Analyses the critical issues in developing cyber jurisprudence & policy.

III Syllabus

Module 1: Information Technology

What is Networking and Internet? What are various Computer Technologies used in Networking? What is relation between Computer Web Technology? , Types of networks; Intra-net and internet, Understanding Internet, www, Computer Memory and Storage, What is relationship between Cyberspace, Technology and Law, Defining the Scope of Information Communication Technology

Module 2: Stakeholders in cyber world

Defining the expansion of Cyber World & IT Industry, Who are Users (subscribers), Service Providers, Intermediaries, Cyber Cafe and other stakeholders. What kind of Agreements are Regulating Stakeholders Relationships: Click Wrap, Shrink Wrap, EDI. Discussing Electronic Contracts regulations in Indian & Cross Border Contracts (Reference to IT Act 2000 & UNCITRAL Model Law)

Module 3: Issues related to Software and Web designing

What are various IPR Issues in Cyber Space?, What is Domain Name Dispute, Cyber Squatting, What is Meta-Tagging, Framing and linking issue, Understanding Issues related to copyright, trade name and trademark infringement in IPR Law, Issues relating to Biotechnology and ICT related to software copyright, software privacy, open source software.

Module 4: Regulating Information Technology

How Authentication of electronic Records is done?, what digital signature? & how it is different from electronic signature?, what are regulatory powers of Controller and Certifying authorities?, Understanding, E-governance, E-commerce, E-banking including mobile banking, What are Civil liabilities under IT Act, Who is Adjudicating officer & What is Cyber Regulation Appellate Tribunal.

Module 5: Cyber Crimes

What is Cyber Crimes & what are its various classifications?, Appraisal of Crimes targeting Commuters, Social crimes committed through internet, Cyber pornography and stalking, Personal crimes, Economic offenses and Social Networking, Terrorist activities through internet. What are various measures taken by government to prevent cybercrimes?

Module 6: Investigation of cyber crimes

How investigation of cybercrime is done? Who is responsible for Cyber Crime Investigation? What are Territorial powers and issues, Confiscation of the computer and other e-devices? What is Computer and cyber forensics, discussing the Admissibility of E-Evidence in court of Law?

Module 7: Issues and challenges to cyber law

Discussing the Relevance of Data Protection Laws & Cyber Security, Legal recognition of Digital Evidence, Recognition of liability in the digital world, deciphering the Jurisdiction Issues in Transnational Crimes, What is Cloud Computing & what is its regulatory structure, Issue of Communication Convergence, Relevance of Online Dispute Resolution in India.

10

V Reference :

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- APAR GUPTA,COMMENTARY ON INFORMATION TECHNOLOGY ACT,LEXIS NEXIS INDIA; (2nd ed.) (2011).
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- ARVIND SINGHAL AND EVERETT ROGERS, INDIA'S COMMUNICATION REVOLUTION : FROM BULLOCK CARTS TO CYBER MARTS.
- MIKE GODWIN, CYBER RIGHTS DEFENCING FREE SPEECH IN THE DIGITAL AGE

Additional Sources :

- Talwant Singh Addl. Distt. & Sessions Judge, Delhi, *Cyber Law & Information Technology*http://delhicourts.nic.in/CYBER%20LAW.pdf
- *New Crimes Under The Information Technology (Amendment) Act*http://www.ijlt.in/archive/volume7/5_Mohanty.pdf
- *(A to Z of cyber crime by Asian School of cyber laws* available at http://ensaiosjuridicos.files.wordpress.com/2013/06/122592201-cybercrime.pdf)
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- http://cis-india.org/internet-governance/blog/relationship-between-privacy-and-confidentiality
- *Availability and Accessibility of Government Information in Public Domain*
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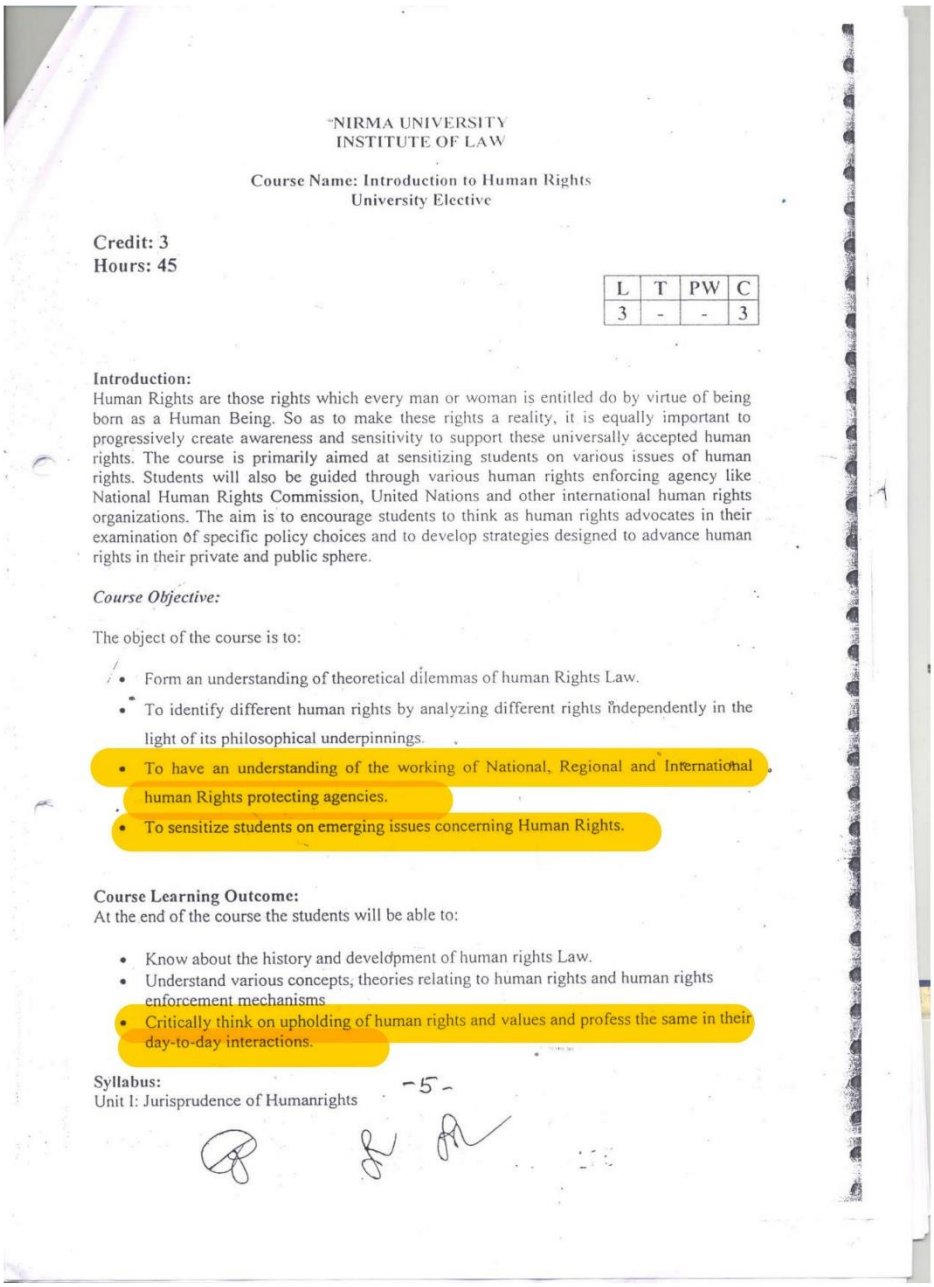

NIRMA UNIVERSITY
INSTITUTE OF LAW

Course Name: Introduction to Human Rights
University Elective

Credit: 3
Hours: 45

L	T	PW	C
3	-	-	3

Introduction:
Human Rights are those rights which every man or woman is entitled do by virtue of being born as a Human Being. So as to make these rights a reality, it is equally important to progressively create awareness and sensitivity to support these universally accepted human rights. The course is primarily aimed at sensitizing students on various issues of human rights. Students will also be guided through various human rights enforcing agency like National Human Rights Commission, United Nations and other international human rights organizations. The aim is to encourage students to think as human rights advocates in their examination of specific policy choices and to develop strategies designed to advance human rights in their private and public sphere.

Course Objective:

The object of the course is to:

- Form an understanding of theoretical dilemmas of human Rights Law.
- To identify different human rights by analyzing different rights independently in the light of its philosophical underpinnings.
- To have an understanding of the working of National, Regional and International human Rights protecting agencies.
- To sensitize students on emerging issues concerning Human Rights.

Course Learning Outcome:
At the end of the course the students will be able to:

- Know about the history and development of human rights Law.
- Understand various concepts, theories relating to human rights and human rights enforcement mechanisms
- Critically think on upholding of human rights and values and profess the same in their day-to-day interactions.

Syllabus:
Unit I: Jurisprudence of Humanrights -5-

- Significance of Human Rights
- Concept of Rights
- Problems of Conceptualization of Human Rights
- Justificatory theories
    - Theology
    - Natural law Theory
    - Positivism
    - Marxism
    - Sociological Process

Unit II: Implementation Mechanisms

- International Mechanism
- Regional Mechanism
- National mechanism

Unit III: Domestic Governance of Human Rights in India: 1993 Legislation

- Constitution of Commission at central and State Level
- Jurisdiction of Commission
- Powers and Duties of Commission

References:

- Henry J Steiner, Philip Alston 2008.*Human Rights Cases and Materials*, Oxford: Oxford Uni. Press.
- Dworkin, R.1979. *Taking Rights Seriously*, London: Duckworth.
- Hart H.L. 1969. *Liberty and Morality*, Oxford: Oxford Uni. Press.
- Waldron.J.J.;ed, 1984 *Theories of Rights*,Oxford: Oxford Uni. Press.
- Dube.M.P and Bora.N.; eds.2000 *Perspective on Human Rights*, New Delhi: Anamika Publishers.
- Winston Morton E.1989. *The Philosophy of Human Rights*, Belmont: Wadworth.
- SAHRDC. 2008, Human Rights and Humanitarian Law, New Delhi. Oxford Uni. Press.

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University Elective Course Briefs (IL-NU)

UEIL011 - Introduction to the Indian Constitution

L	T	PW	C
3	-	-	3

Introduction to Indian Legal System: Constitution, Constitutionalism, Constitutional Law, Constitutional Conventions, Historical evolution of the Constitution of India during British Raj, Formation of Constituent Assembly, Working of Constituent Assembly, Salient Features of Indian Constitution. Goal, Values, Ideals & Aspirations from the Constitution: Objectives Resolution, Preamble to Indian Constitution, 42nd Amendment Act & the Preamble. Nature of Indian Union: Indian Union, Formation, Creation and Establishment of new States under the Union, Citizenship. Fundamental Rights: Definition of State, Definition of Law, Right to Equality, Fundamental Freedoms, Right to Life & Personal Liberty, Right against Exploitation, Right to Religion, Right to Constitutional Remedies. Organs of the Government: Union Executive, Union Parliament, Union Judiciary. Emergency Provisions: National Emergency, State Emergency, Financial Emergency. Amendment to the Constitution: Need for Amendment, Types of Amendment, Procedure for Amendment. Constitutional Bodies: Comptroller & Auditor General of India, Finance Commission of India, Election Commission of India. Panchayati Raj Institutions, Committees, 73rd& 74th Amendment Act, Rural Local Bodies, Urban Local Bodies, PESA Act.

University Elective Course Briefs (IL-NU)

UEIL014 – Intellectual Property Rights

L	T	P W	C
3	-	-	3

Introduction to concept of property and intellectual property, introduction to TRIPS. Patent Law, concept and basis of protection, criteria of patentability and procedures of patent registration. Introduction to copyright law, subject matter of copy right and other related rights. Concepts and justification for trademarks protection, types of trademarks, procedure for registration, rights of trademark owner and infringement. Design law – basic and design justification, rights of design owners and protection against infringements. Concept of traditional knowledge, bio-piracy and bio-prospecting.

Right to Information-UEIL013

Credit: 3

Hours: 45

L	T	PW	C
3	-	-	3

Introduction:-

The great democratising power of information has given us all the chance to effect change and alleviate poverty in ways we cannot even imagine today. With information on our side, with knowledge a potential for all, the path to poverty can be reversed. Right to information is a weapon to bring good governance in the country. It is true that right to information proved to be a tool in a great democracy to provide its citizens a functional transparency of the governance. The Right to information is applicable for every citizen of India; therefore, it is necessary to known the jurisprudence of right to information. It is to believe that after the constitution of India, it is the only enactment interrelated by judiciary in its little age. Another necessity to know about the Right to Information Act is that it is a complete code in itself. The following syllabus prepared with this perspective will comprise about 45 units of one hour duration.

Course Learning Outcomes:

At the end of course, the students will be able :

(1) Know the historical development of RTI, origin and role of judiciary in recognizing it as fundamental rights RTI along with RTI movement.

(2) Distinguish between the 'other authorities' under Article 12 of the Constitution and “public authorities' under RTI Act.

(3) Understand the RTI mechanism of redressal system, authority, appellate authority, State Commission and National Commission with their function and powers.

(4) Differentiate between protective information and information should be disclosed.

(5) Understand the role of RTI in good governance.

(6) Draft and file a RTI Application.

1. Origin and development of Right to Information

1.1. Doctrine of 'right to know'

1.2. Origin of right to information

1.3. The Right to information - Fundamental Right

1.4. Development of right to know

1.5. The Government Privilege to withhold Disclosure of Documents

6. The Freedom of Information Act, 2002

6. Right to information and Good Governance

2. Introduction of Right to Information

2.1 Preamble of the Right to information Act, 2005

2.1 Scope and limitations of the Act

2.2.1 Act not to apply to certain organisations

2.2.2 Act to have overriding effect

2.2.3 Bar of jurisdiction of courts

2.3 Public authority

3. Right to Information

3.1 Meaning of 'information' and 'right to information'

3.2 Obligations of public authorities

3.3 Designation of Public Information Officers

3.4 Request for obtaining information

3.5 Disposal of request

3.6 Exemption from disclosure of information

3.7 Grounds for rejection to access in certain cases

3.8 Third party information

4. The Central Information Commission

4.1 Constitution of Central Information Commission

4.2 Term of office and conditions of service

4.3 Removal of Information Commissioner

4.4 Powers and functions of Information Commissions

5. The State Information Commission

5.1 Constitution of State Information Commission

5.2 Term of office and conditions of service

5.3 Removal of State Information Commissioner

5.4 Powers and functions of Information Commissions

6. Appeal against the order of Public Information Officer

7. Penalties in case information not issued in stipulated time

8. Monitoring and Reporting

9. Right to privacy vs. right to information

9.1 The Official Secret Act, 1923

9.2 Right to Information conflict with Right to Privacy

References:

- Das P.K. : *Handbook on Right to Information Act, 2005*; Universal Publication, New Delhi
- Nagarjan P.S. : *Right to Information and Law;* Gogia Law House, Hyderabad
- Jain K.K. *: Right to Information;* Regal Publication New Delhi
- Prof. (Dr.) SV Joga Rao : Law Relating to Right to Information, Pentagon Press
- Right to Information, Vnigu Publication Ahmedabad
- Saini PK & Gupta RK : Right to Information Act, 2005, Deep and Deep Publication, New Delhi
- Sathe SP : Right to Information, LexisNexis : Butterworth
- Dr Srivastva : Right to know versus Governmental Secretary