SCHEME & SYLLABUS

for

B.TECH. COURSE

in

Electronics Engineering

(w.e.f. Session 2020-21)

DEPARTMENT OF ELECTRONICS ENGINEERING

J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD

J.C.BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA, FARIDABAD

VISION

J.C. Bose University of Science and Technology, YMCA Faridabad, aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building.

MISSION

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the-art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

Department of Electronics Engineering

VISION

To be a Centre of Excellence for producing high quality engineers and scientists capable of providing sustainable solutions to complex problems and promoting cost effective indigenous technology in the area of Electronics, Communication & Control Engineering for Industry, Research Organizations, Academia and all sections of society.

MISSION

- To frame a well-balanced curriculum with an emphasis on basic theoretical knowledge as well the requirements of the industry.
- To motivate students to develop innovative solutions to the existing problems for betterment of the society.
- Collaboration with the industry, research establishments and other academic institutions to bolster the research and development activities.
- To provide infrastructure and financial support for culmination of novel ideas into useful prototypes.
- To promote research in emerging and interdisciplinary areas and act as a facilitator for knowledge generation and dissemination through Research, Institute - Industry and Institute-Institute interaction.

About Electronics Engineering Department

J. C. Bose University of Science & Technology, Faridabad (erstwhile YMCA University of Science & Technology, Faridabad) established in 2009, formerly known as YMCA Institute of Engineering, Faridabad, established in year 1969 as a Joint Venture of Govt. of Haryana and National Council of YMCA of India with active assistance from overseas agencies of West Germany to produce highly practical oriented personnel in specialized field of engineering to meet specific technical manpower requirement of industries. Electronics Engineering Department started in 1969 and has been conducting B.Tech. Courses in Electronics Instrumentation and Control and Electronics and Communication Engineering of 4-Years duration since 1997. Students are admitted through centralized counseling nominated by state govt. in 1st Year and 2nd year through lateral entry entrance test (LEET). Besides under graduate degree courses, it is also running M.Tech. courses in VLSI, Electronics & Communication Engineering . Department of Electronics Engineering is also running Ph.D. Programme. All courses are duly approved by AICTE/ UGC. The Electronics Engineering Department has been well known for its track record of employment of the pass out students since its inception. The Department has good infrastructure consisting of 13 laboratories, 10 Lecture Halls and 1 Conference Room beside 6 workshops. It has excellent faculty with 2 Professors, 2 Associate Professors and 24 Assistant Professors. At present, 9 faculty members are Ph.D in various specializations. The various syllabi of UG/PG courses have been prepared with active participation from Industry. The Department is organizing number of expert lectures from industry experts for students in every semester. Seven month training is mandatory for every B.Tech. student. Emphasis has been given on project work and workshop for skill enhancement of students. Choice based credit system allows students to study the subjects of his/her choice from a number of elective courses /audit courses.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

1. To prepare students to excel in undergraduate programmes and succeed in industry/ technical profession through global, rigorous education.

2. To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve engineering problems and also to pursue higher studies.

3. To provide students with foundation in skill development required to design, develop and fabricate engineering products.

4. To inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate engineering issues to broader social context, additional courses with regard to physical, psychological and career growth.

5. To provide student with an academic environment aware of excellence, outstanding leadership, written ethical codes and guidelines with moral values, and the life-long learning needed for successful professional career.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

1) Engineering knowledge: Apply knowledge of mathematics, science, engineering fundamentals, and Electronics Engineering to the solution of engineering problems.

2) Problem analysis: Identify, formulate, review literature and analyze Electronics Engineering problems to design, conduct experiments, analyze data and interpret data.

3) Design /development of solutions: Design solution for Electronics Engineering problems and design system component of processes that meet the desired needs with appropriate consideration for the public health and safety, and the cultural, societal and the environmental considerations.

4) Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in Electronics Engineering.

5) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to Electronics Engineering activities with an understanding of the limitations.

6) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to mechanical engineering practice.

7) Environment and sustainability: Understand the impact of the Electronics Engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

8) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the Electronics Engineering practice.

9) Individual and team work: Function affectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings in Electronics Engineering.

10) Communication: Communicate effectively on complex engineering activities with the engineering committee and with society at large, such as, being able to comprehend and write affective reports and design documentation, make effective presentations in Electronics Engineering.

11) Project Management and finance: Demonstrate knowledge & understanding of the mechanical engineering principles and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments in Electronics Engineering.

12) Life - long learning: Recognize the need for, and the preparation and ability to engage in independent research and lifelong learning in the broadest contest of technological changes in Electronics Engineering.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1. To apply the fundamental and design concepts of Science & Engineering in the areas of Analog & Digital Electronics, Instrumentation, Control, Communication, Signal Processing, Embedded Systems and Internet of Things (IoT).

(Professional Skill)

PSO 2. To pursue higher degree or get placed in Industries & Organizations after qualifying competitive examinations at National & Global Level.

(Competitive Skill)

GRADING SCHEME

Marks %	Grade	Grade points	Category
90-100	**O**	**10**	**Outstanding**
80 ≤ marks <90	**A+**	**9**	**Excellent**
70 ≤ marks < 80	**A**	**8**	**Very good**
60 ≤ marks < 70	**B+**	**7**	**Good**
50 ≤ marks < 60	**B**	**6**	**Above average**
45 ≤ marks < 50	**C**	**5**	**Average**
40 ≤ marks < 45	**P**	**4**	**Pass**
<40	**F**	**0**	**Fail**
	Ab	**0**	**Absent**

Percentage calculation= CGPA * 9.5

SEMESTER WISE (1st and 2nd) SUMMARY OF THE PROGRAMME: B.TECH. (EE-IoT)

S.No.	Semester	No. of Contact Hours	Marks	Credits
1	I	26	600	18.5
2	II	25	650	19.5
3	MOOCs	-	-	12*
Total		51	1250	

Note:

1. The scheme will be applicable from Academic Session 2020-21 onwards.
2. ***It is mandatory to pass the MOOC course(s) by all the students as per implementation of credit transfer/ mobility policy of on line courses of the University-as mentioned in Annexure-A at the end of the syllabus.**

Chapter -1

General, Course structure & Theme
&
Semester-wise credit distribution

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week 2 Hours Practical (Lab)/week	0.5 credits 1 credit

B. Course code and definition:

Course code	**Definitions**
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
PROJ	Project

C. Category of Courses:

BASIC SCIENCE COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		Physics	3	1	3	5.5
2		Chemistry	3	1	3	5.5
3		Mathematics –I	3	1	0	4
4		Mathematics –2	3	1	0	4

ENGINEERING SCIENCE COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1	ESC 101(Th)/ ESC107(Lab)	Basic Electrical Engineering	3	1	2	5
2	ESC 102	Engineering Graphics & Design	0	0	4	2
3	ESC103(Th)/ ESC105(Lab)	Programming for Problem Solving	3	0	4	5
4	ESC 104	Workshop I	0	0	4	2
5	ES6 106	Workshop II	0	0	4	2

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		English	2	0	2	3

Chapter -2

Detailed first year curriculum contents

I. Mandatory Induction Program

[Induction program for students to be offered right at the start of the first year.]

3 weeks duration
• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

B.TECH 1st YEAR ELECTRONICS ENGINEERING (SEMESTER -I)

COURSE STRUCTURE

S.No	Course Code	Course Title	L	T	P	Credits	Sessional	External	Category Code
1	BSC101C	Physics (Waves and Optics)	3	1	-	4	25	75	BSC
2	BSC103 D	Mathematics-I (Calculus and Linear Algebra)	3	1	-	4	25	75	BSC
3	ESC102	Engineering Graphics & Design	-	-	4	2	30	70	ESC
4	ESC103	Programming for Problem solving	3	-	-	3	25	75	ESC
5	ESC104	Workshop- I	-	-	4	2	30	70	ESC
6	BSC104C	Physics (Waves and Optics) lab	-	-	3	1.5	15	35	BSC
7	ESC105	Programming for Problem solving Lab	-	-	4	2	15	35	ESC
TOTAL			**9**	**2**	**15**	**18.5**	**165**	**435**	

NOTE : (1) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration

(2) Theory Exam of each subject will consist of two sections i.e Section A and Section B. Section A is Compulsory having 10 short answer type questions and should cover the entire syllabus. Section B should have six questions covering the whole syllabus and the students are required to attempt any four questions out of six.

(3) Additional 3 credits per year to be earned through MOOCs

B.TECH 1st YEAR ELECTRONICS ENGINEERING (SEMESTER -II)

COURSE STRUCTURE

S.No.	Course Code	Course Title	L	T	P	Credits	Sessional	External	Category Code
1	BSC106 D	**Mathematics-II** (Calculus, Ordinary Differential Equations and Complex Variable)	3	1	-	4	25	75	BSC
2	ESC101/ ESC101A*	Basic Electrical Engineering/ Basic Electrical Technology	3	1	-	4	25	75	AECC
3	BSC 102	Chemistry	3	1	-	4	25	75	BEC
4	ESC106	Workshop- II	-	-	4	2	30	70	BEC
5	HSMC101	English	2	-	-	2	25	75	BEC
6	ESC107/ ESC107A*	Basic Electrical Technology Lab	-	-	2	1	15	35	BSC
7	BSC 105	Chemistry Lab	-	-	3	1.5	15	35	BEC
8	HSMC102	English Lab	-	-	2	1	15	35	BEC
TOTAL			**11**	**3**	**11**	**19.5**	**175**	**475**	

*** Applicable from 2020-2021 onwards.**

Workshop I and Workshop II can be decided for specific branch by the respective Dean/Principal of respective UTD/Institution

NOTE : (1) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration

(2) Theory Exam of each subject will consist of two sections i.e Section A and Section B. Section A is Compulsory having 10 short answer type questions and should cover the entire syllabus. Section B should have six questions covering the whole syllabus and the students are required to attempt any four questions out of six.

(3) Additional 3 credits per year to be earned through MOOCs

B.TECH 2nd YEAR ELECTRONICS ENGINEERING (SEMESTER -III)

COURSE STRUCTURE

Sr. No	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	EEN 301	Digital Electronics	3	0	0	3	25	75	100
2	PCC	ECP302	Semiconductor Devices	3	0	0	3	25	75	100
3	PCC	ECC01	Signal and Systems	3	0	0	3	25	75	100
4	PCC	ECP305	Circuit Analysis and Synthesis	3	0	0	3	25	75	100
5	BSC	BS301	Mathematics-III	3	1	0	4	25	75	100
6	MC	MC01/ MC02	Indian Constitution/ Essence of Indian Traditional Knowledge	2	0	0	0	25	75	100
7	ESC	ESC01	Engineering mechanics	3	1	0	4	25	75	100
8	PCC	EE351	Semiconductor Devices Lab	0	0	2	1	15	35	50
9	PCC	EE352	Digital Electronics Lab	0	0	2	1	15	35	50
10	PCC	EE353	Circuit Analysis and Synthesis lab	0	0	2	1	15	35	50
11	PROJ	ES301	Electronics Project Workshop-I	0	0	6	3	30	70	100
				20	**2**	**12**	**26**	**250**	**700**	**950**

NOTE : (1) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration

(2) Theory Exam of each subject will consist of two sections i.e Section A and Section B. Section A is Compulsory having 10 short answer type questions and should cover the entire syllabus. Section B should have six questions covering the whole syllabus and the students are required to attempt any four questions out of six.

(3) Additional 3 credits per year to be earned through MOOCs

B.TECH 2nd YEAR ELECTRONICS ENGINEERING (SEMESTER –IV)
COURSE STRUCTURE

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	EEN401	Principle of Communication systems	3	0	0	3	25	75	100
2.	PCC	ECP402	Analog Electronics Circuits	3	0	0	3	25	75	100
3	PCC	EEN402	Measurement and Instrumentation	3	0	0	3	25	75	100
4	PCC	ECC02	Electromagnetic Waves	3	0	0	3	25	75	100
5	PCC	EEN403	Data Structures and algorithms	3	1	0	4	25	75	100
6	BSC	BSC01	Biology	2	1	0	3	25	75	100
7	PCC	EE451	Communication Systems lab	0	0	2	1	15	35	50
8	PCC	EE452	Analog Electronics Circuits lab	0	0	2	1	15	35	50
9	PCC	EEN453	Measurement and Instrumentation lab	0	0	2	1	15	35	50
10	PCC	EE454	Electromagnetic Waves lab	0	0	2	1	15	35	50
11	PROJ	ES402	Electronics Project Workshop-II	0	0	6	3	30	70	100
				17	**2**	**14**	**26**	**240**	**660**	**900**

NOTE : (1) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration

(2) Theory Exam of each subject will consist of two sections i.e Section A and Section B. Section A is Compulsory having 10 short answer type questions and should cover the entire syllabus. Section B should have six questions covering the whole syllabus and the students are required to attempt any four questions out of six.

(3) Additional 3 credits per year to be earned through MOOCs

Semester 1 Syllabus

Course code	BSC101C (Th)/ BSC104 (Lab)				
Category	Basic Science Course				
Course title	**Physics (Waves and Optics) (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester-I
	3	**1**	**3**	**5.5**	

(i) Physics (Waves and Optics) ([L : 3; T:1; P : 0 (4 credits)]

Prerequisites:

(i) Mathematics course on Differential equations

Unit 1: Simple harmonic motion, damped and forced simple harmonic oscillator (7) Mechanical and electrical simple harmonic oscillators, complex number notation and phasor representation of simple harmonic motion, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, steady state motion of forced damped harmonic oscillator, power absorbed by oscillator

Unit 2: Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion (7): Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their eigenfrequencies, longitudinal waves and the wave equation for them, acoustics waves and speed of sound, standing sound waves. Waves with dispersion, water waves, superposition of waves and Fourier method, wave groups and group velocity.

Unit 3: The propagation of light and geometric optics (10): Fermat‟s principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster‟s angle, total internal reflection, and evanescent wave. Mirrors and lenses and optical instruments based on them, transfer formula and the matrix method

Unit 4: Wave optics (6): Huygens‟ principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young‟s double slit experiment, Newton‟s rings, Michelson interferometer, Mach-Zehnder interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power

Unit 5: Lasers (8): Einstein‟s theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He- Ne, CO2), solid-state lasers(ruby,Neodymium), dye lasers; Properties of laser beams: monochromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

REFERENCE BOOKS:

(i) Ian G. Main, Oscillations and waves in physics
(ii) H.J. Pain, The physics of vibrations and waves
(iii) E. Hecht, A. Ghatak, Optics
(iv) O. Svelto, Principles of Lasers

Course Objective

- To acquire skills allowing the student to identify and apply formulas of optics and wave physics using course literature.
- To be able to identify and illustrate physical concepts and terminology used in optics and to be able to explain them in appropriate detail.
- To be able to make approximate judgements about optical and other wave phenomena when necessary.
- To acquire skills allowing the student to organise and plan simpler laboratory course experiments and to prepare an associated oral and written report.

Course Outcome:

- Student will be able to identify and apply formulas of optics and wave physics using course literature.
- Illustration of physical concepts and terminology used in optics and to be able to explain them in appropriate detail.
- To be able to make approximate judgements about optical and other wave phenomena when necessary.
- To acquire skills allowing the student to organise and plan simpler laboratory course experiments and to prepare an associated oral and written report.

(ii) Physics (Waves & Optics) Lab **[L : 0; T:0 ; P : 3 (1.5credits)]**

At least 06 experiments from the following

1. To determine the frequency of an electric tuning fork by Melde‟s experiment and verify $\lambda 2$ –T law.
2. To study Lissajous Figures.
3. Familiarization with: Schuster`s focusing; determination of angle of prism.
4. To determine refractive index of the Material of a prism using sodium source.
5. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
6. To determine the wavelength of sodium source using Michelson‟s interferometer.
7. To determine wavelength of sodium light using Fresnel‟s Biprism.
8. To determine wavelength of sodium light using Newton‟s Rings.
9. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
10. To determine dispersive power and resolving power of a plane diffraction grating.
11. To determine the wavelength of laser source using diffraction of single slit.
12. To determine the wavelength of laser source using diffraction of double slits.
13. To determine angular spread of He-Ne laser using plane diffraction grating

Note: Experiments may be added or deleted as per the availability of equipment.

REFERENCE BOOKS:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 1511,Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal,1985, Vani Pub.

Course code	**BSC103D**				
Category	Basic Science Course				
Course title	**MATHEMATICS 1 (Calculus and Linear Algebra)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester –I
	3	**1**	**-**	**4**	
Pre-requisites (if any)	**-**				

OBJECTIVES:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines. More precisely, the objectives are:

- To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.
- To introduce the fallouts of Rolle‟s Theorem that is fundamental to application of analysis to Engineering problems.
- To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To familiarize the student with functions of several variables that is essential in most branches of engineering.
- To develop the essential tool of matrices and linear algebra in a comprehensive manner.

Module 1: Calculus: (6 hours): Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Calculus: (6 hours): Rolle‟s Theorem, Mean value theorems, Taylor‟s and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3:Sequences and series: (10 hours): Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval‟s theorem.

Module 4: Multivariable Calculus (Differentiation): (8 hours): Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 5: Matrices (10hours): Inverse and rank of a matrix,rank-nullity theorem; System of linear equations; Symmetric, skew- symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley- Hamilton Theorem, and Orthogonal transformation.

TEXTBOOKS/REFERENCES BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course code	ESC 102				
Category	Engineering Science Courses				
Course title	**Engineering Graphics & Design (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester – I
	-	**0**	**4**	**2**	
Pre-requisites (if any)	-				

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

Module 1: Introduction to Engineering Drawing covering,

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales

– Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections covering

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module 3: Projections of Regular Solids covering

Those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4: Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections covering,

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Module 6: Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Module 7: Customization & CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

Course Outcomes

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

- Learn about the visual aspects of engineering design. Analyze engineering graphics standards.
- Prepare orthographic and isometric projection.
- Draw section of solids and conic sections.
- Exposure to computer-aided geometric design

TEXT/REFERENCE BOOKS:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Aggarwal M L & Sandhya Dixit (2017), Engineering Graphics and Machine Drawing, Dhanpat Rai & Company P Ltd.
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers, (Corresponding set of) CAD Software Theory and User Manuals
6. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers (Corresponding set of) CAD Software Theory and User Manuals

Course code	ESC103(Th)/ESC105(Lab)				
Category	Engineering Science Course				
Course title	**Programming for Problem Solving (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester – I/II
	3	**0**	**4**	**5**	
Pre-requisites (if any)	**-**				

(i)Programming for Problem Solving ([L : 3; T:0; P : 0 (3 credits)] [contact hrs : 40]

Unit 1: Introduction to Programming (4 lectures) Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture).**

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2: Arithmetic expressions and precedence (2 lectures) Conditional Branching and Loops **(6 lectures)** Writing and evaluation of conditionals and consequent branching **(3 lectures)** Iteration and loops **(3lectures)**

Unit 3: Arrays (6 lectures) Arrays (1-D, 2-D), Character arrays and Strings

Unit 4: Basic Algorithms (6 lectures) Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 5: Function (5 lectures) Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 6: Recursion (4 -5 lectures) Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 7: Structure (4 lectures) Structures, Defining structures and Array of Structures

Unit 8: Pointers (2 lectures) Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 9: File handling (only if time is available, otherwise should be done as part of the lab)

TEXT BOOKS

(i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

REFERENCE BOOKS

(i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

COURSE OUTCOMES

The student will learn

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

(ii) Laboratory - Programming for Problem Solving[L : 0; T:0 ; P : 4 (2credits)] Tutorial 1:

Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

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

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

LABORATORY OUTCOMES

- To formulate the algorithms for simpleproblems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use them in defining self- referential structures.
- To be able to create, read and write to and from simple text files.

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Semester II
Syllabus

Course code	BSC106D				
Category	Basic Science Course				
Course title	**Mathematics -II (Calculus, Ordinary Differential Equations and Complex Variable)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester-II
	3	**1**	**0**	**4**	
Pre-requisites (if any)	**-**				

OBJECTIVES:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. More precisely, the objectives are:

a. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
b. To introduce effective mathematical tools for the solutions of differential equations that model physical processes.
c. To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.

Module 1:Multivariable Calculus (Integration): (10 hours) Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities);Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

Module 2: First order ordinary differential equations:(6 hours) Exact, linear and Bernoulli‟s equations, Euler‟s equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut‟s type.

Module 3: Ordinary differential equations of higher orders:(8 hours) Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Module 4: Complex Variable – Differentiation:(8 hours): Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Module 5: Complex Variable – Integration:(8 hours): Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville‟s theorem and Maximum-Modulus theorem (without proof); Taylor‟s series, zeros of analytic functions, singularities, Laurent‟s series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

TEXTBOOKS/REFERENCES BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc- Graw Hill, 2004.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

Course code	ESC 101(Th)/ESC107(Lab)				
Category	Engineering Science Course				
Course title	**Basic Electrical Engineering (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester –I/II
	3	**1**	**2**	**5**	
Pre-requisites (if any)	**-**				

(i) Basic Electrical Engineering [L : 3; T:1; P : 0 (4 credits)]

Module 1 : DC Circuits (8 hours) Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time- domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours) Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours) Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours) Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours) DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours) Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

TEXT / REFERENCE BOOKS

(i) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
(ii) D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
(iii) L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
(iv) E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
(v) V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

COURSE OUTCOMES

- To understand and analyze basic electric and magnetic circuits

- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations

(ii) Basic Electrical Engineering Laboratory [L : 0; T:0 ; P : 2 (1 credit)]

List of experiments/demonstrations:

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

Laboratory Outcomes

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

Course code	**ESC 101 A (Th)/ESC107A (Lab)**				
Category	**Engineering Science Course**				
Course title	**Basic Electrical Technology (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester –I/II
	3	**1**	**2**	**5**	
Pre-requisites (if any)	**-**				

[ESC101-A] Basic Electrical Technology (Theory) [L : 3; T : 1; P:0, (4 credit)]Course Outcomes:

- To analyze and solve D. C. networks by different analysis methods and theorems.
- To formulate and solve complex AC single phase and three circuits
- To identify the type of electrical machines and their applications
- To introduce the components of low voltage electrical installations

Module 1: DC Circuits (8 hours)

Basic definitions, Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law and its limitations, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation by mesh analysis and node analysis, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance.

Module3: Poly Phase Systems (5 hours)

Advantages of 3-phase systems, generation of 3-phase voltages, three phase connections (star and delta), voltage and current relations in star and delta connections, three phase powers, analysis of 3-phase balanced circuits, measurement of 3-phase power- 2 wattmeter method.

Module 4: Transformers (6 hours)

Magnetic Circuits, construction and working of single phase transformer, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency, Auto-transformer

Module 5: Electrical Machines (8 hours)

*Induction motor***:** Construction, principle and working of a three-phase induction motor,Single-phase induction motor: Construction, principle and working, Applications

*DC machine***:** Construction, principle and working of dc motor and generator. Applications

*Synchronous machine***:** Construction, principle and working of synchronous motor and generators. Applications

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Fuses, MCB, ELCB, MCCB, Types of Wires, Earthing, Power factor improvement.

TEXT / REFERENCE BOOKS

1.D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press,2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Online Recourses:

1. **NPTL Web Course, Basic Electrical Technology,** Prof. G. D. Roy, Prof. N. K. De,Prof. T.K. Bhattacharya, IIT Kharagpur **(**https://nptel.ac.in/courses/108/105/108105053/)
2. **NPTL Web Course, Electrical Machines-I,** Prof. P. Sasidhara Rao, Prof. G. Sridhara Rao, Dr. Krishna Vasudevan, IIT Madras **(**https://nptel.ac.in/courses/108/106/108106071/)
3. **NPTL Web Course, Electrical Machines-II,** Prof. P. Sasidhara Rao, Prof. G. Sridhara Rao, Dr. Krishna Vasudevan, IIT Madras https://nptel.ac.in/courses/108/106/108106072/

[ESC107-A] Basic Electrical Technology Laboratory [L : 0; T:0 ; P : 2 (1 credit)]

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Verification of network theorem in DC circuits, Thevenin's Theorem, Norton's, Theorem, Superposition Theorem etc.
- Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Poly phase systems, three phase connections (star and delta), measurement of three phase power
- Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Demonstration of cut-out sections of machines: dc machine (commutator- brush arrangement), induction machine (squirrel cage rotor), synchronous

machine (field winging - slip ring arrangement) and single-phase inductionmachine.

- Torque Speed Characteristic of separately excited dc motor.
- Components of LT switchgear.

LABORATORY OUTCOMES

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.

Course code	BSC102(Th)/BSC105(Lab)				
Category	Basic Science Course				
Course title	**Chemistry (Theory & Lab.)** **Contents** (i) Chemistry (Concepts in chemistry for engineering) (ii) Chemistry Laboratory				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester –II
	3	**1**	**3**	**5.5**	
Pre-requisites (if any)	**-**				

(i)Chemistry (Concepts in chemistry for engineering) [L : 3; T:1; P : 0 (4 credits)]

Unit 1: Atomic and molecular structure (12 lectures)

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

Unit 2: Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

Unit 3: Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

Unit 4: Use of free energy in chemical equilibria (6 lectures)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

Unit 5: Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

Unit 6: Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity,

absolute configurations and conformational analysis. Isomerism in transitional metal compounds

Unit 7: Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

TEXT BOOKS

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition

COURSE OUTCOMES

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

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

(ii) Chemistry Laboratory [L : 0; T:0 ; P : 3 (1.5 credits)]

Choice of 10-12 experiments from the following:

- Determination of surface tension and viscosity
- Thin layer chromatography
- Ion exchange column for removal of hardness of water
- Determination of chloride content of water
- Colligative properties using freezing point depression
- Determination of the rate constant of a reaction
- Determination of cell constant and conductance of solutions
- Potentiometry - determination of redox potentials and emfs
- Synthesis of a polymer/drug
- Saponification/acid value of an oil
- Chemical analysis of a salt
- Lattice structures and packing of spheres
- Models of potential energy surfaces
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between two immiscible liquids
- Adsorption of acetic acid by charcoal
- Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of

minimum viscosity for gelatin sols and/or coagulation of the white part of egg .

LABORATORY OUTCOMES

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

Course code	HSMC 101(Th)/HSMC102(Lab)				
Category	Humanities and Social Sciences including Management				
Course title	**English (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester – II
	2	**0**	**2**	**3**	
Pre-requisites (if any)	-				

ENGLISH
Detailed contents

1. Vocabulary Building

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.

2. Basic Writing Skills

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

3. Identifying Common Errors in Writing

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

4. Nature and Style of sensible Writing

Describing, Defining, Classifying, Providing examples or evidence

5. Writing introduction and conclusion

6. Writing Practices

Comprehension, Précis Writing, Essay Writing

ENGLISH LABORATORY [L : 0; T:0 ; P : 2 (1 credit)]

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

SUGGESTED READINGS:

(i) Practical English Usage. Michael Swan. OUP. 1995.
(ii) Remedial English Grammar. F.T. Wood. acmillan.2007
(iii) On Writing Well. William Zinsser. Harper Resource Book. 2001
(iv) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

COURSE OUTCOMES

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

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Course code	ESC 104				
Category	Engineering Science Courses				
Course title	**Workshop-I**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester-I
	-	**0**	**4**	**2**	
Pre-requisites (if any)	-				

Workshop-I
PART-A
Computer Engineering Workshop

COURSE OUTCOMES:

After the completion of the course the student will be able to:
CO1- Acquire skills in basic engineering practice.
CO2- Have working knowledge of various equipment used in workshop.
CO3- Have hands on experience about various machines and their components.
CO4- Obtain practical skills of basic operation and working of tools used in the workshop.

1. To study and demonstrate Block diagram of Digital Computer System and brief explanation of each unit.
2. To demonstrate History/ Generation/ classifications and different types of Personnel Computer. To study and demonstrate internal parts of a Computer System (Card level) and other peripheral devices and explanation of POST & BIOS.
3. To study and demonstrate primary memory and secondary memory.
4. To demonstrate CPU Block diagram and other Peripheral chips, Mother Board/ Main Board and its parts, Connectors, Add On Card Slots etc.
5. To study working of various types of monitors: CRT type, LCD type & LED type.
6. To study Keyboard and Mouse: Wired, Wireless, Scroll & Optical with detail working.
7. To study Printers: Dot Matrix Printers, Daisy wheel Printers, Ink-Jet Printers and Laser Jet Printers with detailed working explanation.
8. Assembly / Installation and Maintenance of Personnel Computer Systems: Practical exercise on assembly of Personnel Computer System, Installation of Operating System: Windows & Linux etc, Installation of other Application Softwares and Utility Softwares, Fault finding in Personnel Computers: Software or Hardware wise, Virus: Introduction, its Types & Removal techniques, Data Backup and Restore, Data Recovery Concepts, Typical causes of Data loss.
9. To demonstrate networking concepts: Introduction of Connecting devices: Hub, Switch & Router etc, Networking Cable preparation: Normal & Cross Cables, Data Transferring Techniques from one Computer System to another Computer System, Configuration of Switch/ Routers etc.

PART-B
Electrical Workshop

1. Introduction of Electrical Safety precautions, Electrical Symbols, Electrical Materials, abbreviations commonly used in Electrical Engg. and familiarization with tools used in Electrical Works.

2. To make a Straight Joint & Tee joint on 7/22 PVC wire and Britannia Joint on GI wire.
3. To study fluorescent Tube Light, Sodium Lamp and High Pressure Mercury Vapour Lamp.
4. To study different types of earthing and protection devices e.g. MCBs, ELCBs and fuses.
5. To study different types of domestic and industrial wiring and wire up a circuit used for Stair case and Godown wiring.
6. To make the connection of fan regulator with lamp to study the effect of increasing and decreasing resistance in steps on the lamp.
7. To fabricate half wave and full wave rectifiers with filters on PCB.
8. Maintenance and Repair of Electrical equipment i,e Electric Iron , Electric Toaster ,Water heater, Air coolers and Electric Fans etc.
9. To study soldering process with simple soldering exercises.
10. To make the connection of a three core cable to three pin power plug and connect the other cable end by secured eyes connection using 23/0.0076”or 40/0.0076” cable.

PART- C

Electronics Workshop

1. To study and demonstrate basic electronic components, Diode, Transistor, Resistance, Inductor and capacitor.
2. To study and demonstrate resistance color coding, measurement using color code and multimeter and error calculation considering tolerance of resistance.
3. To study and demonstrate Multimeter and CRO- front panel controls, description of block diagram of CRT and block diagram of CRO.
4. To study and demonstrate Vp(peak voltage),Vpp(peak to peak voltage), Time, frequency and phase using CRO.
5. Introduction to function generator. Functions of front panel controls and measurement of different functions on CRO.
6. To study and demonstrate variable DC regulated power supply, function of controls and DC measurement using multimeter and CRO.
7. Soldering practice on wire mesh or a resistance decade board includes fabrication, soldering, lacing, harnessing forming and observation.
8. Testing of components using multimeter and CRO like diode, transistor, resistance capacitor, Zener diode and LED.
9. To study and demonstrate rectification, half wave, Full wave and bridge rectifier. Fabrication, assembly and waveform observation.
10. To design and fabricate a printed circuit board of a Zener regulated/ series regulated power supply and various measurements, testing of power supply.

Note: At least 8 exercises are to be performed from each part by the students.

Course code	ESC 106				
Category	Engineering Science Courses				
Course title	**Workshop-II**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester-II
	-	**0**	**4**	**2**	
Pre-requisites (if any)	**-**				

MECHANICAL WORKSHOP

COURSE OUTCOMES (COS):

After studying this course the students would:

CO 1- Have exposure to mechanical workshop layout and safety aspects.
CO 2- Understand the functions of various machines and cutting tools used in machine shop.
CO 3- Practice real time job preparation using various operations related to machine shop such as filing, drilling, milling & turning.
CO 4 - Practice job preparation in welding shop.
CO 5 - Learn to use different measuring tools like vernier caliper, vernier height gauge and micrometer.
CO 6 - Practice job preparation in sheet metal shop.
List of Exercises:
Fitting, sheet metal and welding workshop:

1. To study layout, safety measures and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc) used in workshop.
2. To study and use of different types of tools, equipments, devices & machines used in fitting, sheet metal and welding section.
3. To determine the least count of vernier calliper, vernier height gauge, micrometer and take different reading over given metallic pieces using these instruments.
4. To study and demonstrate the parts, specifications & operations performed on lathe machine.
5. To study and demonstrate the parts, specifications & operations performed on milling machine.
6. To study and demonstrate the parts, specifications & operations performed on shaper machine.
7. To prepare a job involving different type of filing practice exercise in specified dimensions.
8. To prepare a job involving multi operational exercise (drilling, counter sinking, tapping, reaming, hack sawing etc.)
9. To prepare a multi operational sheet metal job (self secured single groove joint/ hasp & stay etc.).
10. To practice striking an arc, straight short bead, straight continuous bead and restart of electrode in flat position by arc welding on given M.S. plate as per size.
11. To practice tack weld of two close plate in flat position by arc welding on given M.S. plate as per size.
12. To practice close butt joint in flat position by arc welding on given M.S. plate as per size.

NOTE: - At least nine exercises should be performed from the above list; remaining three may either be performed from above list or designed by the concerned institution as per the

scope of the syllabus and facilities available in institute.

Annexure-A

J.C. Bose University of Science & Technology, YMCA, Faridabad
(A Haryana State Government University)
(Established by Haryana State Legislative Act No. 21 of 2009 & Recognized by UGC Act 1956 u/s 22 to Confer Degrees)
Accredited 'A' Grade by NAAC

Implementation of Credit Transfer/Mobility Policy of online courses

Reference: Gazette of India (Extraordinary) Part-III, Section-4 No. 295, UGC **(Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016,** dated 19/07/2016.

With reference to 12th Academic Council Meeting dated 03/05/2017 (Agenda Item No. AC/11/12), wherein MOOCs were adopted in the CBCS scheme, In continuation to that, following modalities are proposed to introduce the credit transfer policy in academic curriculum for the Massive Open Online Courses (MOOC"s) offered through SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds) Portal.

A. General Guidelines

1. The SWAYAM shall notify in June and November every year, the list of the online learning Courses going to be offered in the forthcoming Semester on its website https://swayam.gov.in.
2. All the UTDs/Affiliated Colleges shall, within 4 weeks from the date of notification by SWAYAM, consider through their Chairperson/Principal the online learning courses being offered through the SWAYAM platform; and keeping in view their academic requirements, decide upon the courses which it shall permit for credit transfer and keeping in view the following points:

    a) There is non-availability of suitable teaching staff for running a course in the Department.
    b) The facilities for offering the elective papers (courses), sought for by the students are not on offer/scheme in the Institution, but are available on the SWAYAM platform.
    c) The courses offered on SWAYAM would supplement the teaching-learning process in the Institution.
    d) Online courses through SWAYAM should not be more than 20% of total courses offered in a particular semester of a programme.
3. The courses offered in a particular semester will be compiled by Digital India Cell as decided and forwarded by concerned UTDs and affiliated colleges in the prescribed format to digitalindia.ymca@gmail.com and compiled set will be put up in Academic Council for approval.
4. Student can opt for 12-16 weeks course equivalent to 3-6 credits under mentorship of faculty (MHRD MOOC"s guidelines 11.1(J) issued by the MHRD vide its orders dated 11/03/2016).

5. Every student being offered a particular paper (course) would be required to register for the MOOCs for that course/paper on SWAYAM through University‟s/Affiliated College‟s SWAYAM-NPTEL Local Chapter.
6. The UTD/College may designate a faculty member as course coordinator/mentor to guide the students (at least 20 students) throughout the course with 2 hours per week contribution and with mentor addition on the Local Chapter. The mentor Chairperson/Principal will ensure the provision of facilities for smooth running of the course viz. Internet facility and proper venue in the department/college.
7. Digital India Cell of the University will be the Nodal point for keeping track of MOOCs enrolments in the University and the concerned chairpersons/principals are expected to aware their students/faculty about the online courses.
8. Importance of online learning and credit transfer policy must be shared with the students at entry level by the concerned department/college. Same may be incorporated during induction program for newly admitted students.
9. The departmental/college MOOC coordinators appointed by chairpersons of concerned departments/Principals of affiliated colleges will be responsible for identification of relevant MOOCs in the UTDs/Colleges and smooth conduction during the course.

B. Credit Transfer/Mobility of MOOCs

1. The parent Institution (offering the Course) shall give the equivalent credit weightage to the students for the credits earned through online learning courses through SWAYAM platform in the credit plan of the program.
2. Following pattern will be followed for distribution of credits and will be applicable to all students from Jan 2018 onwards:

Program	**Duration**	**Minimum Credits to be earned***
B.Tech	Semester I to VIII	3
M.Tech/MBA/M.Sc./MA	Semester I to IV	3
BBA/BCA/B.Sc./BA	Semester I to VI	3

***All students of UTDs/Affiliated colleges of all courses have to mandatorily earn minimum prescribed credits.**

<u>Note:</u> From session 2019-20 onwards, for B.Tech program, a student has to earn at least 12 credits during the duration of the Degree subject to the passing of at least one MOOC course (carrying minimum 3 credits per year).

3. A student will be eligible to get Under-Graduate/Post-Graduate degree (B.Tech/M.Tech) with Honours if he/she completes additional credits through MOOC‟s. (AICTE Model Curriculum, Chapter1(B)). Following pattern will be followed for earning additional credits for the award of Honours degree:

Program	Duration	Credits to be earned*	Minimum CGPA
B.Tech	Semester I to VIII	12	8.0
M.Tech	Semester I to IV	6	8.0

*Inclusive of *Minimum credits to be earned* mentioned in clause B(2) above.

4. The earned credits shall be accepted and transferred to the total credits of the concerned students by the University for Completion of his/her degree. Credits earned through MOOCs will be incorporated in the mark sheet issued to the student by Controller of Examination.
5. Credits for MOOC"s will be verified by the concerned department/college and will be forwarded to Controller of Examination for further processing.
6. The courses where model curriculum of AICTE is not applicable, pattern laid down as in B(2) will be followed.

NOTE:

1. These guidelines will be applicable to all Affiliating institutions under University along with all UTDs. Affiliating colleges will establish their own Local Chapter on SWAYAM and follow the same process.
2. For further clarifications, Notifications "Credit Framework for Online Learning Courses through SWAYAM" (UGC Regulations dated 19/07/2016) and "MHRD MOOC"s guidelines" (MHRD guidelines dated 11/03/2016) may be referred.

Semester III
Scheme & Syllabus

B.TECH 2nd YEAR EE(IoT) (SEMESTER -III)

COURSE STRUCTURE

Sr. No	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	EEN 301	Digital Electronics	3	0	0	3	25	75	100
2	PCC	ECP302	Semiconductor Devices	3	0	0	3	25	75	100
3	PCC	ECC01	Signal and Systems	3	0	0	3	25	75	100
4	PCC	ECP305	Circuit Analysis and Synthesis	3	0	0	3	25	75	100
5	BSC	BS301	Mathematics-III	3	1	0	4	25	75	100
6	MC	MC01/ MC02	Indian Constitution/ Essence of Indian Traditional Knowledge	2	0	0	0	25	75	100
7	ESC	ESC01	Engineering mechanics	3	1	0	4	25	75	100
8	PCC	EEN351	Semiconductor Devices lab	0	0	2	1	15	35	50
9	PCC	EEN 352	Digital Electronics Lab	0	0	2	1	15	35	50
10	PCC	EEN353	Circuit Analysis and Synthesis lab	0	0	2	1	15	35	50
11	PROJ	ES301	Electronics Project Workshop-I	0	0	6	3	30	70	100
				20	**2**	**12**	**26**	**250**	**700**	**950**

NOTE : (1) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration

(2) Theory Exam of each subject will consist of two sections i.e Section A and Section B. Section A is Compulsory having 10 short answer type questions and should cover the entire syllabus. Section B should have six questions covering the whole syllabus and the students are required to attempt any four questions out of six.

(3) Additional 3 credits per year to be earned through MOOCs

Semester III

Syllabus

Digital Electronics

EEN301

L	T	P	CR			
3	0	0	3			

Theory 75

Class Work 25

Duration of Exam: 3 Hrs

Total 100

Course Objectives:

- To introduce Digital signals, numbers systems, various types of logic gates and various types of codes
- To understand and design various combinational circuits
- To study Sequential circuits, F/F Conversions, sequence generators, Counters
- To explore various types of Digital Logic Families and to introduce various types of A/D and D/A converters
- To classification of memories and various types of Programmable Logic Devices

Syllabus

UNIT 1: FUNDAMENTALS OF DIGITAL TECHNIQUES:

Digital signal, logic gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Boolean algebra. Review of Number systems. Binary codes: BCD, Excess-3, Gray, EBCDIC, ASCII, Error detection and correction codes. Design using gates, Karnaugh map and Quine Mcluskey methods of simplification.

UNIT 2: COMBINATIONAL DESIGN USING MSI DEVICES:

Multiplexers and Demultiplexers and their use as logic elements, Decoders, Adders / Subtractors, BCD arithmetic circuits, Encoders, Decoders / Drivers for display devices.

UNIT 3: SEQUENTIAL CIRCUITS:

Flip Flops: S-R, J-K, T, D, master-slave, edge triggered, shift registers, F/F Conversions, sequence generators, Counters, Asynchronous and Synchronous Ring counters and Johnson Counter, Design of Synchronous and Asynchronous sequential circuits.

UNIT 4: DIGITAL LOGIC FAMILIES:

Switching mode operation of p-n junction, bipolar and MOS. devices. Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families. Tristate logic, Interfacing of CMOS and TTL families. 82

UNIT 5: A/D AND D/A CONVERTERS:

Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters : Quantization, parallel -comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs.

UNIT 6: MEMORIES AND PLD'S:

Classification of memories –RAM organization l-Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell – ROM- PROM –EPROM –EEPROM –EAPROM –Programmable Logic Devices –Programmable Logic Array (PLA)-Programmable Array Logic (PAL)-Field Programmable Gate Arrays (FPGA).

COURSE OUTCOMES:

On successful complete of this course, the students should be able to:

• Represent numerical values in various number systems and perform number conversions between different number systems.
• Design digital combinational circuits like decoders, encoders, multiplexers, and de-multiplexers including arithmetic circuits (half adder, full adder).
• Analyze and design sequential digital circuits like registers, counters using flip flop.
• Describe he difference logic families and analog to digital converter.
• Nomenclature and technology in the area of memory devices: ROM, RAM, PROM, PLD, FPGA etc.

TEXT/ REFERENCE BOOKS:

1. Modern Digital Electronics(Edition III) : R. P. Jain; TMH.
2. Digital Principles and Applications: Malvino & Leach; McGraw Hill.
3. Digital Electronics, Kharate : Oxford publications
4. Digital Fundamentals, Thomas L. Floyed, Pearson
5. Digital Design: Morris Mano; PHI

Semiconductor Devices

ECP302

L	T	P	CR		
				Theory	**75**
3	**0**	**0**	**3**	**Class Work**	**25**
Duration of Exam: 3 Hrs				**Total**	**100**

Course Objectives:

- To give exposure to the students about Semiconductor Physics.
- To understand about working and characteristics of semiconductor diodes
- To understand the working of bipolar Junction Transistor and FETs and their characteristics.
- To learn the concept of fabrication technologies of semiconductor devices.

Syllabus

UNIT 1: Introduction to Semiconductor Physics: Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon: Carrier transport: diffusion current, drift current, mobility and resistivity, sheet resistance.

UNIT 2: Generation and recombination of carriers, Poisson and continuity equation, P-N junction, P-N junction diode, I-V characteristics, and small signal switching models: Avalanche breakdown, Zener breakdown, Zener diode, Zener diode as constant voltage regulator, Schottky diode, LED, photodiode and Solar Cell.

UNIT 3: Bipolar Junction Transistor (BJT), Structure, Working, Common Base CB, Common Emitter CE and Common Collector CC configuration, I-V characteristics and Current gain, Ebers-Moll Model.

UNIT 4: Field Effect transistor (FET), Junction FET, MOSFET: Depletion Type, Enhancement type MOSFET, Structure, Working, I-V characteristics and small signal models of MOS Transistor, MOS capacitor.

UNIT 5: Integrated circuit fabrication process: oxidation, diffusion, ion implantation, etching, photolithography, chemical vapor deposition, sputtering, twin-tub CMOS process.

COURSE OUTCOMES:

On successful completion of this course, the students should be able to :-

- Understand the principles of semiconductor Physics.
- Describe characteristics of semiconductor diodes and utilize the mathematical models of semiconductor junction diodes for different applications
- Implement and evaluate the characteristics of BJT and FETs
- Learn and Understand various semiconductor Fabrication Process.

TEXT /REFERENCE BOOKS:

1. David A. Bell, ―Electronics Devices and Circuits, 5th edition, Oxford Higher Education.
2. Jacob Millman , Christos Halkias , Electronics - Analog and Digital Circuit and Systems, McGraw-Hill Education.
3. Boylstad : Electronics devices and Circuit theory: Robert L. Boylestad Louis Nashelsky, Pearson.
4. G. Streetman, and S. K. Banerjee, ―Solid State Electronic Devices,‖ 7th edition, Pearson,2014.
5. D. Neamen, D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
6. S. M. Sze and K. N. Kwok, ―Physics of Semiconductor Devices,‖ 3rd edition, John Wiley & Sons, 2006.
7. C.T. Sah, ―Fundamentals of solid state electronics,‖ World Scientific Publishing Co. Inc, 1991.
8. Y. Tsividis and M. Colin, ―Operation and Modeling of the MOS Transistor,‖ Oxford Univ.Press, 2011.

Signal and System

ECC01

L	T	P	CR		
				Theory	**75**
3	**0**	**0**	**3**	**Class Work**	**25**
Duration of Exam: 3 Hrs				**Total**	**100**

Course Objects:

- To introduce students about various types of signals and their classifications.
- To understand students about LSI (linear shift invariant) systems and their properties.
- To introduce students about properties of Fourier Series, Fourier Transforms like DTFT and DFT.
- To introduce students about Laplace Transform, Z Transform and State-Space Analysis.

Syllabus

Unit 1: Signals and systems as seen in everyday life, and in various branches of engineering and science, Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals, System properties, linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

Unit 2: Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input output behaviour with a periodic convergent inputs, Characterization of causality and stability of linear shift-invariant systems, System representation through differential equations and difference equations.

Unit 3: Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT), Parseval's Theorem, the idea of signal space and orthogonal bases

Unit 4: The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behaviour

Unit 5: The z-Transform for discrete time signals and systems eigen functions, region of convergence, z-domain analysis.

Unit 6: State-space analysis and multi-input, multi-output representation, the state-transition matrix and its role, The Sampling Theorem and its implications spectra of sampled signals.

Reconstruction: ideal interpolator, zero-order hold, first order hold, and so on, Aliasing and its effects, relation between continuous and discrete time systems.

COURSE OUTCOMES:

On successful completion of this course, the students should be able to:

- Analyze different types of signals.
- Represent continuous and discrete systems in time and frequency domain using different transforms.
- Describe applications of DFT, Laplace transform and Z transform
- Perform sampling and reconstruction of a signal.

TEXT/REFERENCE BOOKS:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, 1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: 1999.
6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, 1998.
7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.
8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
9. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
10. Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.

Circuit Analysis and Synthesis

ECP305

L	T	P	CR		
				Theory	**75**
3	**0**	**0**	**3**	**Class Work**	**25**
Duration of Exam: 3 Hrs				**Total**	**100**

Course Objectives:

- To understand students about basic electrical circuits with nodal & mesh analysis.
- To give exposure to the students about various network theorem applicable to AC circuits.
- To describe the application of Laplace transform.
- To understand the students about network functions, two port network for analysis of electrical networks.
- To learn the students about filters and types of filters.

Syllabus

Unit 1: Node and Mesh Analysis: matrix approach of network containing voltage and current sources, and reactance, source transformation and duality. Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC circuits.

Unit 2: Laplace transforms and properties: Partial fractions, Transfer functions, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transform.

Unit 3: Network functions: Terminal pairs or Ports, concept of complex frequency, Network functions for one-port and two-port networks, poles and zeros of Network functions, Restrictions on pole and zero Locations for driving point functions and transfer functions, Time domain behaviour from the pole-zero plot.

Unit 4: Two port network: Relationship of two-port variables, short-circuit Admittance parameters, open circuit impedance parameters, Transmission parameters, hybrid parameters, relationships between parameter sets, condition for reciprocity, condition for symmetry, Inter-connection of two port networks.

Unit 5: Filter fundamentals: parameters of a filter, filter networks, characteristics of filter networks, Introduction of filters: low pass, high pass, band pass and band reject filters.

COURSE OUTCOMES:

On successful completion of this course, the students should be able to:

1. Analyse basics electrical circuits with nodal and mesh analysis and apply network theorems to AC circuits
2. Apply Laplace Transform for steady state and transient analysis.
3. Identify different network functions and behaviour based on Pole Zero plot.

4. Evaluate two port network parameters, relationship between parameters and interconnection of two port network.
5. Analyse filter fundamentals and behaviour of different filters

TEXT/REFERENCE BOOKS:

1. Van, Valkenburg; “Network analysis”; Prentice Hall of India, 2000.
2. Sudhakar, A., Shyammohan, S. P.; “Circuits and Network”; Tata McGraw-Hill New Delhi, 1994.
3. A William Hayt, “Engineering Circuit Analysis” 8th Edition, McGraw-Hill Education.

Mathematics-III

BS 301

L	T	P	CR		
				Theory	**75**
3	**1**	**0**	**4**	**Class Work**	**25**
Duration of Exam: 3 Hrs				**Total**	**100**

Course Objectives:

- To gain knowledge about:
- Laplace Transform,
- Fourier Transform, Z- transform and
- Numerical Methods.

Syllabus

Unit 1: Transform Calculus-1: Polynomials – Orthogonal Polynomials – Lagrange's, Chebysev Polynomials; Trigonometric Polynomials. Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.

Unit 2: Transform Calculus-2: Fourier transforms, Z-transform: Properties, methods, inverses and their applications.

Unit 3: Vector differentiation, gradient, divergence and curl, line and surface integrals, path independence, statements and illustrations of theorems of Green, Stokes and Gauss, arc length parameterization, applications.

COURSE OUTCOME:

- To understand Laplace Transform and its applications
- To solve problems on Fourier Transform, Z Transform and their applications
- To solve the curl, gradient and divergence
- To apply the applications curl, gradient and divergence in various theorems in various applications

TEXT/REFERENCES BOOKS

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9 th Edition, John Wiley & Sons,2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
3. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
4. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
5. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

INDIAN CONSTITUTION

MC01

L	T	P	CR		
				Theory	**75**
2	**0**	**0**	**0**	**Class Work**	**25**
Duration of Exam: 3 Hrs				**Total**	**100**

Course Objectives

- To gain knowledge about Historical perspectives, salient features and Characteristics of CoI .
- To gain knowledge about various schemes of Fundamental Rights, Fundamental Duties, Article-19 & Article 21 and D.P.S.P
- To know about the basic structure of the Government of India.
- To know about Constitutional Amendments and Emergency Provisions.
- To gain knowledge about the Local Government of India and its Three Tier Structure.

Syllabus

Unit 1: Meaning of the terms: Constitution, Constitutional Laws and Constitutionalism. History of Indian Constitution -Company rule and Crown Rule. Salient features and Characteristics of Constitution of India.

Unit 2: Part-1to Part-V of Constitution of India. Various Schemes of Fundamental Rights, Scheme of Fundamental Duties and its legal status, DPSP- Its importance and implementation.

Unit 3: Federal Structure and distribution of Legislative and Financial Powers between the Union and the States. Parliamentary form of Government in India- The Constitution Power and the Status of President of India.

Unit 4: Amendments of the Constitutional Powers and Procedure. The Historical Perspectives of the Constitutional Amendments in India. Various Emergency Provisions in India.

Unit 5: Local Self Government-Its three-tier structure and Constitutional scheme of India.

COURSE OUTCOMES:

On successful completion of this course the student should be able to:

- Understand the Historical Perspective of Constitution of India.
- Understand various schemes and scope of Fundamental Rights, Fundamental Duties and D.P.S.P
- Understand the Type of Government in India and its Federal Structure.
- Understand Constitutional Amendments and Emergency Provisions in India.
- Understand Local Self Government and its three tier structure.

REFERENCE BOOKS

1. The Constitutional Law of India 9th Edition, by Pandey. J.N
2. The Constitution of India by P.M Bakshi.
3. Constitutional Law of India by Narender Kumar.

Essence of Indian Traditional Knowledge भारतीय विद्यासार								
MC02								
L	**T**	**P**	**CR**				**Theory**	**75**
2	**0**	**0**	**0**				**Class Work**	**25**
Duration of Exam: 3 Hrs							**Total**	**100**

Course Objective:

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.

Part-I focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

Basic structure of Indian Knowledge System: अष्टादशविद्या -४वेद,४उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थापत्य आदि) ६वेदांग (शिक्षा, कल्प, निरुक्त, व्याकरण, ज्योतिष, छंद) ४ उपाङ्ग (धर्मशास्त्र, मीमांसा, पुराण, तर्कशास्त्र)

Course Contents

−Yoga and Holistic Health care
−Case studies

REFERENCE BOOKS:

- V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya VidyaBhavan, Mumbai. 5th Edition, 2014
- Swami Jitatmanand, Modern Physics and Vedant, BharatiyaVidya Bhavan
- Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
- Fritz of Capra, Tao of Physics
- Fritz of Capra, The Wave of life
- VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam
- Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata
- GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016
- RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi Prakashan, Delhi 2016
- P B Sharma (English translation), Shodashang Hridayan

Pedagogy: Problem based learning, group discussions, collaborative mini projects.

COURSE OUTCOME:

- Ability to understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.

Engineering Mechanics

ESC01

L	T	P	CR		
				Theory	**75**
3	**1**	**0**	**4**	**Class Work**	**25**
Duration of Exam: 3 Hrs				**Total**	**100**

Course Objectives:

- To provide an introductory treatment of Engineering
- To give a working knowledge of statics with emphasis on force equilibrium and free body diagrams.
- To provide an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems.
- To give an understanding of the mechanical behaviour of materials under various load conditions

Syllabus

Unit 1: Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminancy

Unit 2: Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.

Unit 3: Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;

Unit 4: Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia-Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Unit 5: Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

Unit 6: Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's

2nd law (rectangular, path, and polar coordinates). Work-kinetic energy power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

Unit 7: Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

Unit 8: Mechanical Vibrations covering, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums; Tutorials from the above Units covering, To find the various forces and angles including resultants in various parts of wall crane, roof truss, pipes, etc.; To verify the line of polygon on various forces; To find coefficient of friction between various materials on inclined plan; Free body diagrams various systems including block-pulley; To verify the principle of moment in the disc apparatus; Helical block; To draw a load efficiency curve for a screw jack

COURSE OUTCOMES:

On successful completion of this course, the students should be able to:

- Use scalar and vector analytical techniques for analyzing forces in statically determinate structures
- Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems
- Apply basic knowledge of maths and physics to solve real-world problems, Understand measurement error, and propagation of error in processed data.
- Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts);
- Understand basic dynamics concepts – force, momentum, work and energy; Understand and be able to apply Newton's laws of motion;
- Understand and be able to apply other basic dynamics concepts - the Work-Energy principle, Impulse-Momentum principle and the coefficient of restitution;
- Extend all of concepts of linear kinetics to systems in general plane motion (applying Euler's Equation and considering energy of a system in general plane motion, and the work of couples and moments of forces)
- Learn to solve dynamics problems. Appraise given information and determine which concepts apply, and choose an appropriate solution strategy; and Attain an introduction to basic machine parts such as pulleys and mass-spring systems.

TEXT/REFERENCE BOOKS:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer‟s Engineering Mechanics

8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
9. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
10. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

Semiconductor Devices Lab

EEN 351

L T P CR	**Final Marks**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
Duration of Exam: 3 Hrs	**Total**	**:**	**50**

List of Experiments

1. Study and plot of VI Characteristics of PN junction diode.
2. Study and plot of VI Characteristics of Zener diode.
3. Study and plot of Common Base(CB) Configuration characteristics of transistor.
4. Study and plot of Common Emitter (CE) configuration characteristics of transistor.
5. Study of Common Collector (CC) amplifier as a buffer.
6. Study and verification of Zener diode as a voltage regulator.
7. Study and plot output waveform of half and full wave rectifier.
8. Study and plot output waveform of clipper and clamper circuit.
9. Study of 3-terminal IC regulator.
10. Study of LED, photo diode and solar cell.
11. Study and plot response of FET common source amplifier.
12. Study and plot of FET common Drain amplifier.

COURSE OUTCOMES:

On successful complete of this course, the students should be able to:

- Understand the characteristics of PN junction diode.
- Understand the application of diode & Zener diode experimentally.
- Obtain input and output characteristics of transistors in CE, CB & CC configurations.
- Plot and analyse FET characteristics.
- Write experimental reports and work in a team in professional way.

Digital Electronics Lab

EEN 352

L T P CR	**Final Marks**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
Duration of Exam: 3 Hrs	**Total**	**:**	**50**

List of Experiments

1. Study of TTL gates – AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.

2. Design & realize a given function using K-maps and verify its performance.

3. To verify the operation of multiplexer & Demultiplexer.

4. To verify the operation of comparator.

5. To verify the truth tables of S-R, J-K, T & D type flip flops.

6. To verify the operation of bi-directional shift register.

7. To design & verify the operation of 3-bit synchronous counter.

8. To design and verify the operation of synchronous UP/DOWN decade counter using J K flip-flops & drive a seven-segment display using the same.

9. To design and verify the operation of asynchronous UP/DOWN decade counter using J K flip-flops & drive a seven-segment display using the same.

10. To design & realize a sequence generator for a given sequence using J-K flip-flops.

11. Study of CMOS NAND & NOR gates and interfacing between TTL and CMOS gates.

12. Design a 4-bit shift-register and verify its operation. Verify the operation of a ring counter and a Johnson counter.

13. To realize the given function using decoder and OR gate.

COURSE OUTCOME:

On the successful competition of this course, the students should be able to:

- Verify the operation of basic & universal gates and Design & verification of combinational circuits.
- Verify the operations of different type of flip flops.
- Design the counters using flip flops for a given sequence.
- Verify the working of shift registers.
- Write experimental reports and work in a team in professional way

Circuit Analysis and Synthesis Lab

EEN 353

L T P CR	**Final Marks**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
Duration of Exam: 3 Hrs	**Total**	**:**	**50**

List of Experiments

1. Transient response of RC circuit.
2. Transient response of RL circuit.
3. To find the resonance frequency, Band width of RLC series circuit.
4. To calculate and verify ―Z" parameters of a two port network.
5. To calculate and verify "Y" parameters of a two port network.
6. To determine equivalent parameter of parallel connections of two port network.
7. To plot the frequency response of low pass filter and determine half-power frequency.
8. To plot the frequency response of high pass filters and determines the half-power frequency.
9. To plot the frequency response of band-pass filters and determines the band-width.
10. To calculate and verify "ABCD" parameters of a two port network.
11. To synthesize a network of a given network function and verify its response.
12. Introduction of P-Spice

COURSE OUTCOMES:

On successful complete of this course, the students should be able to:

- Design RC & RL circuits and check their transient response and frequency response experimentally.
- Analyse the circuits of two port network and verify ABCD,‘Z‘ & Y‘ parameters of two port network.
- Design & plot the frequency response of low pass filter, high pass filter & band-pass filter experimentally.
- Write experimental reports and work in a team in professional way.

Electronics Project Workshop-I

ES 303

L T P CR	**Final Marks**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
Duration of Exam: 3 Hrs	**Total**	**:**	**50**

List of Problems

1. Testing of Electronics Devices

   i) Diode ii) Transformer iii) Capacitors iv) Inductor

2. Design, Fabrication, Testing & Measurement of half & full wave rectifier
3. Design and fabrication of fixed & variable regulators (Zenes, Transistor and IC)
4. Design of transistor as a switch, amplifier and multivibrator.
5. To study of 555 as Astable, Monostable, Bistable multivibrator.
6. To design various applications of OP amp such as

   1) Amplifiers (Inverting & Non Inverting)

   2) Adder, Subtractor & scale changer

   3) Integrator and differentiator

   4) Oscillator and Schmitt trigger

7. Mini project based on anolog circuits of above.

COURSE OUTCOME:

On the successful competition of this course, the students should be able to:

- Test various electronics component and devices
- Verify the operations of different type semiconductor devices.
- Design different types of multivibrators using 555 Timer.
- design different circuits using OP-Amps
- Write experimental reports and work in a team in professional way

Semester IV
Syllabus

B.TECH 2nd YEAR ELECTRONICS ENGINEERING (SEMESTER –IV)
COURSE STRUCTURE

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	EEN401	Principle of Communication Systems	3	0	0	3	25	75	100
2.	PCC	ECP402	Analog Electronics Circuits	3	0	0	3	25	75	100
3	PCC	EEN402	Measurement and Instrumentation	3	0	0	3	25	75	100
4	PCC	ECC02	Electromagnetic Waves	3	0	0	3	25	75	100
5	PCC	EEN403	Data Structures and Algorithms	3	1	0	4	25	75	100
6	BSC	BSC01	Biology	2	1	0	3	25	75	100
7	PCC	EEN451	Communication Systems lab	0	0	2	1	15	35	50
8	PCC	ECP452	Analog Electronics Circuits lab	0	0	2	1	15	35	50
9	PCC	EEN452	Measurement and Instrumentation lab	0	0	2	1	15	35	50
10	PCC	EEN453	Electromagnetic Waves lab	0	0	2	1	15	35	50
11	PROJ	ES402	Electronics Project Workshop-II	0	0	6	3	30	70	100
				17	**2**	**14**	**26**	**240**	**660**	**900**

NOTE : (1) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration

(2) Theory Exam of each subject will consist of two sections i.e Section A and Section B. Section A is Compulsory having 10 short answer type questions and should cover the entire syllabus. Section B should have six questions covering the whole syllabus and the students are required to attempt any four questions out of six.

(3) Additional 3 credits per year to be earned through MOOCs

Principle of Communication Systems

EEN401					
L	**T**	**P**	**CR**	**Theory**	**75**
3	**0**	**0**	**3**	**Class Work**	**25**
Duration of Exam: 3 Hrs				**Total**	**100**

Course Objectives:

- To learn about the basics of communication systems and different types of signal used for communication.
- To understand the Amplitude modulation and its different types.
- To describe the concept of Angle modulation.
- To understand digital modulation and different digital modulation techniques.
- To introduce the students about noise.

Syllabus

UNIT 1: INTRODUCTION TO COMMUNICATION SYSTEMS:
The essentials of a Communication system, modes and media's of Communication, Classification of signals

UNIT2: AMPLITUDE MODULATION:
Amplitude modulation, Generation of AM waves, Demodulation of AM waves, DSBSC, Generation of DSBSC waves, Coherent detection of DSBSC waves, single side band modulation, generation of SSB waves, demodulation of SSB waves, vestigial sideband modulation (VSB).

UNIT3: ANGLE MODULATION:
Basic definitions: Phase modulation (PM) & frequency modulation (FM), narrow band frequency modulation, wideband frequency modulation, generation of FM waves, Demodulation of FM waves.

UNIT4: PULSE MODULATION:
Sampling theory, pulse amplitude modulation (PAM), pulse time modulation., Elements of pulse code modulation, Quantization, Uniform & nonuniform Quantization, Necessity of nonuniform quantization, A law of Companding, μ law of companding, Quantization error in PCM, transmission BW of PCM, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, TDM, FDM.

UNIT5: DIGITAL MODULATION TECHNIQUES:
ASK, Generation and detection of ASK, FSK Generation and detection of FSK, BPSK , Generation & detection of BPSK, QPSK, generation and detection of QPSK, DPSK, M-ary PSK.

UNIT6: INTRODUCTION TO NOISE:
External noise, internal noise, S/N ratio, noise figure, noise temperature.

COURSE OUTCOMES:

After studying this course, the students are be able to

- Understand the basics of communication systems and different types of signal used for communication.
- Describe and understand the Amplitude modulation and its different types.
- Explain and analyse the concept of Angle modulation.
- Learn the concept of Digital modulation and different digital modulation techniques.
- Introduce the concept of noise and its effect on communication systems

TEXT/ REFERENCE BOOKS:

1. Communication systems (4th edn.): Simon Haykins; John wiley & sons.
2. Communication systems: Singh & Sapre; TMH.
3. Electronic Communication systems: Kennedy; TMH.
4. Communication Electronics: Frenzel; TMH.
5. Communication system: Taub & Schilling; TMH.
6. Communication systems: Bruce Carlson.

Analog Electronics Circuits

ECP 402

L	T	P	CR		
				Theory	**75**
3	**0**	**0**	**3**	**Class Work**	**25**
Duration of Exam: 3 Hrs				**Total**	**100**

Course Objectives:

- To Describe the basic concept of Diode and its application
- To understand the basic concepts of transistor and its circuits
- To explore the concepts of FET and its circuit
- To understand the concepts of various types of amplifier and their efficiency.
- To learn about oscillators and its various types.
- To understand Operational amplifier and design its linear & nonlinear applications.

Syllabus

Unit 1: DIODE CIRCUITS

P-N junction diode, V-I characteristics of a diode; review of halfwave and full-wave rectifiers, Zener diodes, clamping and clipping circuits, voltage multiplier circuits.

Unit 2: BJT & BIASING CIRCUITS

Structure and V-I characteristics of a BJT, BJT as an amplifier, common-emitter, common-base and common collector amplifiers; Analysis of transistor amplifier circuits using h parameters. Biasing: operating point, bias stability, stability factor, and different biasing methods.

Unit 3: FET CIRCUITS

Junction field effect transistor, pinch off voltage, V-I characteristics, small signal model, common source amplifier, source follower, biasing of FET, application of FET as VVR.

Unit 4: MULTI-STAGE AND POWER AMPLIFIERS

Frequency response of an amplifier, R C coupled amplifier, low frequency response of RC coupled amplifier, various classes of operation (Class A, B, AB, C etc), their power efficiency.

Unit 5:OSCILLATORS

Review of the basic concept, Barkhausen criterion, RC oscillators (Phase Shift, Wein Bridge), LC oscillators (Hartley, Colpitt, Clapp), non-sinusoidal oscillators.

Unit 6: OPERATIONAL AMPLIFIER

Ideal and practical operational amplifier, inverting and non inverting amplifier, differential amplifier, offset error: voltage and current, common mode rejection ratio (CMRR).

Unit 7:LINEAR & NONLINEAR APPLICATIONS OF OP-AMP

Scale changer, phase shifter, adder, subtractor, integrator, differentiator, comparators, schimitt trigger, zero crossing detector, active filters, precision rectifier.

COURSE OUTCOMES:

On successful complete of this course, the students should be able to:

- Analyse and solve different circuits using Diodes
- Understand the concepts of transistor and analyse various applications of Transistors
- Evaluate the concepts of FET and its circuits.

- Implement the concept of transistor for different types of amplifiers and oscillators
- Understand basics of Operational amplifier and design its circuits for linear and non linear applications.

TEXT/ REFERENCE BOOKS:

1. Integrated Electronics: MilmanHalkias,TMH.
2. Operational Amplifiers: Gaikwad,PHI
3. Electronic Circuit Analysis and Design (Second edition) : D.A.Neamen;TMH
4. Integrated Circuits: K RBotkar.
5. Linear Integrated Circuits : D R Chaudhary(WEL).
6. Electronics Devices & Circuits: Boylestad&Nashelsky ;Pearson

Measurements and Instrumentation

EEN402

L	T	P	CR		
3	0	0	3	Theory	75
				Class Work	25
Duration of Exam: 3 Hrs				Total	100

Course Objectives

- To understand the fundamentals of various types of Instruments.
- To understand the principle, working and applications of voltmeter, AC, DC Meters. Digital Voltmeters
- To introduce the principle, working and applications of signal analysers
- To introduce the principle, working and applications of various types of AC and DC bridges.
- To introduce the principle, working and applications of oscilloscopes
- To introduce the principle, working and applications different types of transducers

Syllabus

UNIT I: Introduction
Block Schematics of Measuring Systems, Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors. Gaussian Error, Root Sum Squares formula. Dynamic Characteristics, Repeatability. Reproducibility. Fidelity, Lag; Measuring Instruments: DC Voltmeters, D'Arsonval Movement. DC Current Meters, AC Voltmeters and Current Meters. Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

UNIT 2: Electronic Voltmeters, Multimeters, AC, DC Meters. Digital Voltmeters:
Electronic Voltmeters, Multimeters, AC, DC Meters. Digital Voltmeters: Ramp Type, Staircase Ramp, Dual slope_ Integrating type, Successive Approximation Type, Auto ranging, 31/2, 33/4 Digit display, Pico ammeter, High Resistance Measurements, Low Current Ammeter, Applications; Signal Generators: AF, RF Signal Generators. Sweep frequency Generators, Pulse and Square wave Generators, Function Generators. Arbitrary waveform Generator, Video signal Generators, Specifications.

UNIT 3: Signal Analyzers:
Signal Analyzers: AF, HF Wave Analyzers. Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators.

UNIT 4: DC and AC Bridges:
DC and AC Bridges: Wheat stone Bridge. Kelvin Bridge, AC Bridges, Maxwell, Hay, Sobering, Wien, Anderson Bridges, Resonance Bridge. Similar Angle Bridge. Wagner's' ground connection. Twin T, Bridged T Networks, Detectors.

UNIT 5: Oscilloscopes:
Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes. High Frequency CRO Considerations. Delay lines. Applications, Specifications. Special purpose oscilloscopes: Dual Trace, Dual Beam CROs. Sampling oscilloscopes. Storage oscilloscopes. Digital Storage CROs. Frequency Measurement, Period Measurement, Errors in

Time/Frequency measurements, universal counters. Extension of range: Recorders: Strip-Chart. X-Y. Oscillographic recorders.

UNIT 6: Transducers and Measurement of Physical Parameters:
Transducers: Classification, Strain gauges, Bonded, unbounded; Force and Displacement Transducers. Resistance Thermometers. Hotwire Anemometers, LVDT, Thermocouples, Special Resistance Thermometers, Digital Temperature sensing system. Piezoelectric Transducers, Variable Capacitance Transducers. Magneto strictive Transducers. Measurement of Physical Parameters: Flow Measurement. Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure - High Pressure, Vacuum level, Temperature -Measurements, Data Acquisition Systems.

COURSE OUTCOMES:

On successful completion of this course, the students should be able to:

- Understand different parameters effecting performance of measuring instruments.
- Use different types of voltmeter, multimeter, AC, DC meter.
- Understand working and application of signal analyser
- Determine the circuit parameters using AC and DC bridges.
- Understand the principle, working and applications of various types of CROs
- Select transducers for the measurement of various electrical and physical quantities.

TEXT / REFERENCE BOOKS:

1. Electronic Measurements and Instrumentation - K. Lai Kishore, Pearson Education 2010.
2. Electronic Instrumentation: H.S.Kalsi -TMH, 2*Edition 2004.
3. Electronic instrumentation and measurement technique: W.D. Cooper & A.D. Helfrick Cooper
4. Electronic Instrumentation and Measurements - David A. Bell, Oxford Univ. Press, 1997.
5. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs. W.D. Cooper, PHI Edition 2003.
6. Electronic Measurements and Instrumentation: B.M. Oliver, J.M. Cage TMH Reprint 2009.
7. Industrial Instrumentation: TR. Padmanabham Springer 2009.
8. A course in Electrical and Electronic measurement and instrumentation: A.K. Sawhney, Dhanpat Rai Publication.

Electromagnetic Waves

ECC 02

L	T	P	CR		
3	0	0	3	Theory	75
				Class Work	25
Duration of Exam: 3 Hrs				Total	100

Course Objectives:

- To introduce the concept of Transmission line, no loss transmission and understanding the concept of Smith Chart.
- To give exposure to the students regarding the physical meaning and importance of Maxwell's equation and how it derived from basic laws of Electromagnetic.
- To introduce how the Electromagnetic waves are formed, its propagation in different medium and the concept of Poynting Vector.
- To introduce the phenomenon of Reflection or refraction of wave when strikes obliquely or normally to any surface.
- To introduce the concept of travelling of wave in waveguides and other phenomena.
- To impart the knowledge of principle of radiation and radiation characteristics of an antenna.

Syllabus

Unit 1: Transmission Lines: Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines, Impedance Matching, use transmission line sections as circuit elements.

Unit 2: Maxwell's Equations- Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface.

Unit 3: Uniform Plane Wave: Uniform plane wave, Propagation of wave, Wave polarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor

Unit 4: Plane Waves at a Media Interface: Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

Unit 5: Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Unit 6: Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna,

COURSE OUTCOMES:

On successful completion of this course, the students should be able to:

- Understand characteristics and wave propagation on high frequency transmission lines as well as carryout impedance transformation on TL.
- Use sections of transmission line sections for realizing circuit elements.
- Characterize uniform plane wave and calculate reflection & transmission of waves at media interface.
- Analyze wave propagation on metallic waveguides in modal form.
- Understand principle of radiation and radiation characteristics of an antenna.

TEXT/REFERENCE BOOKS:

- R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005.
- E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India.
- Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
- David Cheng, Electromagnetics, Prentice Hall.

Data Structure and Algorithms

EEN 403

L	T	P	CR		
				Theory	**75**
3	**0**	**0**	**3**	**Class Work**	**25**
Duration of Exam: 3 Hrs				**Total**	**100**

Course Objectives:

- To study in detail the concept of Loops, Conditional statements, Arrays, Functions, structures, file handling file concepts, file organization
- To understand link list, Header Link list, Multiway link list and perform various data structure operations.
- To learn the concept of stack and Queues and implement the same using array and link list form.
- To implement Binary Trees type and implement the same in array and link list form.
- To study the Graphs using set, linked and matrix representation.
- To understand and implement file handling concepts.

Syllabus

Unit 1: Overview, Flow of Control, Input output functions, Arrays and Structures, Functions.

Unit 2: Data structures and Algorithms an overview: concept of data structure, choice of right data structures, types of data structures, basic terminology Algorithms, how to design and develop an algorithm, Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off

Unit 3: Arrays Operations Defined: traversal, selection, searching, insertion, deletion, and sorting, Multidimensional arrays, Searching: Linear search, Recursive and Non recursive binary Search. Sorting: Selection sort, Bubble sort, Insertion sort, Merge sort, Quick sort, Shell sort, Heap sort

Unit 4: Stacks and queues: Stacks, array representation of stack, Applications of stacks, Queues, Circular queues, array representation of Queues, Deque, priority queues, Applications of Queues.

Unit 5: Linked Lists: Concept of a linked list, Circular linked list, doubly linked list, operations on linked lists. Concepts of header linked lists. Applications of linked lists, linked stacks, linked Queues.

Unit 6: Tree and Graphs: Trees: Introduction to trees, binary trees, representation and traversal of trees, operations on binary trees, types of binary trees, threaded binary trees, B Trees, Application of trees. Graphs: Introduction, terminology, set, linked and matrix representation, Graph traversal techniques: BFS, DFS, operations on graphs, Minimum spanning trees, Applications of graphs.

Unit 7: File Handling and Advanced data Structure: Introduction to file handling, Data and Information, File concepts, File organization, files and streams, working with files.

AVL

trees, Sets, list representation of sets, applications of sets, skip lists

COURSE OUTCOMES:

On successful complete of this course, the students should be able to:

- Understand the programming of one computer language from basic to advance level.
- Implement the Concept of link list, stack, queue, binary tree its usage in real life.
- Describe the Working of binary trees and graph with their applications.
- Understand the concept of files and their organization of memory.

REFERENCE/TEXT BOOKS:

1. Data Structures using C by A. M. Tenenbaum, Langsam, Moshe J. Augentem, PHI Pub.
2. Data Structures using C by A. K. Sharma, Pearson
3. Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low Priced Edition.
4. Fundamentals of Data structures by Ellis Horowitz & SartajSahni, Pub, 1983,AW
5. Fundamentals of computer algorithms by Horowitz Sahni and Rajasekaran.
6. Data Structures and Program Design in C By Robert Kruse, PHI,
7. Theory & Problems of Data Structures by Jr. SymourLipschetz, Schaum_s outline by TMH.
8. Introduction to Computers Science -An algorithms approach , Jean Paul Tremblay, Richard B. Bunt, 2002, T.M.H.

Biology

BSC01

L	T	P	CR		
2	1	0	3	Theory	75
				Class Work	25
Duration of Exam: 3 Hrs				Total	100

Course Objectives:

- To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.
- "Genetics is to biology what Newton‟s laws are to Physical Sciences",
- all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine,
- without catalysis life would not have existed on earth,
- molecular basis of coding and decoding (genetic information) is universal and that
- fundamental principles of chemical and physical energy transactions are the same in physical/chemical and biological world.

Syllabus

Module 1:(2 hours)- Introduction

Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Module 2: (3 hours)- Classification

Purpose: To convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification.

Discuss classification based on

a) cellularity- Unicellular or multicellular
b) ultrastructure- prokaryotes or eucaryotes
c) Energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes
d) Ammonia excretion – aminotelic, uricoteliec, ureotelic
e) Habitata- acquatic or terrestrial
f) Molecular taxonomy- three major kingdoms of life.

A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M.musculus

Module 3: (4 hours)-Genetics

Purpose: To convey that "Genetics is to biology what Newton‟s laws are to Physical Sciences" Mendel‟s laws, Concept of segregation and independent assortment. Concept of allele.Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to off spring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Module 4:(4 hours)-Biomolecules

Purpose To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA.Two carbon units and lipids.

Module 5: (4 Hours). Enzymes

Purpose: To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions. Enzyme classification .Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Module 6: (4 hours)- Information Transfer

Purpose: The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

Module 7:(5 hours). Macromolecular analysis

Purpose: How to analyses biological processes at the reductionistic level Proteins structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

Module 8: (4 hours)- Metabolism

Purpose: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Module 9: (3 hours)- Microbiology

Purpose: Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy, Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

COURSE OUTCOMES

1. Classify enzymes and distinguish between different mechanisms of enzyme action.
2. Identify DNA as a genetic material in the molecular basis of information transfer.
3. Analyze biological processes at the reductionist level
4. Apply thermodynamic principles to biological systems.
5. Identify and classify microorganisms.

TEXT/ REFERENCE BOOKS:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.;Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Communication Systems Lab

EEN451

L T P CR	**Final Marks**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
Duration of Exam: 3 Hrs	**Total**	**:**	**50**

List of Experiments

1. Study of Amplitude Modulation and determination of Modulation index.
2. Study of Frequency Modulation and determination of Modulation index.
3. Study of Phase Modulation.
4. Study of Pulse Amplitude Modulation.
5. Study of Pulse Width Modulation.
6. Study of Pulse Frequency Modulation.
7. Study of Pulse Code Modulation (PCM)
8. Study of Frequency Shift Keying (FSK)
9. Study of Amplitude Shift Keying (ASK)
10. Study of Pulse Shift Keying (PSK).
11. Study of Delta modulation

COURSE OUTCOMES:

On successful complete of this course, the students should be able to:

- Demonstrate about various blocks in communication system.
- Analyze the types of modulations.
- Analyze and design the analog modulator and demodulator circuits.
- Generate the waveforms of AM,FM, PM, PWM,PPM and PAM.
- Calculate Power relations in Amplitude and Frequency modulated waves.
- Write experimental reports and work in a team in professional way

Analog Electronics Circuits Lab

ECP452

L T P CR	**Final Marks**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
Duration of Exam: 3 Hrs	**Total**	**:**	**50**

List of Experiments

1. Study of Half wave & Full wave rectifiers.
2. Study of Diode as clipper and clamper.
3. Study of CE amplifier for voltage, current & Power gains and input, output impedances
4. Study of CC amplifier as a buffer
5. Design & realize inverting amplifier, non-inverting and buffer amplifier using 741 OP AMP.
6. Verify the operation of a differentiator circuit using 741 OP-AMP and show that it acts as a high pass filter.
7. Verify the operation of a integrator circuit using 741 OP-AMP and show that it acts as a low pass filter.
8. Design and verify the operations of OP-AMP adder and subtractor circuits.
9. Design and realize Wein-bridge oscillator using op amp741
10. To design & realize Schmitt trigger using op amp741.
11. To design & realize square wave generator using op amp741.
12. To design & realize zero crossing detector using op amp741

COURSE OUTCOMES:

On successful complete of this course, the students should be able to:

1. Understand the operation of half wave & full wave rectifier.
2. Understand the application of diode experimentally.
3. Understand the transistor as an amplifier.
4. Implement amplifiers, differentiator, Integrator and active filters circuit using OP-AMP. Design op-amp as Wein-Bridge Oscillator, Square Wave Generator, Schimtt trigger and zero crossing detector.
5. Write experimental reports and work in a team in professional way.

Measurement and Instrumentation Lab

EEN452

L T P CR	**Final Marks**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
Duration of Exam: 3 Hrs	**Total**	**:**	**50**

List of Experiments

1. To measure unknown frequency using CRO by Lissajous pattern
2. Find the value of unknown resistance using Wheatstone Bridge.
3. To find value of unknown resistance using Kelvin Double Bridge
4. To study AC bridges (Hay‘s bridge, Maxwell bridge, Schering bridge)
5. To measure unknown frequency using CRO by Lissajous pattern
6. To determine output characteristics of LVDT and measure displacement using LVDT
7. To study characteristics and measurement of temperature using thermocouple/ thermistor/ RTD
8. Measurement of displacement using strain Gauge based displacement transducer
9. Measurement of displacement using magnetic pickup.
10. To study differential pressure transducer & signal conditioning of output signal.
11. Measurement of level using capacitive transducer.
12. To study of distance measurement using ultrasonic transducer.

COURSE OUTCOMES:

On successful completion of this course, the students should be able to:

- Measure Resistance /capacitance/ Inductance using ACX and DC bridges.
- Understand working and application of signal analyser
- Understand working principle and applications of CRO.
- Selection and application of transducers for the measurement of various electrical and physical quantities.

Electromagnetic Waves Lab

EEN453

L T P CR	**Final Marks**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
Duration of Exam: 3 Hrs	**Total**	**:**	**50**

List of experiments

1. To study the microwave Test Bench.
2. To study and plot V-I characteristics of Gunn diode and to determine the threshold voltage.
3. To study and plot characteristics of the reflex klystron tube and to determine its electronic tuning range.
4. To study EMFT/ transmission line trainer kit ME 1200 and RF analyser.
5. To measure voltage at different points of transmission line using experimental Kit ME 1200 when its far end is properly terminated.
6. To measure voltage at different points of transmission line using experimental Kit ME 1200 when its far end is open circuited.
7. To measure voltage at different points of transmission line using experimental Kit ME 1200 when its far end is short circuited.
8. To calculate Voltage Standing Wave Ratio of a transmission line using experimental kit ME 1200, when the far end is open circuited.
9. To calculate Voltage Standing Wave Ratio of a transmission line using experimental kit ME 1200, when the far end is short circuited.
10. Introduction to Impedance Transformation Using Single-Stub Transmission Line Networks.

COURSE OUTCOMES:

On successful completion of this course, the students should be able to:

- Learn microwave test bench and different components used for microwaves.
- Determine threshold voltage of Gunn diode and electronic Tuning range of Reflex klystron.
- Use the Vector analyser and experimental kit ME1200 for different applications of Transmission line.
- Measure Voltage, current and standing wave ratio of transmission line when it is properly terminated, short circuited and open circuited.

जे. सी. बोस विज्ञान एवं प्रौद्योगिकी विश्वविद्यालय, वाई एम.सी.ए. फरीदाबाद
J.C. BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA
SECTOR -6, MATHURA ROAD, FARIDABAD, HARYANA-121006
(Established vide Haryana State Legislative Act No. 21 of 2009)
'A' GRADE NAAC Accredited

Program: B.Tech. (Electronics Engineering (in specialization in IOT)(2019-20)

Mapping of the Courses with the Employability/Entrepreneurship/Skill Development

Sr. No.	Course Name	Course Code	Employ ability	Entrepreneurship	Skill Development
1	Physics (Waves and Optics)	BSC101C			√
2	Mathematics-I (Calculus and Linear Algebra)	BSC103 D			√
3	Engineering Graphics & Design	ESC102	√		√
4	Programming for Problem solving	ESC103			√
5	Workshop- I	ESC104	√		√
6	Physics (Waves and Optics) lab	BSC104C			√
7	Programming for Problem solving Lab	ESC105	√		√
8	Mathematics-II	BSC106 D			√
9	Basic Electrical Engineering/ Basic Electrical Technology	ESC101/ ESC101A*			√
10	Chemistry	BSC102			√
11	Workshop- II	ESC106	√		√
12	English	HSMC101			√
13	Basic Electrical Engineering Lab/ Basic Electrical Technology lab	ESC107/ ESC107A*	√		√
14	Chemistry Lab	BSC105			√
15	English Lab	HSMC102			√
16	Digital Electronics	EEN 301		√	√
17	Semiconductor Devices	ECP302	√		√

18	Signal and Systems	ECC01	√		√
19	Circuit Analysis and Synthesis	ECP305	√		√
20	Mathematics-III	BS301			√

	Indian Constitution/ Essence of Indian Traditional Knowledge	MC01/ MC02			√
22	Engineering mechanics	ESC01	√		√
23	Semiconductor Devices Lab	EE351	√		√
24	Digital Electronics Lab	EE352	√		√
25	Circuit Analysis and Synthesis lab	EE353			√
26	Electronics Project Workshop-I	ES301	√		√
27	Principle of Communication systems	EEN401	√		√
28	Analog Electronics Circuits	ECP402	√	√	√
29	Measurement and Instrumentation	EEN402	√	√	√
30	Electromagnetic Waves	ECC02	√		√
31	Data Structures and algorithms	EEN403	√		√
32	Biology	BSC01	√		√
33	Communication Systems lab	EE451	√	√	√
34	Analog Electronics Circuits lab	EE452	√	√	√
35	Measurement and Instrumentation lab	EEN453	√	√	√
36	Electromagnetic Waves lab	EE454	√	√	√
37	Electronics Workshop-II	ES402	√	√	√

Chairperson (Electronics Engg
Meeting
16/8/2021