Curriculum Structure & Syllabi

(As per National Education Policy 2020)

of

B.Tech.

In

ELECTRONICS AND COMMUNICATION ENGINEERING

(w.e.f. 2021-2022)

Vision

Mission

Program Educational Objectives

Program Outcomes

Program Specific Outcomes

Overall Credit Structure

Curriculum

Syllabus

Offered By

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

M. M. M. UNIVERSITY OF TECHNOLOGY

GORAKHPUR-273010, UP

August 2022

CURRICULA & SYLLABI
B. Tech. Electronics and Communication Engineering

Vision:

To become a leader of education, research and innovation in the area of Electronics and Communication Engineering and to train students to be innovative and well prepared professionals in the area of Electronics and Communication Engineering.

Mission:

1. Educate and mentor students to meet the current as well as future challenges by providing them with a firm foundation in both theory and practice of Electronics and Communication Engineering.
2. Create, develop and disseminate new knowledge by top quality applied research in Electronics and Communication Engineering by interacting with government agencies and private industry.
3. Promote a sense of leadership and service to the society.

Program Educational Objectives (PEOs)

PEO-1: Excel in professional career and/or higher education by acquiring knowledge in area of Electronics and Communication Engineering.

PEO-2: Analyze real life problems, design appropriate system to provide solutions that are technically sound, economically feasible and socially acceptable.

PEO-3: Exhibit professionalism, ethical attitude, communication skills, teamwork in their profession and adapt to current trends by engaging in life-long learning.

Programs Outcomes (POs)

B.Tech. Electronics and Communication Engineering students will demonstrate the ability to:

PO-1 **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO-2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3 **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-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.

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

PO-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 the professional engineering practice.

PO-7 **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8 **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO-9 **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO-10 **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11 **Project management and finance**: Demonstrate knowledge and understanding of the engineering 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.

PO-12 **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programs Specific Outcomes (PSOs)

PSO-1 An ability to understand the concepts of basic Electronics & Communication Engineering and to apply them to various areas like Signal processing, VLSI, Embedded systems, Communication Systems, Digital & Analog Devices, etc.

PSO-2 An ability to solve complex Electronics and Communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.

PSO-3 Wisdom of social and environmental awareness along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.

Syllabus and Credit Structure for B. Tech. (Electronics and Communication Engineering)
(Session 2021-2022 and onwards)

OVERALL CREDIT STRUCTURE FOR B.TECH. (ECE) PROGRAM

Credit Courses			
Core Courses (CC)		**Electives Courses (EC)**	
Category	**Min. Credits**	**Category**	**Min. Credits**
Basic Sciences & Maths (BSM)	18	Program Electives (PE)	12
Engineering Fundamentals (EF)	18	Open Electives (OE) (Other Departments)	3
Professional Skill (PS)	4		
Program Core (PC)	64	Humanities & Social Science elective (HSSE)	2
Management (M)	4		
Humanities & Social Science (HSS)	6		
Project (P)	5		
Seminar (S)	2		
Industrial Practice (IP)/ Industrial Elective (IE)	12		
Program link basic science and engineering courses (PLBSE) (To be decided by the department)	15		
Sub-total	**148**	**Sub-total**	**17**
Grand Total	**165**		

1. Extracurricular Activities Courses (ECA) Two compulsory courses from the following S.No (ii) to (v) non-credit courses: (i) Induction Program (compulsory) (ii) Skill development (iii) Unity and Discipline (NCC or NSS) (iv) Sports, Cultural and Games (v) Personality Development	**Non-Credit**
2. Audit Courses (AC) Two of the Audit Courses are compulsory	**Non-Credit**
3. Industrial Training (Mandatory)	**Non-Credit**

Minor Degree Courses (Optional) from any department	**Credits**
Department Minor (DM) Courses	18-20

Semester wise Credit Structure for B. Tech. (ECE)

Category Semesters	I	II	III	IV	V	VI	VII	VIII	Total
Basic Sciences & Maths (BSM)	8	4	2	4	-	-	-	-	**18**
Engineering Fundamentals (EF)	5	8	5	-	-	-	-	-	**18**
Professional Skill (PS)	2	2	-	-	-	-	-	-	**4**
Program Core (PC)	-	-	10	18	13	14	9	-	**64**
Management (M)	-	-	-	-	2	2	-	-	**4**
Humanities & Social Science (HSS)	2	2	2	-	-	-	-	-	**6**
Humanities & Social Science Elective (HSSE)	-	2	-					-	**2**
Project (P)	-	-	-	-	-	2	3	-	**5**
Seminar (S)	-	-	-	-	-	2	-	-	**2**
Industrial Practice (IP)/ (Minor Project + Industrial Elective (IE))#	-	-	-	-	-	-	-	12	**12**
Program link basic science and engineering courses (PLBSE) (To be decided by the department)	4	3	3	2	3		-	-	**15**
Program Electives (PE)	-	-	-	-	4	4	4	-	**12**
Open Electives (OE) (Other Departments)	-	-	-	-	-	-	3	-	**3**
Total	**21**	**21**	**22**	**24**	**22**	**24**	**19**	**12**	**165**

CURRICULUM FOR B.TECH. (ECE) PROGRAM

First Year, Semester I

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-101	Calculus and Linear Algebra	3	1	0	4
2.	EF	BEE-101	Fundamentals of Electrical Engineering	3	1	2	5
3.	HSS	BHM-101	Professional Communication	2	0	0	2
4.	BSM	BSM-127	Engineering Physics	3	0	2	4
5.	PS	BEC-103	Electronic Component Testing and Measurement	0	0	4	2
6.	PLBSE	BSM-142	Advanced Environmental Chemistry	3	0	2	4
			Total	**14**	**2**	**10**	**21**
7.	ECA-I	ECA-100	Induction Program	-	-	-	**0**

First Year, Semester II

S. N.	Category	Paper Code	Subject	L	T	P	Credit

1.	BSM	BSM-152	Ordinary and Partial Differential Equations	3	1	0	4
2.	EF	BEC-151	Fundamentals of Electronics Engineering	3	1	2	5
3.	HSS	BHM-155	Engineering Economics	2	0	0	2
4.	EF	BEC-152	Fundamentals of Communication Systems	2	0	2	3
5.	PS	BEC-153	Electronic Workshop	0	0	4	2
6.	PLBSE	BCS-154	Basics of Programming Skills	2	0	2	3
7.	HSSE	BHM-154	Human values & Professional Ethics	2	0	0	2
			Total	**14**	**2**	**10**	**21**
8.	ECA-II	-		-	-	-	**0**

Second Year, Semester III

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-226	Physics of Electronic Materials	2	0	0	2
2.	EF	BEC-201	Digital Electronics and Computer Organization	3	1	2	5
3.	HSS	BHM-201	Scientific and Technical Writing	2	0	0	2
4.	PC	BEC-202	Network Analysis & Synthesis	3	1	0	4
5.	PC	BEC-203	Electronic Measurement and Instrumentation	2	1	0	3
6.	PC	BEC-204	Electronic Devices &Circuits	2	1	0	3
7.	PLBSE	BCS-205	Data Structure & Algorithms	2	0	2	3
			Total	**16**	**4**	**4**	**22**
8.	ECA-III	-		-	-	-	0
9.	AC	-		-	-	-	**0**

Second Year, Semester IV

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-254	Numerical Techniques	3	1	0	4
2.	PC	BEC-251	Analog Integrated Circuits	3	1	2	5
3.	PC	BEC-252	Principles of Communication Systems	3	1	0	4
4.	PC	BEC-253	Microprocessors and Applications	3	1	2	5
5.	PC	BEC-254	Electromagnetic Field Theory	3	1	0	4
6.	PLBSE	BEC-255	Electronic Software Tools	1	0	2	2
			Total	**16**	**5**	**6**	**24**
7.	ECA-IV	-		-	-	-	**0**
8.	AC	-		-	-	-	**0**

9.	DM	-	Departmental Minor 1/2	3	1/0	0/2	4

Third Year, Semester V

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	M	BHM-302	Industrial Management	2	0	0	2
2.	PC	BEC-301	Digital communication	3	1	2	5
3.	PC	BEC-302	Control Systems	3	1	0	4
4.	PC	BEC-303	Digital Signal Processing	3	1	0	4
5.	PE1	-	Program Elective-1	3	1	0	4
6.	PLBSE	BEC-304	Internet of Things	2	0	2	3
			Total	**16**	**4**	**4**	**22**
7.	ECA-V	-		-	-	-	0
8.	DM	-	Departmental Minor 1/2	3	1/0	0/2	4

Third Year, Semester VI

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	M	BHM-354	Business Management	2	0	0	2
2.	PC	BEC-351	Microcontroller and Embedded Systems	3	1	0	4
3.	PC	BEC-352	Optical Communication	3	1	2	5
4.	PC	BEC-353	Microwave Engineering	3	1	2	5
5.	PE2	-	Program Elective-2	3	1	0	4
6.	P	BEC-370	Project Part-I	0	0	4	2
7.	S	BEC-380	Seminar	0	0	4	2
			Total	**14**	**4**	**12**	**24**
8.	ECA-VI	-		-	-	-	**0**
9.	DM	-	Departmental Minor 1/2	3	1/0	0/2	4

Final Year, Semester VII

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	PC	BEC-401	VLSI Design	3	1	2	5
2.	PC	BEC-402	Introduction to Wireless and Cellular Communication	3	1	0	4
3.	PE3	-	Program Elective-3	3	1	0	4
4.	OE	-	-	2	1	0	3
5.	P	BEC-440	Project Part-II	0	0	6	3
			Total	**11**	**4**	**8**	**19**

6.	ECA-VII	-		-	-	-	0
7.	DM	-	Departmental Minor 1/2	3	1/0	0/2	4

Final Year, Semester VIII

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	IP	IEC400	Industrial Practices	0	0	24	12
	Without Industrial Practices (IP)						
2.	MP	BEC-410	Minor project	0	0	8	4
3.	IE#	IEC-401-404	Industrial Elective-1	3	1	0	4
4.	IE#	IEC-405-409	Industrial Elective-2	3	1	0	4
			Total	**6**	**2**	**8**	**12**
5.	DM	SEC-410/ 420	Research Project*	0	0	4	2

University level Theory based courses run by the department
*For Theory based Department Minor only
Note: Department may consider PE1, PE2, PE3 to be taught through MOOCs. The MOOC courses may replace any Program Core (PC) subject if the course content of MOOCs courses matches more than 75% with the course content of PC subject.

Program Elective

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
PE1							
01.	BEC-326	Optoelectronics		3	1	0	4
02.	BEC-327	Information Theory & Coding		3	1	0	4
03.	BEC-328	Digital System Design		3	1	0	4
04.	BEC-329	Data Communication Network		3	1	0	4
PE2							
01.	BEC-376	VLSI Technology		3	1	0	4
02.	BEC-377	DSP Architecture and Applications		3	1	0	4
03.	BEC-378	Antenna Design		3	1	0	4
04.	BEC-379	Radar Technology		3	1	0	4
PE3							
01.	BEC-426	Digital Image Processing		3	1	0	4
02.	BEC-427	RFIC		3	1	0	4

03.	BEC-428	Application of ML in Wireless Communication		3	1	0	4
04.	BEC-429	Neural Networks		3	1	0	4

Industrial Electives

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	IEC-401	Satellite communication		3	1	0	4
2.	IEC-405	Digital CMOS Design		3	1	0	4

Open Elective (OE)							
1.	OEC-401	Biomedical Instrumentation		3	0	0	3
2.	OEC-402	Evolution from 1G to 5G Communication		3	0	0	3

Departmental Minor

Note: Departmental Minor Course will be introduced or revised as per industrial requirement and duly recommended by BOS of the department.

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
Departmental Minor-1 (VLSI)							
1.	SEC-211	Microelectronic Devices to Circuits		3	1	0	4
2.	SEC-311	Device and circuit simulation		3	0	2	4
3.	SEC-312	CMOS analog circuit design		3	1	0	4
4.	SEC-411	High speed devices and circuits		3	1	0	4
Departmental Minor-2 (IoT)							
1.	SEC-221	Programming in Python		3	0	2	4
2.	SEC-321	IOT architecture and its protocols		3	1	0	4
3.	SEC-322	Concepts in artificial		3	1	0	4

		intelligence					
4.	SEC-421	Wireless technologies for IoT		3	1	0	4

List of Audit Courses (AC)

S.No.	Subjects	Codes
1.	Constitution of India	AUC01
2.	Indian Culture and Heritage	AUC02
3.	Indian Architecture	AUC03
4.	Indian Festivals	AUC04
5.	Vaidic Mathematics	AUC05
6.	Astronomy	AUC06
7.	Arts of India	AUC07
8.	Intellectual Property Right	AUC08
9.	Human Rights	AUC09
10.	Logical Research	AUC10
11.	Professional Ethics	AUC11
12.	Environmental Law	AUC12
13.	Health Law	AUC13
14.	National Cadet Corps	AUC14
15.	Basics of Human Health and preventive medicines	AUC15

**Note: Detailed syllabus of Audit Courses (AC) is attached as annexure-01.

List of Extra Curricular Activity (ECA) Courses

ECA-II						
S. No.	Branch	Category	Subject Name	Subject Code	Hours/ Week	Credit
1.	Open to all Branches	ECA	Skill Development-I	ECA-151	2	0
2.	Open to all Branches	ECA	Unity and Discipline (NCC)-I	ECA-171	2	0
3.	Open to all Branches	ECA	Unity and Discipline (NSS)-I	ECA-172	2	0
4.	Open to all Branches	ECA	Games & Sports-I	ECA-181	2	0
5.	Open to all Branches	ECA	Cultural, Art & Literary-I	ECA-182	2	0

ECA-III						
S. No.	Branch	Category	Subject Name	Subject Code	Hours/ Week	Credit
1.	Open to all Branches	ECA	Skill Development-II	ECA-201	2	0
2.	Open to all Branches	ECA	Unity and Discipline (NCC)- II	ECA-221	2	0
3.	Open to all Branches	ECA	Unity and Discipline (NSS)-II	ECA-222	2	0

4.	Open to all Branches	ECA	Games & Sports-II	ECA-231	2	0
5.	Open to all Branches	ECA	Cultural, Art & Literary-II	ECA-232	2	0

ECA-IV						
S. No.	Branch	Category	Subject Name	Subject Code	Hours /Week	Credit
1.	Open to all Branches	ECA	Skill Development-III	ECA-251	2	0
2.	Open to all Branches	ECA	Unity and Discipline (NCC)- III	ECA-271	2	0
3.	Open to all Branches	ECA	Unity and Discipline (NSS)- III	ECA-272	2	0
4.	Open to all Branches	ECA	Games & Sports-III	ECA-281	2	0
5.	Open to all Branches	ECA	Cultural, Art & Literary-III	ECA-282	2	0

ECA-V						
S. No.	Branch	Category	Subject Name	Subject Code	Hours/ Week	Credit
1.	Open to all Branches	ECA	Skill Development-IV	ECA-301	2	0
2.	Open to all Branches	ECA	Unity and Discipline (NCC)- IV	ECA-321	2	0
3.	Open to all Branches	ECA	Unity and Discipline (NSS)-IV	ECA-322	2	0
4.	Open to all Branches	ECA	Games & Sports-IV	ECA-331	2	0
5.	Open to all Branches	ECA	Cultural, Art & Literary-IV	ECA-332	2	0
ECA-VI						
S. No.	Branch	Category	Subject Name	Subject Code	Hours/ Week	Credit
1.	Open to all Branches	ECA	Skill Development-V	ECA-351	2	0
2.	Open to all Branches	ECA	Games & Sports-V	ECA-381	2	0
3.	Open to all Branches	ECA	Cultural, Art & Literary-V	ECA-382	2	0

ECA-VII						
S. No.	Branch	Category	Subject Name	Subject Code	Hours/ Week	Credit
1.	Open to all Branches	ECA	Skill Development-VI	ECA-401	2	0
2.	Open to all Branches	ECA	Games & Sports-VI	ECA-431	2	0
3.	Open to all Branches	ECA	Cultural, Art & Literary-VI	ECA-432	2	0

**Note: Detailed syllabus of Extra Curricular Activity (ECA) Courses is attached as annexure-02.

FRAMEWORK FOR THE IMPLEMENTATION OF MOOC COURSES IN B. TECH PROGRAMME

As per the guidelines given by AICTE via GO. No. AICTE/P&AP/SWAYAM/2016 dated 17th August 2016, M. M. M. University of Technology Gorakhpur has decided to implement 20% subjects/courses from MOOCs from SWYAM portal in the curricula of B. Tech programme offered by University from the session 2022-23 onwards. The framework for incorporating the MOOC courses in the curricula of B. Tech programme is given below.

1. The MOOC Courses of Swayam portal will be offered in:
   (a) B. Tech-IInd semester for HSSE Courses of Humanities & Management Science Department.
   (b) B.Tech-IIIrd and IVth semester for Audit Courses (AC) of Humanities & Management Science Department.
   (c) B.Tech-Vth, VIth & VIIth semester as Program Elective (PE) Course of respective Engineering Departments.
   (d) B. Tech-VIIIth semester for Industrial Elective (IE) Course of respective Engineering Departments.
2. It has been indicated in the above GO of AICTE that MOOC Courses of Swayam portal will be announced on 1st June for odd semester and 1st November for the even semester every year. After the announcement of the subjects on Swayam portal, each department of University will identify the subjects against each of the MOCC courses in respective semester from the Swayam portal and send the list of identified subjects to the office of Dean UGS & E after the approval of BOS of respective department. Dean UGS & E will notify the same and notification will be uploaded on the University website well in advance so that students may get registered in the subject in time.
3. Concern department will nominate one of its faculty as a departmental MOOCs Coordinator for each of the MOOC Course and same will be intimated to Dean UGS & E along with the teaching load of the department. The departmental MOOCs Coordinator will be responsible for the registration, assignment submission, term end examination and result of the students who have opted MOOC courses.
4. For the reimbursement of MOOCs registration fee, student will write an application addressed to Dean UGS & E through the concerned Head of Department and departmental MOOCs Coordinator along with the receipt of MOOCs registration fee and admit card/hall ticket. The application of student for the reimbursement of fee will be entertained only if it is recommended by concerned MOOCs Coordinator and Head of Department.
5. Credit will be defined as per clause 6.1.5.5 of B. Tech ordinance for the MOOC Courses on Swayam portal in which credit is not mentioned,
6. If better practical facility is available at virtual lab of different premier institution of national and international importance, then the practical facility of that subject could be availed through the virtual lab. In any practical based subject, if practical lab is not assigned and better practical facility is available on virtual lab then it may be conducted on the virtual lab and one credit will be added through the BOS of concerned department.
7. The evaluation scheme for practical based subjects conducted through virtual lab will be same as the existing evaluation scheme of practical courses of the University.

Syllabus

Course Code: Calculus and Linear Algebra
BSM-101

Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor tests and one major theory examination.
Course Objectives	:	The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of basic differential operators in various engineering problems.
2. Understand the concepts of limit theory and nth order differential equations and their applications to our daily life
3. Solve linear system of equations using matrix algebra.
4. Know about qualitative applications of Gauss , Stoke's and Green's theorem.
5. To know the applications of double and triple integration in finding the area and volume.
6. To inculcate the habit of mathematical thinking and lifelong learning.

Topics Covered

UNIT-I 9

Differential Calculus: Limit, Continuity and Differentiability, Mean value theorems. Leibnitz theorem, Partial derivatives, Euler's theorem for homogenous function, Total derivative, Change of variable. Taylor's and Maclaurin's theorem. Expansion of function of two variables, Jacobian, Extrema of function of several variables.

UNIT-II 9

Linear Algebra: Symmetric, Skew-symmetric matrices, Hermitian, Skew Hermitian Matrices, orthogonal and unitary matrices and basic properties, linear independence and dependence of vectors, Rank of Matrix, Inverse of a Matrix, Elementary transformation, Consistency of linear system of equations and their solution, Characteristic equation, Eigenvalues, Eigen-vectors, Cayley-Hamilton theorem, Diagonalization of matrices.

UNIT-III 9

Multiple Integrals: Double and triple integrals, change of order of integration, change of variables. Application of multiple integral to surface area and volume. Beta and Gamma functions, Dirichlet integral.

UNIT-IV 9

Vector Calculus: Gradient, Divergence and Curl. Directional derivatives, line, surface and volume integrals. Applications of Green's, Stoke's and Gauss divergence theorems (without Proofs).

Text and Reference Books

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers
2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons.
3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications.
4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd.,

Course Code: BEE-101/ 151		**Fundamentals of Electrical Engineering**
Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and two minor tests and one major theory & practical examination.
Course Objectives	:	**1.** To demonstrate and understand the basic knowledge of electrical quantities such as current, voltage, power, energy, and frequency to understand the impact of technology in a global and societal context. **2.** To demonstrate and understand the basic concepts of analysis of simple DC and AC circuits, Magnetic Circuits, Transformers and Electrical Machines.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course:

1. Understand the basic properties of electrical elements, and solve problem based on basic electrical circuits & DC network theorems.
2. Understand the fundamental behaviour of AC circuits and solve AC circuit problems.
3. Apply the knowledge gained to explain the behaviour of the circuit at series & parallel resonance of circuit & the effect of resonance.
4. Understand 3 phase balanced and unbalanced, star and delta connected supply and load and to measure power in 3 phase circuits
5. Explain construction and working principle of transformer with background of magnetic circuits.
6. Classify and compare different types of Electrical machines.

Topic Covered

UNIT I

D C Circuit Analysis and Network Theorems:

9

Circuit Concepts: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, R, L and C as linear elements, Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem.

UNIT II

Steady- State Analysis of Single-Phase AC Circuits: **9**

AC fundamentals: Sinusoidal, square and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasor, phasor representation of sinusoidally varying voltage and current, Analysis of series, parallel and series-parallel RLC Circuits, Resonance in series and Parallel circuit

Three Phase AC Circuits: Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, Three-phase power, and its measurement

UNIT III

Magnetic Circuit & Single-Phase Transformers: **9**

Magnetic circuit, concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis, and eddy current losses.

Single Phase Transformer: Principle of operation, Construction, EMF equation, Power losses, Efficiency, O.C & S.C Test and Introduction to auto transformer.

UNIT IV

Electrical Machines: **9**

Concept of electromechanical energy conversion DC machines: Types, EMF equation of generators and torque equation of motor, Characteristics, and applications of DC Generators & motors.

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Induction Motor: Types, Principle of operation, Torque-slip characteristics, Applications

EXPERIMENTS

1. Verification of Kirchhoff's Law.
2. Verification of Norton's Theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Superposition Theorem.
5. Verification of Maximum Power Transfer Theorem.
6. Verification of Series R-L-C circuit.
7. Verification of Parallel R-L-C circuit.
8. Measurement of Power and Power factor of three phase inductive load by two wattmeter method.
9. To perform O.C. and S.C. test of a single-phase transformer.
10. To draw the magnetization characteristics of separately excited dc motor.

11. To perform the external load characteristics of dc shunt motor.

Text and Reference Books:

1. Fundamentals of Electric Circuits, C.K. Alexander and M.N.O. Sadiku; TATA McGraw-Hill.
2. Principles of Electrical Engineering, V. Del Toro; Prentice Hall International.
3. Electrical and Electronics Technology, Edward Hughes; Pearson.
4. Basic Electrical Engineering, D P Kothari, I.J. Nagarath; Tata McGraw Hill
5. Electrical Technology, B. L. Thareja and A. K. Thareja; S. Chand.

Course Code: BHM-101/151 **PROFESSIONAL COMMUNICATION**

Course category	:	HSS
Pre-requisite Subject	:	None
Contact hours/week	:	Lecture: 2, Tutorial: 0, Practical: 0
Number of Credits	:	02
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, two minor tests and one major theory examination.
Course Objectives	:	To sensitize the students to understand the role & importance of communication for personal & professional success and enable learners to exhibit knowledge, skills, and judgment in and around human communication that facilitate their ability to work collaboratively with others in an interpersonal environment.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Use of various facets of communication skills, such as, Reading, Writing, Listening and speaking skills.
2. To identify, formulate and solve the real-life problems with positive attitude.
3. To inculcate the habit of learning and developing the communication and soft skills by practice.
4. To create an amicable ambience to make them learn the different part of English language with the correction of the language.
5. Enhancing word power by counselling scientific literature.
6. Focusing on effortless speaking and writing.

Topics Covered

UNIT-I 6

VERBAL COMMUNICATION:

Received Pronunciation; how to activate passive vocabulary; Technical/non-technical and Business Presentations; questioning and answer skills; soft skills for professionals; role of body postures, movements, gestures, facial expressions, dress in effective communication; Information/ Desk/ Front Office/ Telephone conversation; how to face an interview/press conference; Group discussions, debates, elocution.

UNIT-II

READING COMPREHENSION 6

Skimming and Scanning; factual and inferential comprehension; prediction; guessing meaning of words from context; word reference; use and interpretation of visuals and graphics in technical writing.

UNIT-III

WRITTEN COMMUNICATION: 6

Note Making and Note Taking; summarizing; invitation, advertisement, agenda, notice and memos; official and commercial letters; job application; resume and curriculum vitae; utility, technical, project and enquiry reports; paragraph writing: General – Specific, Problem – Solution, Process – Description, Data – Comment.

UNIT-IV

SHORT ESSAYS: 6

Description and Argument; comparison and contrast; illustration; using graphics in writing: tables and charts, diagrams and flow charts, maps and plans, graphs; how to write research paper; skills of editing and revising; skills of referencing; what is a bibliography and how to prepare it.

Text and Reference Books

1. Bansal, R.K. & Harrison J.B., (1972) *Spoken English*, Orient Longman, India.
2. Chauhan, Narender Kr. & Singh, Sudhir N., (2013) *Formal Letters*, Pankaj Publication International, New Delhi.
3. Chhabra T.N., (2019) *Business Communication*, Sun India Publication, New Delhi.
4. Dixon Robert J., (1986) *Complete Course in English*, Prentice Hall of India, New Delhi.
5. Jones, Daniel., (2012) *Cambridge English Pronouncing Dictionary*, 18th Edition, Paperback, CUP, India.
6. Lewis, Norman, (2015) *Word Power Made Easy*, Penguin India.

BSM-127/177 **ENGINEERING PHYSICS (for Electronics and Communication Engineering)**

Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	Physics at 12th standard
Contact hours/week	:	Lecture: 3, Tutorial:0, Practical: 2
Number of Credits	:	4

Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and two minor tests and one major theory & practical examination.
Course Objectives	:	Understanding of the principle and concepts of Crystallography, Quantum Mechanics, Basic principles of electricity and magnetism, Maxwell's Equations, of and Advanced Materials for their applications Engineering.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Basics of crystallography and its applications in Engineering
2. Quantum Mechanics and its application to understand material properties at atomic level.
3. Basic principles of electricity and magnetism applied in Engineering.
4. Maxwell's equation of electromagnetic theory and its applications in engineering.
5. Basic principles of semiconducting materials and its application.
6. Basic Principles of advanced materials and their applications in Engineering.

Topics Covered

UNIT-I 9

Crystal Structures and X-ray Diffraction: Space lattice, basis, Unit cell, Lattice parameter, seven crystal systems and Fourteen Bravais lattices, Crystal-System Structure, Packing factor (cubic, body and face), Lattice planes and Miller Indices, Diffraction of X-rays by crystal, Laue's experiment, Bragg's Law, Bragg's spectrometer.

UNIT-II 9

Quantum Mechanics: De Broglie waves and Group velocity concept, Uncertainty principle and its application, Davisson-Germer experiment, Derivation of Schrodinger equation for time independent and time dependent cases. Postulates of quantum mechanics, Significance of wave function, Application of Schrodinger wave equation for a free particle; Particle in a box (one dimensional)

UNIT-III 9

Electrodynamics –I: Basic concepts of Gauss's law, Ampere's law and faradays law of electromagnetic induction. Correction of Ampere's law by Maxwell (concept of displacement current), Maxwell's equation, transformation from integral form to differential form, physical significance of each equation

Electrodynamics –II: Maxwell's equation in free space, velocity of electromagnetic wave, transverse character of the wave and orthogonality of E, H and k vectors, Maxwell's equations in dielectric and conducting medium, velocity of e. m. wave, comparison with free space, penetration depth

UNIT-IV 9

Physics of Advanced Materials

Semiconducting Materials**,** Concept of energy bands in solids, concept of direct and indirect band gap, Carrier concentration and conductivity in semiconductors, Optoelectronic Materials, Superconducting Materials**,** Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Type I and Type II superconductors, BCS theory (Qualitative), Introduction of nanoscience and technology

EXPERIMENTS

1. To determine the specific resistance of a given wire using Carrey Foster's Bridge.
2. To study the variation of magnetic field along the axis of current carrying circular coil.
3. To study the Hall's effect and to determine Hall coefficient in n type Germanium.
4. To study the energy band gap of n- type Germanium using four probe method.
5. To determine e/m of electron using Magnetron valve.
6. To draw hysteresis curve of a given sample of ferromagnetic material.

Text and Reference Books

1. Introduction to Solid State Physics- Kittel , 7th edition, Wiley Eastern Ltd.
2. Solid State Physics - S. O. Pillai, 5th edition, New Age International.
3. Quantum Mechanics: Theory and Applications- AjoyGhatak, Tata McGraw-Hill
4. Introduction to Electrodynamics- David J. GriffithsPearson, New International Edition
5. Semiconductor Devices and Application - S.M. Sze, Wiley
6. Introduction to Nano Technology - Poole Owens, Wiley India
7. Engineering Physics by B. K. Pandey and S. Chaturvedi, 2e Cengage Learning Pvt. Limited, India

Course Code: Electronic Component Testing and Measurement
BEC-103

Course category	:	Professional Skill (PS)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:0, Tutorial: 0, Practical: 4
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through viva voce, practical work/record, attendance and major practical examination.

Course Objectives : The objective of this course is to identify different electronic components & to develop the understanding of different instruments.

Course Outcomes : After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes.

1. Able to identify electronics components.
2. Understanding of measuring instruments.
3. Able to demonstrate the measuring process using measuring instruments and components.
4. Able to execute the experiment based on DC bridges.
5. Able to examine the experiment performed on breadboard.
6. To study and analyze the signal using CRO and DSO.

Topics covered

List of experiments

Note: At least seven experiments should be performed

1. To identify the components which are used in electronic circuits.
2. To study the resistance, voltage, current measurement by using of multimeter.
3. To get familiarization and to study the operation of a function generator instrument and visualize the types of waveforms produced by a function generator.
4. To study the CRO and to find the Amplitude, phase difference and Frequency of a sinusoidal waveform using CRO.
5. Study of Lissajous patterns and measurement of frequency through Lissajous patterns
6. Measurement of low resistance using Kelvin's double bridge.
7. Measurement of medium resistance using Wheatstone bridge.
8. Measurement of time constant of RC circuit.
9. To study the bread board measurement and perform experiment no 2 on bread board.
10. To study the DSO and measure the amplitude, phase difference and frequency of sinusoidal waveform
11. Measure the values of capacitors using DMM and Schering bridge method.
12. Measure the values of inductors using Maxwell bridge method.
13. To Study of AC and DC Waveforms on CRO & DSO.
14. To study of classification and coding of capacitors-using numerals, directly printed values on capacitors, Ceramic capacitor and Electrolytic capacitor.
15. Measurement of h-parameters of CE configuration

Course Code: BSM-142 **Advanced Environmental Chemistry (ECE)**

Course category : Program Link basic Science and Engineering Course (PLBSE)
Pre-requisite Subject : NIL
Contact hours/week : Lecture:3, Tutorial: 0, Practical: 2
Number of Credits : 4

Course Assessment methods	:	Continuous assessment through attendance, assignments, quizzes, practical work, record, viva voce and two minor test and one major theory & practical examination.
Course Objectives	:	➢ Solve environmental engineering problems and persue higher studies using solid foundation in Chemistry and environmental science. ➢ Design and operate various environmental systems in industries as well as higher studies through interactive education.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Gain knowledge about environment and atmospheric composition.
2. Study about natural resource (air, water and soil), its importance and environmental impacts.
3. Knowledge about major sources of environmental pollution.
4. Knowledge about impact of environmental pollution and control measures.
5. To acquire awareness for ethical principle of environment.
6. To gain knowledge as a leader in multidisciplinary areas.

Topics Covered

UNIT-I

Atmospheric composition and principles of contaminant behavior: **9**

The atmosphere of Earth, Contaminant behaviour in the environment, Greenhouse effect - Global temperature-acid rain and Ozone layer depletion.

Contaminants and their natural pathways of degradation and their abatement:

Carbon cycle, Nitrogen cycle, Sulphur cycle, CO formation in atmosphere, Organic pollutants, Pollution from combustion Systems, Coal combustion, Photochemical smog.

UNIT-II

Air Pollution control techniques: **9**

Indoor air Pollution, Control techniques of: Carbon Monoxide, Oxides of nitrogen, Sulphur Dioxide, Volatile Organic Compounds, Instruments techniques to monitor pollution.

UNIT-III

Water Pollution: **9**

Ground and subsurface water contamination, Water pollution sources, Ground water pollution, Ocean pollution.

Water Pollution Treatment:

Introduction, Technological Approach, Chemical degradation of wastes and chemicals, Coagulation and flocculation, Photocatalytic degradation of pollutants. Supercritical water oxidation.

UNIT-IV

Soil Pollution

Soil around us, Soil water characteristics, soil erosion, Soil &pollution, Water resources: Irrigation and Wetlands, Soil pollution management, Nuclear waste management, Sewage treatment, Solid waste management. **9**

LIST OF EXPERIMENTS

1. Study of contaminations in atmosphere.
2. Determination of Henry's law constantsof air sample.
3. Determination of an ion balance for a water sample.
4. Measuring the concentration of chlorinated pesticides in water samples.
5. Determination of chloride, bromide, and fluoride in water samples.
6. Analysis of nickel solutions by ultraviolet–visible spectrometry.
7. Soxhlet extraction and analysis of a soil or sediments sample contaminated with n-pentadecane.
8. Determination of a clay–water distribution coefficient for copper.
9. Determination of the biochemical oxygen demand of sewage influent.
10. Determination of inorganic and organic solids in water samples: mass balance exercise.
11. Determination of alkalinity of natural waters.
12. Determination of hardness in a water sample.

Text and Reference Books

1. Manahan,Stanley E. Fundamentals of Environmental Chemistry Boca Raton: CRC Press LLC.
2. Sonja Krause, Herbert M. Clark, James P. Ferris, Robert L. Strong Chemistry of the Environment,Elsevier Science & Technology Books.
3. Eugene R. Weiner Applications of Environmental Chemistry, CRC Press, LLC.
4. By Clair N.Sawyer,Perry L. McCarty, Gene F.Parkin Chemistry for environmental engineering and science (5th edition), McGraw-Hill Professional.

BSM-102/BSM-152 Ordinary and Partial Differential Equations

Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor tests and one major theory examination.
Course Objectives	:	The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. To solve the ordinary differential equations.
2. To solve the partial differential equations using Lagrange and charpit's method.
3. To solve and understand the properties of Bessel`s and Legendre`s differential equation.
4. Application of partial differential equation in real life problems
5. To solve Wave, Heat and Laplace equation upto two dimensions.
6. To inculcate the habit of mathematical thinking and lifelong learning.

Topics Covered

UNIT-I 9

Ordinary Differential Equations I: Linear differential equations with constant coefficients $(n^{th} order)$, complementary function and particular integral. Simultaneous linear differential equations, solution of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications of differential equations to engineering problems

UNIT-II 9

Ordinary Differential Equations II: Series solution of second order differential equations with variable coefficient (Frobeneous method). Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.

UNIT-III 9

Partial Differential equations I: Partial differential equations of the first order, Lagrange's solution, Charpit's general method of solution, Partial differential equations of the second order: Constant coefficient and reducible to constant coefficient, Classification of linear partial differential equations of second order.

UNIT-IV 9

Partial Differential Equations II: Method of separation of variables for solving partial differential equations, Wave equation up to two-dimensions, Laplace equation in two dimensions, Heat conduction equations up to two dimensions

Text and Reference Books

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers
2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons.
3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications.
4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd..
5. M.D. Raisinghania, Ordinary and Partial Differential Equations. S Chand Publications.

BEC-101/ 151 FUNDAMENTALS OF ELECTRONICS ENGINEERING

Course category : Engineering Fundamentals (EF)
Pre-requisite Subject : NIL
Contact hours/week : Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits : 5

Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and two minor tests and one major theory & practical examination.
Course Objectives	:	The objective of this course is to gain knowledge of basic electronic components and develop the understanding of the working principle of different electronic devices such as voltmeter, multimeter, CRO, etc.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to memorize the basic concept of electronic circuits using Diode, BJT, FET, etc.
2. Able to execute and examine the general characteristic of electronic circuits.
3. Illustrate the basics of Boolean algebra and logic gates with their realisation using discrete electronic components.
4. Compute different parameters for characterising different circuits like rectifier, amplifiers, integrators, etc.
5. Examine the working principle of digital voltmeter, multimeter using block diagram approach.
6. Discuss and calculate voltage, current, phase and frequency using CRO.

Topics Covered

UNIT-I

Semiconductor materials and properties: electron-hole concepts, Basic concepts of energy bands in materials, concept of forbidden gap, Intrinsic and extrinsic semiconductors, donors and acceptors impurities, Junction diode, p-n junction, depletion layer, v-i characteristics, diode resistance, capacitance, diode ratings (average current, repetitive peak current, non-repetitive current, peak-inverse voltage). Diode Applications in rectifier, filters, voltage multipliers, load regulators, clipper and clamper circuits, Breakdown mechanism (Zener and avalanche),Breakdown characteristics, Zener resistance, Zener diode ratings, Zener diode application as shunt regulator 9

UNIT-II

Transistors (BJT); Basic construction, transistor action, CB, CE and CC configurations, input/output characteristics, Biasing of transistors-fixed bias, emitter bias, potential divider bias, comparison of biasing circuits. Transistor Amplifier: Graphical analysis of CE amplifier, concept of voltage gain, current gain, h- parameter model (low frequency), computation of Ai, Av, Ri, Ro of single transistor CE and CC amplifier configurations. 9

UNIT-III

Field Effect Transistors(JFET and MOSFET): Basic construction, transistor action, concept of pinch off, maximum drain saturation current, input and transfer characteristics, characteristic equation CG, CS and CD configurations, fixed & self-biasing. 9

MOSFET: depletion and enhancement type MOSFET - construction, operation and characteristics. Computation of Av, Ri, Ro, of single FET amplifiers using all the three configurations

Switching theory and logic design: Number systems, conversion of bases, Boolean algebra, logic gates, concept of universal gate, canonical forms, Minimization using K-map

UNIT-IV

Operational Amplifiers and Electronics Instruments: 9

Concept of ideal operational amplifiers, ideal op-amp parameters, inverting, non-inverting and unity gain amplifiers, adders, difference amplifiers, integrators Working principle of digital voltmeter, digital multi-meter (block diagram approach), CRO (its working with block diagram), measurement of voltage, current, phase and frequency using CRO

EXPERIMENTS

Note: Minimum Five experiments are to be performed

1. To plot the forward / Reverse Characteristics of Si P-N junction diode.
2. To plot the forward / Reverse Characteristics of Zener diode
3. Study and plot the characteristic of Zener diode as voltage regulator
4. Study of half wave rectifier and draw the nature of input / output signal. Calculate the value of Idc, Irms and ripple factor.
5. Study of Full wave rectifier and draw the nature of input / output signal. Calculate the value of I_{dc}, I_{rms} and ripple factor.
6. Study of Bridge Rectifier and draw the nature of input / output signal. Calculate the value of I_{dc}, I_{rms} and ripple factor.
7. Draw input output characteristic curve of n-p-n transistor in CE configuration
8. Draw input output characteristic curve of n-p-n transistor in CB configuration
9. Draw the drain and transfer curve of JFET
10. Study of OPAMP (741) and calculate the gain in (i)Inverting mode and (ii)Non-inverting mode
11. Study of OP-AMP as a (i) Summer (ii) Integrator (iii) Differentiator; and plot the nature of input & output waveform
12. Study of CRO and multi-meter measurement voltage, frequency, phase difference using CRO along with the testing of electronics component

Text and Reference Books

1. Electronic Devices and Circuits-Boylestad and Nashelsky, 6e, PHI, 2001
2. Electronic Devices and Circuits, A Mottershead, PHI,2000, 6e
3. Digital Computer Design, Morris Mano, PHI,2003
4. Electronic Instrumentation-H.S. Kalsi, 2e,TMH, 2007

ENGINEERING ECONOMICS

Course Code:

BHM-105/155

Course category	:	HSS
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 2, Tutorial : 0, Practical: 0
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through attendance, home assignments, quizzes and two minor tests and one major theory examination.
Course Objectives	:	Enable students to understand the fundamental economic concepts applicable to engineering.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will acquire basic knowledge in Engineering Economics, which allows students to gain theoretical and empirical skill of Economics.
2. To develop the basic understanding of Microeconomics and Macroeconomics and its application to decision making and Managerial Economics.
3. Become acquainted with basic economic concepts such as demand and supply and Elasticity of Demand.
4. To develop a significant understanding of various concepts of cost.
5. To develop the ability to understand the various kinds of market structure.
6. To develop the ability to acquire the knowledge of National Income and its measurement.

Topics Covered

UNIT-I 6

Introduction: Meaning, Nature and Scope of Micro Economics, Macro Economics and ManagerialEconomics, Decision making Process with reference to Managerial economics, Managerial Economics and its application in engineering perspective.

UNIT-II 6

Concepts of Demand and Supply: Demand Analysis, Law of Demand, Determinants of Demand,Elasticity of Demand: Price, Income and cross Elasticity. Uses of concept of elasticity of demand in managerial decision, Law of Supply.

UNIT-III 6

Production function, Overview of cost: fixed cost, variable cost, average cost, marginal cost, opportunity cost, An over-view of Short and long run cost curves.

UNIT-IV 6

Market Structure: Perfect Competition, Imperfect competition – Monopolistic, Oligopoly, Monopoly, National Income: Concept and Measurement of National Income.

Books & References

1. Mote, Paul and Gupta, Managerial Economics, T M H, New Delhi.
2. H L Ahuja, Managerial Economics, S Chand & Co. New Delhi
3. P.L. Mehta, Managerial Economics, Analysis, Problems and Cases, Sultan Chand Sons, NewDelhi.
4. Prof. D.N. Kakkar , Managerial Economics for Engineering, PHI publication, New Delhi
5. Varshney and Maheshwari, Managerial Economics, Sultan Chand and Sons, New Delhi.

Course Code: Fundamentals of Communication Systems
BEC-152

Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:2, Tutorial: 0, Practical: 2
Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, two minor tests and one major theory & practical examination.
Course Objectives		The objective of this course is to develop a basic understanding of communication and to develop the concept of modulation in communication systems.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to understand the basic elements of the communication systems.
2. Familiarity with angle modulation.
3. Able to understand the difference between the Frequency modulation and Phase modulation and its practical applications.
4. Able to represent an analog signal in digital form using Digital modulation.
5. Ability to gather knowledge to understand applications of signal modulation in wireless systems.
6. Develop basic understanding regarding mobile system such as CDMA, GSM etc.

Topics Covered

UNIT-I

Introduction of Communication system: Elements of Communication systems, Need of modulation and Modulation techniques, Baseband and Pass band signals, Introduction of analog and digital modulation, **Amplitude Modulation (AM) and demodulation:** Modulation index, Types of amplitude modulation, Double sideband with Carrier (DSB-C), Double side band without Carrier (DSB-SC), Single Side Band Modulation (SSB), vestigial Modulation (VSB). **6**

UNIT-II

Angle modulation: Types of angle modulation, Frequency Modulation (FM): Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, Phase modulation (PM): Transmission bandwidth of PM Signals, Generation of PM Signals, Demodulation of PM Signals, Comparison of FM and PM system. **6**

UNIT-III

Digital Modulation: Digital representation of analog signals: Introduction, Sampling process, Pulse amplitude modulation, Pulse time modulation, Pulse position modulation, Comparison of PAM and PPM systems, Pulse code modulation, Time Division Multiplexing and Frequency division multiplexing, Crosstalk **6**

UNIT-IV

Noise in Communication Systems: Types of Noise, Noise in Signal, Signal to Noise Ratio (SNR), Figure of Merit (FOM). Evolution of mobile communications (CDMA, GSM Technology). **6**

LIST OF EXPERIMENTS

Note: Minimum Five experiments should be performed

1. Plan and select tools to assemble the receiver.
2. Check the functionality of AM/FM receiver and troubleshoot and replace the faulty components.
3. Modulate various signals using AM and FM on the trainer kit and observe waveforms.
4. Demodulate various signals using AM and FM on the trainer kit and observe waveforms.
5. Construct and test IC based AM Receiver
6. Construct and test IC based FM transmitter and receiver
7. Modulate a signal using PAM, PPM, and PWM Techniques.
8. Demodulate a signal using PAM, PPM, and PWM Techniques.

Text and Reference Books

1. Communication Systems, Simon Haykins& Moher, 5th Edition, John Willey, India Pvt. Ltd, 2010, ISBN 978 – 81 – 265 – 2151– 7.
2. T. S. Rappaport, "Wireless Communications: Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint 2003.
3. Principles of Communication Systems, H.Taub &D.L.Schilling, TMH, 2011
4. W.C.Y. Lee, "Mobile Communications Engineering: Theory and applications, Second Edition, McGraw-Hill International, 1998.
5. Modern Digital and Analog Communication Systems, B. P. Lathi, Oxford University Press., 4th edition.

Course Code: ELECTRONIC WORKSHOP

BEC-153

Course category	:	Professional Skills (PS)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:0, Tutorial: 0 , Practical: 4
Number of Credits	:	2

Course Assessment methods	:	Continuous assessment through attendance, practical work, record, viva voce, and practical major examination.
Course Objectives		The objective of this course is to develop the skill and working of different circuit board & prototypes of the designed electronics circuits.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. To identify the circuit components and their application specially for electronics PCB design.
2. Understand the design processes and production methods used in the manufacturing of a printed circuit board.
3. Understand the use and application of chemical itching and drilling in the manufacture of an electronic circuit.
4. Be able to design and manufacture a prototype printed circuit board and use it to assemble and test an electronic circuit.
5. Able to design rectifier and filter and study their practical applications.
6. Able to have knowledge of these circuits using breadboard.

List of Experiments

Note: Minimum Seven experiments should be performed

1. Winding shop: Step-down transformer winding of less than 5VA.
2. Soldering shop: Fabrication of DC regulated power supply.
3. Printing of circuits on PCB.
4. Design a PCB using Etching & drilling.
5. Coating of etched PCB to protect it from oxidation.
6. Convert the power supply circuit into PCB & simulates its 2D & 3D view.
7. Design a full wave center tapped rectifier & study the effect of capacitive filter & it's output on a virtual oscilloscope.
8. Design a RLC resonance circuit & verify the transient & phase response for different values of R, L&C.
9. Assemble electronic circuit/system on general purpose PCB, test and show the functioning.
10. Construct various electronic circuits on breadboard
11. Identify and test different types of ICs.
12. To study the specifications and working of a Transistor radio kit and perform measurements on it.
13. Study the working of Distortion Meter.
14. To study the working of Spectrum analyzer and determine the bandwidth of different signals.

Text and Reference Books

1. Electronics Components and Materials by SM Dhi, Tata McGraw Hill, New Delhi
2. Electronics Device and circuits by Millman and Halkias; McGraw Hill.

3. Principle of Electronics by Albert Paul Malvino; Tata McGraw Hill.

Course Code: BCS-154		**BASICS OF PROGRAMMING SKILLS (For the students of Electronics and Communication Engineering Department)**
Course category	:	PLBSE
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 2, Tutorial: 0, Practical: 2
Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, two minor tests and one major theory & practical examination.
Course Objectives	:	This course helps the students in gaining the knowledge to write simple C language applications, mathematical and engineering problems. This course helps to undertake future courses that assume this programming language as a background in computer programming. Read and understand C programs. 1. Discuss basic theory and practice of programming 2. Design and implement practical programs using C language
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Read and understand C programs.
2. Discuss basic theory and practice of programming.
3. Design and implement practical programs using C language.
4. Use compiler and feel comfortable with Windows environment
5. Identify and fix common C errors.
6. Acquire the knowledge of embedded systems.

Topics Covered

UNIT-I 6

Basics of Computer: Introduction to Digital Computer, Basic Operations of Computer, Functional Components of Computer, Classification of Computers. Introduction to Operating System: DOS, Windows, Linux, Function, Services and Types. Basics of Programming: Approaches to Problem Solving, Concept of Algorithm and Flow Charts, Types of Computer Languages: Machine Language, Assembly Language and High-Level Language, Concept of Assembler, Compiler, Loader and Linker.

UNIT-II 6

Standard I/O in "C", Fundamental Data Types: char, int, short, long, float, double, long double. Storage Classes: Automatic, Register, Static, External. Operators and Expressions: Using Numeric and Relational Operators, Mixed Operands and Type Conversion, Logical Operators,

Bit Operations, Operator Precedence and Associativity. C Conditional Program Execution: Applying if and Switch Statements, Nesting if and else, Restrictions on switch Values, Use of Break. Program Loops and Iteration: Uses of while, do and for Loops, Multiple Loop Variables, Assignment Operators, Use of break and continue keywords.

UNIT-III 6

Functions: Designing Structured Programs, Functions in C, User Defined and Standard Functions, Formal vs. Actual Arguments, Function Category, Function Prototype, Parameter Passing, Recursive Functions. Arrays: One Dimensional, Multidimensional Array and their Applications, Declaration and Manipulation of Arrays. Strings: String Variable, String Handling Functions, Array of Strings. Storage Classes revisited.

UNIT-IV 6

Pointers: Pointer Variable and its Importance, Pointer Arithmetic and Scale Factor, Compatibility, Dereferencing, L value and R-Value, Pointers and Arrays. Structure and Union: Declaration and Initialization of Structures, Structure and array, Structure Pointers, Declaration and Initialization of union, Union vs Structure. Embedded Devices, Microprocessor, Microcontroller. Implement the concept of Logic Gates, Adders.

EXPERIMENTS

1. Write a program that finds whether a given number is even or odd.
2. Write a program that tells whether a given year is a leap year or not.
3. Write a program that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:
    a. Between 90-100%----------Print „A“
    b. 80-90%----------Print „B“
    c. 60-80%----------Print „C“
    d. Below 60%----------Print „D“
4. Write a program that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
5. Write a program to print sum of even and odd numbers from 1 to N numbers.
6. Write a program to print the Fibonacci series.
7. Write a program to check whether the entered number is prime or not.
8. Write a program to find the reverse of a number.
9. Write a program to print Armstrong Numbers from 1 to 100.
10. Write a program to convert binary number into decimal number and vice versa.
11. Write a program that simply takes elements of the array from the user and finds the sum of these elements.
12. Write a program that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
13. Write a program to find the minimum and maximum element of the array.
14. Write programs to implement the concept of functions and pointer.
15. Write programs to implement the concept of structure and union.
16. Write a program to implement the concept of Logic Gates.
17. Write programs to implement the Adders.

Text and Reference Books

1. .Jeri R. Hanly and Elliot B. Koffman, Problem Solving and Program Design in C, 7th Edition, Pearson.
2. Schildt, Herbert, Complete Reference with C, Tata McGraw Hill.
3. Kerninghan and Ritchie, The C programming Language, 2nd Edition, Prentice Hall.

Course Code: HUMAN VALUES & PROFESSIONAL ETHICS-1
BHM-104/154

Course category : HSSE
Pre-requisite Subject : None
Contact hours/week : Lecture: 2, Tutorial:0, Practical: 0
Number of Credits : 2
Course Assessment methods : Continuous assessment through tutorials, attendance, home assignments, quizzes and two Minor Tests, one Major Theory Examination.
Course Objectives : To give basic insights and inputs to the students to inculcate Human values to grow as a responsible human being with holistic personality and enable them to understand and appreciate versatility and universality of human values and their pivotal role in professional field.
Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. To create conducive environment for professionals to grow as good and responsible human beings imbibing values and ethics.
2. Understanding the significance of environment.
3. Developing humanitarian outlook.
4. Able to understand nature of the individual and legal aspects of environment.
5. Understanding g major ideas, values, beliefs, and experiences.
6. These issues will help to sensitise students to be broader towards the social, cultural and human issues involved in social changes.

Topics Covered

UNIT-I **6**

Origin, Meaning, and Definition of Value, Types of Values, Individual Value, Family Value, Societal Value, Human Value, Value in Education System, Understanding Happiness and Prosperity, Self-Exploration and Natural Acceptance.

UNIT-II 6

Harmony in family, Harmony in Society, Values Leading to Harmony, Creating a world family, Harmony in Nature, Environment and Sustainable Developmental, Legal aspects of Environment, Holistic Perspectives of Values, Existence and Co-existence.

UNIT-III 6

Origin, Meaning and Definition of Ethics, Ethics: The science of the Morality of The Art of Correct Living, Ethics in Human Acts, Ethics and Religion, Ethical Norms and Laws, Ethics in Literature, Ethics in Science and Technology.

UNIT-IV 6

Ethical Approaches: Theistic Approach, Atheistic Approach, General and Special Ethics, Professional Ethics: Ethics at work-place, Ethics as Skill, Values and Ethics, Ethics with Value Education, Managerial and Business & Corporate Ethics, Corporate Social Responsibilities.

Text and Reference Books

1. Bangaria, G. P et.al, (2010) *A foundation course in Human Values and Professional Ethics*, Excel books.
2. Govindrajan, M. (2013) *Professional Ethics and Human Values*, Eastern Economy Edition.
3. Naagrazan, R.S. (2018) *Textbook on Professional Ethics and Human Values*, New age International. Misra, Anuranjan and Shukla, Dr. R.K., *Human values and Professional Ethics*.
4. Fernando, A. C., (2009) *Business Ethics: An Indian Perspective*, Pearson, India.

Subject Code: Basic Electronic Components and Circuits (BEC-154)

Course category	: Engineering Fundamentals (PLBSE)
Pre-requisite Subject	: Nil
Contact hours/week	: Lecture: 3, Tutorial:0, Practical: 2
Number of Credits	: 4
Course Assessment methods	: Continuous assessment through attendance, assignments, quizzes, practical work, record, viva voce and two minor test and one major theory & practical examination.
Course Objectives	: The objective of this course is to develop an understanding of the different types of different electronic components and circuits such as BJT, MOSFET etc. and study the working principles of different instruments.
Course Outcomes	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to memorize the basic concept of electronic circuits using Diode, BJT, FET, etc.
2. Able to execute and examine the general characteristic of electronic circuits.
3. Illustrate the basics of Boolean algebra and logic gates with their realisation using discrete electronic components.
4. Compute different parameters for characterising different circuits like rectifier, amplifiers, integrators, etc.
5. Examine the working principle of digital voltmeter, multiimeter using block diagram approach.

6. Discuss and calculate voltage, current, phase and frequency using CRO.

Topics Covered

UNIT-I

Semiconductor materials and properties: electron-hole concepts, Basic concepts of energy bands in materials, concept of forbidden gap, Intrinsic and extrinsic semiconductors, donors and acceptors impurities, Junction diode, p-n junction, depletion layer, v-i characteristics, diode resistance, capacitance, diode ratings (average current, repetitive peak current, non-repetitive current, peak-inverse voltage). Diode Applications in rectifier, filters, voltage multipliers, load regulators, clipper and clamper circuits, Breakdown mechanism (Zener and avalanche),Breakdown characteristics, Zener resistance, Zener diode ratings, Zener diode application as shunt regulator 9

UNIT-II

Transistors(BJT and FET);Basic construction, transistor action, CB, CE and CC configurations, input/output characteristics, Biasing of transistors-fixed bias, emitter bias, potential divider bias, comparison of biasing circuits. Transistor Amplifier: Graphical analysis of CE amplifier, concept of voltage gain, current gain, h- parameter model (low frequency), computation of Ai, Av, Ri, Ro of single transistor CE and CC amplifier configurations. 9

UNIT-III

JFET & MOSFET/ Switching theory and logic design: 9

Field Effect Transistors(JFET and MOSFET): Basic construction, transistor action, concept of pinch off, maximum drain saturation current, input and transfer characteristics, characteristic equation CG, CS and CD configurations, fixed & self-biasing. application of MOSFET as an amplifier and switch

Number systems, conversion of bases, Boolean algebra, logic gates, concept of universal gate, canonical forms, Minimization using K-map

UNIT-IV

Operational Amplifier: Concept of ideal operational amplifiers, ideal op-amp parameters, inverting, non-inverting and unity gain amplifiers, adders, difference amplifiers, integrators, Other Circuits based on Operational Amplifiers 9

EXPERIMENTS

Note: Minimum Five experiments are to be performed

1. To plot the forward / Reverse Characteristics of Si P-N junction diode.
2. To plot the forward / Reverse Characteristics of Zener diode
3. Study and plot the characteristic of Zener diode as voltage regulator
4. Study of half wave rectifier and draw the nature of input / output signal. Calculate the value of Idc, Irms and ripple factor.
5. Study of Full wave rectifier and draw the nature of input / output signal. Calculate the value of Idc, Irms and ripple factor.
6. Study of Bridge Rectifier and draw the nature of input / output signal. Calculate the value of Idc, Irms and ripple factor.
7. Draw input output characteristic curve of n-p-n transistor in CE configuration
8. Draw input output characteristic curve of n-p-n transistor in CB configuration
9. Draw the drain and transfer curve of JFET
10. Study of OPAMP (741) and calculate the gain in (i)Inverting mode and (ii)Non-inverting mode
11. Study of OP-AMP as a (i) Summer (ii) Integrator (iii) Differentiator; and plot the nature of input & output waveform
12. Study of CRO and multi-meter measurement voltage, frequency, phase difference using CRO along with the testing of electronics component

Text and Reference Books

1. Electronic Devices and Circuits-Boylestad and Nashelsky, 6e, PHI, 2001
2. Electronic Devices and Circuits, A Mottershead, PHI,2000, 6e
3. Digital Computer Design, Morris Mano, PHI,2003
4. Electronic Instrumentation-H.S. Kalsi, 2e,TMH, 2007

BSM-226/276 PHYSICS OF ELECTRONIC MATERIALS

Course category	:	Basic Sciences &Maths (BSM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 2, Tutorial : 0 , Practical: 0
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, two minor tests and one major theory examination.

Course Objectives	:	The course is aimed to develop the basic electronic physics skills of engineering students that are imperative for effective understanding of applied engineering science subjects.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Knowledge about basic crystal structures
2. To understand the concept of quantum mechanics.
3. To understand the lattice dynamical properties of solids.
4. To understand the quantum theory of solids.
5. To understand the classification of solids on the basis of Band structure.
6. Knowledge about superconducting materials.

Topics Covered

UNIT-I 6

Crystal Structures:

Space lattice, basis, Unit cell, Lattice parameter, Seven crystal systems and Fourteen Bravais lattices, Crystal-System Structure, Packing factor (cubic, body and face), Crystal structure of Silicon and diamond, Lattice planes and Miller Indices, Reciprocal Lattice.

UNIT-II 6

Defects in Solids

Various kinds of crystal imperfections, Point defect, Schottky and Frenkel defect, Dislocations, Edge and screw dislocation, Grain boundary, Effect of defects on electrical properties of materials.

Lattice Dynamics and Thermal Properties

Concept of lattice vibrations and thermal heat capacity, theories of molar heat capacity and their limitations, concept of phonons.

UNIT-III 6

Band Theory of Solids:

Allowed and forbidden energy bands, Formation of energy bands, The Kronig-Penney model, The k-space diagram, Electrical conduction in solids, The energy band and the bond model, Electron effective mass, Density of states function: mathematical equation, Fermi Energy

UNIT-IV 6

Physics of Advanced Materials

Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Type I and Type II superconductors, BCS theory (Qualitative),

Nanomaterials: Introduction of nanoscience and technology, structure, properties and applications of Carbon nanotubes

Text and Reference Books

1. Solid State Physics by S.O. Pillai (New Age Science Ltd., New Delhi)
2. Solid state Physics by A-J. Dekkar (McMillan and Co., London)
3. Introduction to Solid State Physics by C. Kittel (Wiley Eastern, New Delhi)
4. Concept of Modern Physics by Arthur Beiser(Tata Mc Graw Hill)

Course Code: BEC-201 Digital Electronics and Computer Organization

Course category	:	Engineering Fundamental (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, two minor tests and one major theory & practical examination.
Course Objectives	:	The course is aimed to develop the concepts of digital electronic and computer organization skills of engineering students that are imperative for effective understanding of engineering subjects.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Acquired knowledge about basics of digital electronics and solving problems related to number systems and Boolean algebra.
2. Ability to identify, analyze and design combinational and sequential circuits.
3. To design, implement and evaluate various synchronous and asynchronous sequential circuits and applications.
4. Acquired knowledge about internal circuitry and logic behind any digital system.
5. Ability to understand basic building blocks of a computer system and addressing techniques in computer organization.
6. Acquired knowledge about Indian Super Computer ‘PARAM’.

Topics Covered

UNIT-I

Overview of Digital Electronics: Number Systems, Boolean algebra: Representation of values and complements, De’Morgans theorem-simplifying expressions. AND, OR, NOT, XOR, XNOR, NAND, NOR gates and their truth tables, Combinational logic circuits for expressions using NAND and NOR gates, Logic circuit families and characteristics, SSI, MSI, LSI and VLSI circuits **9**

UNIT-II

Combinational and sequential circuits: (Simple block diagrams, truth tables and IC packages only required). Adders, decoders, multiplexers, encoder circuits, Flip-flops: RS, clocked RS, JK, D and T flip flops, Master slave flip flops, edge and level triggering, Multivibrators - Astable, Bistable, Monostable, counters-ripple and decade. Registers, latches and Tristate buffers. **9**

UNIT-III

Building blocks of a computer system: Basic building blocks-I/O, memory, ALU, Control and their interconnections, Control unit and its functions- Instruction-word, Instruction execution cycle, organizational sequence of operation of control registers; controlling of arithmetic operations; branch, skip, jump and shift instructions, ALU-its components. **9**

Addressing techniques and registers: Addressing techniques-Direct, immediate addressing; paging, relative, Indirect and indexed addressing. Memory buffer register; accumulators; Registers-Indexed, General purpose, Special purpose; overflow, carry, shift, scratch registers; stack pointers; floating point; status information and buffer registers

UNIT-IV

Memory: Main, RAM, static and Dynamic, ROM, EPROM, EAROM, EEPROM, Cache and Virtual memory. Interconnecting System components: Buses, Interfacing buses, Bus formats-address, data and control, Interfacing keyboard, display, auxiliary storage devices, and printers. I/O cards in personal computers. Development of Indian Super Computer 'PARAM': History, Characteristics, Strengths, Weakness and basic Architecture. **9**

LIST OF EXPERIMENTS

1. Design and verification of following arithmetic circuits using 74xx family ICs.
   a. Half adder and Full adder
   b. Half subtractor and full subtractor
2. To perform the code conversion- binary to gray and gray to binary and its truth table verification.
3. To design a combinational logic circuit using 74xx family ICs and its truth table verification in both SOP and POS forms.
4. Realization of 2:4 decoders and 4:2 encoder circuit and verification of its truth table.
5. To design and verify the truth table of multiplexer and demultiplexer circuits.
6. To design a 1-bit comparator using 74xx family ICs and to study the performance of 4-bit comparator IC 7485.

Text and Reference Books

1. Digital principle and applications Malvino and Leach- (TMH)
2. A.S.Tannenbaum : Structured Computer Organization, Pearson
3. Thomas C. Bartee : Digital Computer Fundamentals, McGraw-Hill
4. Duglus V Hall : Microprocessors and Interfacing: programming and Hardware, McGraw-Hill, 1986

Course Code: BHM-201 SCIENTIFIC AND TECHNICAL WRITING

Course category : HSS
Pre-requisite Subject : NIL

Contact hours/week	:	Lecture: 2, Tutorial : 0 , Practical: 0
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two Minor Tests and one Major Theory Examination.
Course Objectives	:	To Prepare Professionals with a view to developing the power of know-how of the subject and enhance them face challenges in English language.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Overcome the problems he/she faces in oral and written communication.
2. Acquire knowledge of and methods for using technical communication, such as, reports, proposals and business letters etc.
3. Use and practice compositions correctly.
4. Enhancing word power by counselling scientific literature.
5. Focusing on effortless speaking and writing.
6. Give Presentations in different sessions and make self-appraisal

Topics Covered

UNIT-I

Language Vs communication: Communication as coding and decoding – signs, symbols & pictograph – verbal and non –verbal symbols – Language & communication; Types of Communication- functional, situational, verbal, and non-verbal, interpersonal, group, interactive, public, Mass Communication. Thinking and Articulation – cognitive, affect, critical, creative aspects of articulation. **6**

Skills of Language Acquisition: Natural Language Acquisition Skills: Listening, Speaking, Reading & Writing {LSRW}; Language Acquisition Through Training: Listening, Speaking, Reading, Writing, Grammar & Vocabulary {LSRWGV}

Phrase, Clause & Sentence: Professional Drafting-Simplicity, Clarity and Conciseness of a Presentation, Differentiating between Professional & Creative Writing, Blending of Artistic/Professional Writing, Avoiding gender, racial and other forms of bias in Professional Writing. Pre Writing, Drafting and Re-writing.

Processing Professional Data: Data Collection, Literature Review, Data Analysis, Drafting Data & Deriving Inferences.

UNIT-II

Technical Paper Writing: Professional Paper Elements-Front Matter of a Paper, Main Text of a Paper, End Matter of a Paper: Organising References and Bibliography, Order of a thesis and Paper Elements, Concluding Remarks. **Methods of Research Paper Writing:** Identification of Author and His Writing-Author's name and Affiliation, Joint Authorship of a Paper, Identification of Writing-Title, Keywords, Synopsis, Preface and abstract. Drafting Research Article & Methodology. **6**

Thesis/Dissertation Writing: Thesis Elements-Front Matter of a Thesis, Main Text of a Thesis, End Matter of a Thesis, Specimen—Thesis and Research Paper, Chapters and Sections-

Introductory Chapters and Sections, Statement of the Problems, Plan and Scope, Core Chapters and Sections-Theoretical Analysis and Synthesis, Basic Assumption and Hypothesis.

Professional Presentation & Seminar Delivery Tools: Designing the Presentation; Establishing the Objectives. Making Professional Power Point Presentations, Signalling Structure of Presentation through Sentences and Crisp Phrases, Preparing Notes for Professional/Technical Presentation, Text Animation, White Board, Flip Charts, Diagrams, Preparing Cards. Seminar Presentations: Purpose modes and methods. Nascent Emerging Platforms for On-line Presentations viz. Zoom, Webex, Team & Meet etc.

UNIT-III

Introduction to Generation–Z, Cyber Identity & Professional Netiquettes for Netizens: Drafting E-mails, Blogs on social media, Videoconferencing. Managing Profiles on social media. What to Write and Share on social media. **6**

Professional Drafting: Letters Vs E-mails, Formal and Informal mails, Parts of e-mails, Types of e-mails, Managing tone of E-mails & Business Letters, Examples of Letters & E-mail, Professional Correspondence through E-mail, Job Applications & Covering Letters. Introduction to DOs (Demi-Official Letters)

Conducting Professional Meeting: Pre-meeting Preparation, During Meeting: Action Taken Report (ATR) & New Agenda Points, Post Meeting Follow ups. Notice, Circular, Agenda & Minutes.

Career & Correspondence: Developing a Professional C.V, Bio Data & Resume Building. Report Writing, Kinds of Reports, Length of Report, Parts of a Report, Terms of Reference, Collection of Facts, Outlines of Report, Examples of Report, Technical Proposal, Elements of Proposal, Examples of Proposal, drafting of proposal.

UNIT-IV

Professional Interviews- Interview skills-body language, gesture, posture, tips, and tactics of interview. Professional interview of an expert. Questioning & Answering Skills. **9**

Case study- objectives, methods, examples of various case-study.

Audience Analysis in Technical Writing: Industrial vs. non-industrial users; Exploring primary, secondary, tertiary users in contexts of production and use; Creating personas; Multicultural issues; Analysing real-world examples. Estimating, tracking, and managing tech writing projects. Determine the project scope, Estimates and schedules, Assemble the team, provide resources and leadership, Evaluate the project, Appendixes and Annexure, References, Peripherals—Official Formalities, Rights and Permission, Certificate and Copyright, Dedication, Acknowledgement, Correspondences. Managing Tone in Writing.

Project Writing: Elements of a Professional Project Making: Making a final Project on topics, given by the instructor, Result & Discussion.

Text and Reference Books

1. Acharya Anita. (2012) *Interview Skills- Tips & Techniques*. Yking Books, Jaipur.
2. Basu, B. N., (2008) *Technical Writing*. PHI Learning Pvt. Ltd.., New Delhi.

3. Chauhan, N. K & Singh, S. N. (2013) *Formal Letters*, Pankaj Publication International, New Delhi.
4. Chhabra T.N. (2018) *Business Communication. Sun* India Publication New Delhi.
5. Dubey Arjun et.al. (2016) *Communication for Professionals. Alfa* Publications, Delhi.

Course Code: BEC-202 Network Analysis & Synthesis

Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, two minor tests and one major theory examination.
Course Objectives		The course is aimed to develop the concepts of network analysis and synthesis skills of engineering students that are imperative for effective understanding of engineering subjects.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Able to apply the electric circuit concepts and theorems with nodal and mesh on the complex RL, RC & RLC circuits in time and frequency domain.
2. Able to apply the concept of Laplace Transform to evaluate the system function for single and two port networks.
3. Able to understand the properties of real immittance functions
4. Able to synthesize the LC, RC & RL immittance networks using the Foster and Cauer approaches.
5. Able to realize and synthesize the transfer functions of two port networks.
6. Able to realize and synthesize the transfer functions of active networks.

Topics Covered

UNIT-I

Signal and System analysis, Definition and basic circuits concepts, Mesh and nodal analysis, General characteristics of signals and wave forms: step, impulse, ramp, and gate function; Initial and final conditions in circuits, Network Theorem: Maximum Power Transfer Theorem, Milliman's Theorem; Solution of network equations: Transient Response &steady state response, Convolution Integral of basic signals. **9**

UNIT-II

Laplace Transform: Introduction, Region of Convergence, Laplace transform of common basic signals, Properties, Inverse Laplace Transforms, Application of Laplace Transform Techniques to Electrical Circuits analysis, Transform Circuits, Thevenin and Norton's Theorem, Initial and Final Value theorem. **9**

Two-Port Network functions: Introduction, Parameters, Condition for reciprocity and symmetry, Relation between port parameters, Interconnection of two ports networks.

UNIT-III

Element of Realizability: Concepts of Poles and Zeroes, Causality & Stability, Hurwitz polynomials, Positive real functions; Network Synthesis using Cauer and Foster: Properties of real immittance functions, synthesis of LC driving point immittances, Properties of RC driving point impedances, Synthesis of RC impedances or RL admittances, Properties of RL impedances and RC admittances. **9**

UNIT-IV **9**

Transfer function synthesis: Properties of transfer function, Zeroes of Transmission, Synthesis of Y_{21}& Z_{21} with 1-ohm termination, Introduction to Active network synthesis: Operation of filters, filter design, frequency scaling.

Text and Reference Books

1. Franklin F. Kuo, 'Network Analysis and synthesis', 2nd Edition, Wiley India Pvt Ltd.
2. M.E. Van Valkenberg, 'Network Analysis', 2nd Edition, Prentice Hall of India Ltd.
3. M.S. Sukhija, T.K. Nagsarkar, 'Circuits and Networks' 2nd Edition, Oxford University Press.
4. S.P. Ghosh, A.K. Chakraborty, 'Network Analysis and Synthesis' McGraw Hill Education Pvt Ltd.

Course Code: BEC-203 **Electronic Measurement & Instrumentation**

Course category : Program Core (PC)

Pre-requisite Subject : Nil

Contact hours/week : Lecture: 2, Tutorial:1, Practical: 0

Number of Credits : 3

Course Assessment methods : Continuous assessment through tutorials, attendance, assignments, quizzes, two minor tests and one major theory examination.

Course outcomes : The course is aimed to develop the concepts of electronic measurement & instrumentation skills of engineering students.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Able to explain the quality measurements with electronic instruments.
2. Able to articulate the range of measuring instruments.
3. Able to solve and illustrate the numerical problem for DC/AC bridge-based circuits.
4. Able to illustrate the principles of various types of transducers and their applications.
5. Able to explain the construction, principle of operation, and applications of Data Acquisition System (DAS).
6. Able to use the digital display devices in practical applications.

UNIT-I 6

Measuring Instruments: classification, absolute and secondary instruments, Performance Characteristics, Error in measurement, Sources of error, Arithmetic mean, Deviation from the mean, Average deviation, Standard deviation, Limiting errors. Ammeters and Voltmeters, PMMC, Moving Iron (MI) type, Expression for the deflecting torque and control torque, Extension of range using shunts and series resistance.

UNIT-II 6

DC/AC Bridges: General equations for bridge balance, Self-inductance measurement by Maxwell's bridge, Hay's bridge, Capacitance measurement by Schering bridge, Method of measuring low, medium and high resistance: Kelvin's double bridge for measuring low resistance, Wheat-stone's bridge, measurement of high resistance, Basics of wattmeter and energy meter

UNIT-III 6

Transducers: Introduction, Selection Parameters of Transducer, Type of Transducer, Resistive Transducer, Strain Gauges, Inductive Transducer: LVDT, Capacitive Transducer, Photo-electric Transducer, Photo-Voltaic Cell, Photo Transistors, Temperature Transducers, Digital Transducer.

UNIT-IV 6

Data Acquisition and Conversion: Introduction, Objective of Data Acquisition System, Single and Multichannel DAS, A/D and D/A converters using Op-Amp, Data Loggers: Block diagram, principle of operation

Digital Display Devices: LED, LCD, Incandescent Display, LVD (Liquid Vapour Display)

Text and Reference Books

1. H. S. Kalsi, "Electronic Instrumentation", 3rd Ed., McGraw Hill Education(India), 2015.
2. David A. Bell, "Electronic Instrumentation and Measurements", 3rd Ed., Oxford University Press, 2013.
3. A K Sawhney, "Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai & Co.

Course Code: BEC-204 **ELECTRONIC DEVICES & CIRCUITS**

Course category	:	Department Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 2, Tutorial : 1, Practical: 0
Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, and two minor tests and one major theory examination.
Course Outcomes	:	The course is aimed to develop the concepts of electronic devices & circuits skills of engineering students that are imperative for effective understanding of engineering subjects.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Ability to understand the basic operation and working of BJT.
2. Able to understand the small-signal operation and models of BJT.
3. To understand and use of the device models to explain and calculate the characteristics of the field effect transistors.
4. Able to understand the small-signal operation and models of MOSFET.
5. To be able to understand and analyze the feedback amplifiers.
6. Understand the basic principles of oscillators.

Topics Covered

UNIT-I 6

BJT: Review of device structure operation and V-I characteristics, BJT circuits at DC, BJT as amplifier and switch, biasing in BJT amplifier circuit;

Small-signal operation and models, single stage BJT amplifier, BJT internal capacitances and high frequency model, frequency response of CE amplifier. Darlington pair, BJT differential pair, Cascode and Cascade amplifier.

UNIT-II 6

FET: Review of device structure operation and V-I characteristics, FET Circuits at DC, FET as Amplifier and switch, Biasing in FET amplifier circuits;

Small-signal operation and models, single stage FET amplifier, FET internal capacitances and high frequency model, frequency response of CS amplifier.

UNIT-III 6

Feedback Amplifiers: The general feedback structure, properties of negative feed- back, the four basic feedback topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, the shunt-shunt and shunt-series feedback amplifier.

UNIT-IV 6

Oscillators: Basic principles of sinusoidal oscillators, RC Phase-shift Oscillator circuits, Resonant-circuit based LC oscillators.

Text and Reference Books

1. Milman, Halkias&Jit- Electronics Devices and Circuits- TMH
2. Donald ANeaman, “Semiconductor Physics and Devices Basic Principles”, 3e, TMH India.

Course Code: BCS-205 **DATA STRUCTURE & ALGORITHMS**

Course category : PLBSE
Pre-requisite Subject : NIL
Contact hours/week : Lecture: 2, Tutorial: 0, Practical: 2

Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, practical work, record, viva voce, two minor tests and one major theory & practical examination.
Course Objectives	:	This course helps the students in gaining the knowledge of data structure concepts, arrays, stack, queues, trees etc, discussion of various implementations of these data objects, programming styles, and run-time representations. Course also examines algorithms for sorting and searching. Algorithm analysis and efficient code design is discussed.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Explain how to use a specific data structure in modelling a given problem
2. Identify, construct, and clearly define a data structure that is useful for modelling a given problem.
3. Use a specific algorithmic technique in solving a given problem.
4. Design an algorithm to solve a given problem.
5. Define the notions of worst-, best-, and average-case running times of algorithms.
6. Combine fundamental data structures and algorithmic techniques in building a complete algorithmic solution to a given problem.

Topics Covered

UNIT-I **9**

Introduction to Algorithms and Algorithm Strategies: Overview, Algorithm Strategies, Overview of Specific Algorithms, Introduction to Run Time Analysis and Big-O: Overview, Asymptotic Run Time Complexity, Big O Notation, Analysis of Algorithms, Implementation of Specific Algorithms, Algorithm Specifications: Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best & worst case analysis).

UNIT-II 9

Introduction to Essential Data Structures: Overview, Fundamental Data Structures, Visualizing Data Structures, Types of Data Structures-Linear & Non-Linear Data Structures.

Linear Data Structure: Array: Representation of arrays, Applications of arrays, sparse matrix and its representation, Stack: Definitions & Concepts, Operations on Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression and Their Compilation, Recursion, Tower of Hanoi.

UNIT-III 9

Queue: Representation of Queue, Operations on Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue, Linked List: Singly Linked List, Doubly Linked list, Circular linked list, Linked implementation of Stack, Linked implementation of Queue

Nonlinear Data Structure: Tree-Definitions and Concepts, Representation of binary, tree, Binary tree traversal (Inorder, Postorder, Preorder), Threaded binary tree, Binary search trees, AVL trees.

UNIT-IV 9

Graph-Matrix Representation of Graphs, Elementary, Graph operations, (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree).

SORTING And SEARCHING: Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Linear Search, Binary Search.

EXPERIMENTS:

1. **Stack operations**-Write a program to perform PUSH, POP, PEEP & CHANGE operations on Stack.
2. **Queue Operations**-Write a program to implement insertion & deletion in a queue.
3. **Circular Queue Operations**-Write a program to implement insertion & deletion in a circular queue
4. Write a program for linked list insertion, deletion & copy
5. **Sorting and searching:** Write a program to perform
    a. Selection sort
    b. To sort the given number using bubble sort
    c. Merge sort
    d. Quick sort
    e. Sequential and binary search

Text and Reference Books

1. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, Publisher-Tata McGraw Hill.
2. Ten Baum, Data Structures using C & C++ , Publisher – Prenctice-Hall International.
3. Horowitz, Sahni, Fundamentals of Computer Algorithms, Galgotia Pub. 2001 ed.
4. Sartaj Sahani, Fundamentals of Data Structures in C++.
5. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, Publisher-Thomson Learning.

BSM-254 Numerical Techniques

Course category	:	BSM
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination.
Course Objectives	:	The course is aimed to understand and implement various concepts of numerical analysis to solve real life problems.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. To understand numerical techniques for finding the roots of non-linear equations
2. To understand numerical techniques for finding the solution of system of linear equations.
3. To understand the concept of interpolation.
4. To understand concept of numerical integration.
5. To find numerical solutions of initial value problem for ordinary differential equations.
6. To apply appropriate approximation techniques to solve real world engineering problems.

Topics Covered

UNIT-I

Solution of System of Linear Equations and Eigen Value Problem: Gauss Elimination Method, Jordan Elimination Methods, LU Factorization Methods, Error in Solving Linear Systems, Matrix Norm, Eigenvalue Problem: Gerschgorin's Theorem, Power Method, Jacobi Method and Given`s Method. **9**

UNIT-II

Roots of Nonlinear Equations: Bisection method, Regula-Falsi method, Secant Method, Newton-Raphson method, Fixed point iteration method, convergence criteria, Modified Newton Raphson Method, Aitken's delta square method to accelerate the rate of convergence. **9**

UNIT-III

Interpolation and Numerical Differentiation: Finite difference operators, Newton's Forward/Backward Interpolations, Central difference formula's i.e. Bessel and Stirling's interpolation formulae, Divided differences, Lagrange interpolation and Newton's divided difference interpolation, Error in Polynomial Interpolation, Numerical Differentiation: Using Forward/ Backward/central difference formula. **9**

UNIT-IV **9**

Numerical Integration and Numerical solution of Ordinary differential equations: Trapezoidal and Simpson's rules for integration, Solution of first order ordinary differential equations: Euler method, Modified Euler method, Improved Euler method, Runge-Kutta methods, Discretization, Euler's Method, Multistep Methods: Milne Predictor Corrector method, Adam's Predictor and Corrector method.

Text and Reference Books

1. M.K. Jain, S.R.K. Iyenger and R.K. Jain, Numerical Methods:, New Age Publishers.

2. P. *Kandasamy*, K.Thilagavathi, K.Gunavathi , *Numerical Methods*., S. Chand & Company.

3. S. D. Conte and Carl de Boor, Elementary Numerical Analysis - An Algorithmic Approach (3rd edition), McGraw-Hill, 1981.

4. Greenbaum & T. P. Chartier, Numerical methods, Princeton University Press, 2012.

Course Code: BEC-251	**Analog Integrated Circuits**
Course category	: Program Core (PC)
Pre-requisite Subject	: Fundamentals of Electronics Engineering
Contact hours/week	: Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits	: 5

Course Assessment methods	:	Continuous assessment through Viva voce, Practical work, attendance, two minor tests one major & practical examination.
Course Objectives	:	The course is aimed to develop an understanding of Integrated Circuit Design, Op-amp circuits and its applications.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Explain about the operational amplifiers and its characteristics as well as various types of op-amps.
2. Acquire the ability to design and test practical circuits for amplifiers.
3. Able to implement the concept of Op-Amp to design Op-Amp based linear and non-linear applications.
4. Understand the operation of feedback amplifiers and oscillators
5. Able to learn the basic functioning of filters, and advanced applications of OP- amp to design first and second order filter.
6. Able to design integrated circuits for advanced applications.

Topics Covered

UNIT-I

Introduction to Integrated Circuit Design **9**

Review of electronics integrated circuits, Block diagram of Op-AMP, differential amplifiers, Current mirrors using BJT and MOSFETs, Base current compensated mirrors, Wilson current mirrors, Widlar current source, Basic OPAMP configurations and characteristics, OPAMP non-idealities.

UNIT-II

Op-amp circuits: **9**

Amplifiers, summers, differentiators, integrators, and oscillators.

Linear and Nonlinear applications of Op-amp:

V-I and I-V converters, Log-antilog amplifiers, Precision rectifier, Peak detector, Sample and Hold Circuits, Analog multiplier and their applications, Op-amp as a comparator, Zero-crossing detector, Schmitt trigger, stable and Monostable multivibrator using Op-Amp, Generation of triangular waveform.

UNIT-III

Filters: **9**

Characteristics of filters, Classification of filters: LPF,HPF,BPF,BSF,APF

Design of first and second order filter: Butterworth filters, Chebyshev filters, Bessel filters.

UNIT-IV

Advance Applications of integrated circuits: **9**

Frequency Divider, PLL IC, 555 IC timer, Design of astable and monostable Multivibrators using 555 Timer IC, VCO.

LIST OF EXPERIMENTS

1. Study the characteristics of inverting operational amplifier.

2. Design of an instrumentation amplifier.
3. Design and test an astable multivibrator for a given frequency.
4. Study the characteristics of integrator circuit.
5. Design of Analog filters.
6. Design of a Phase Locked Loop (PLL)
7. Realization of Schmitt trigger circuit.
8. Op-amp (741) as an integrator and realization of low pass filter, and op-amp as differentiator and realization high pass filter.
9. (a) Verify the operation of voltage comparator circuit.
   (b) Verify the operation of zero crossing detector circuit.

Text and Reference Books

1. Microelectronic Circuits, Sedra and Smith, 7th Edition, Oxford, 2017.
2. Behzad Razavi: Design of Analog CMOS Integrated Circuits, TMH.

Course Code: BEC-252 Principles of Communication Systems

Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial : 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, record, viva voce, two minor tests and one major theory examination.
Course Objectives	:	This course is intended to develop the concepts of signals, frequency domain transformation, communication systems with analog modulation schemes.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to understand the characteristics of different signals and operation on signals.
2. Acquire the knowledge of Fourier Series, Fourier Transform, Laplace Transform and their properties.
3. Able to analyze the behavior of continuous and discrete time system in time & frequency domain.
4. Able to understand the amplitude modulation.
5. Able to understand the angle modulation.
6. Able to understand the multiple access techniques.

Topics Covered

UNIT-I

Signals: Introduction to elementary signals, Representation of Composite signals using elementary signals, Classification of signals, Operation on signals, Time shifting, Time scaling, Time Reversal, Fourier series and its properties, Magnitude & Phase spectrum of Fourier coefficient, Fourier transform for continuous time signals (CTFT), Fourier transform of **9**

Discrete time signals (DTFT), Inverse Fourier Transform CT & DT Signals, Properties of CTFT & DTFT

UNIT-II

Laplace Transform and properties, Inverse Laplace Transform, Z-transform and properties, Inverse Z-transform, Sampling theorem and applications, **9**

Systems: Introduction to Continuous and Discrete time LTI systems, Properties of LTI Continuous and discrete time systems, Response of Continuous and discrete time LTI system, Time domain analysis and Frequency domain analysis of Continuous & Discrete time LTI System. Block diagram representation of continuous and discrete time system

UNIT-III

Introduction of Communication system: Elements of Communication systems, Need of modulation and Modulation techniques, Baseband and Pass band signals, Introduction of analog and digital modulation, **9**

Detailed Analysis of Amplitude Modulation (AM) and demodulation: Modulation index, Types of amplitude modulation, Double sideband with Carrier (DSB-C), Double side band without Carrier (DSB-SC), Single Side Band Modulation (SSB), vestigial Modulation (VSB), Power Spectrum and Bandwidth of different modulation scheme.

UNIT-IV **9**

Detailed Analysis of Angle modulation: Types of angle modulation, Frequency Modulation (FM): Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, Phase modulation (PM): Transmission bandwidth of PM Signals, Generation of PM Signals, Demodulation of PM Signals, Carson's Bandwidth, Comparison of FM and PM system. superheterodyne receivers, Basics of TDMA, FDMA and CDMA.

Text and Reference Books

1. Alan V Oppenheim and S Hamid, "Signals and Systems", Pearson New International Edition
2. Barry Van Veen and Simon Haykin "Signals and Systems", 2e, Wiley India
3. H. Taub, D L Schilling and GoutomSaha, "Principles of Communication", 3e, Tata McGraw-Hill Publishing Company Ltd.
4. Simon Haykin, "Communication Systems",4e, Wiley India.
5. H. P. HSU and D. Mitra, "Analog and Digital Communications", 2e, Tata McGraw-Hill Publishing Company Ltd.

Course Code: **Microprocessors and Applications**
BEC-253

Course category : Program Core (PC)
Pre-requisite Subject : Digital Electronics and Computer Organization
Contact hours/week : Lecture: 3, Tutorial : 1 , Practical: 2

Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, practical work, record, viva voce, two minor tests and one major theory & practical examination.
Course Objectives	:	This course is aimed to develop the concepts of microprocessors and applications skills with basics of intel 8085 & 8086 microprocessors.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to understand the basic building blocks of Microprocessors.
2. Acquiring knowledge about 8085 Microprocessor and supporting devices.
3. Foster ability to write the assembly language programming using 8085 microprocessor.
4. Foster ability to understand 8086/8088 microprocessors
5. Foster ability to write the assembly language programming using 8086 microprocessor.
6. Foster ability to develop microprocessor-based system using different peripheral devices.

Topics Covered

UNIT-I

Introduction to Microprocessors: Evolution of Microprocessors, Microprocessor Architecture and its operations, Memory devices, I/O Devices, 8-bit Microprocessor (8085): Introduction, Signal Description, Register Organization, Architecture, Basic Interfacing Concepts for Memory and I/O Devices **9**

UNIT-II

8085 Assembly Language Programming: Instruction Classification, Instruction Format, Addressing Modes, 8085 Instructions: Data Transfer operations, Arithmetic operations, Logic Operations, Branch operation, Flow Chart, Writing assembly language programs, Programming techniques: looping, counting and indexing. **9**

UNIT-III

16-bit Microprocessors (8086/8088): Architecture, Physical address segmentation, memory 18 organization, Bus cycle, Addressing modes, difference between 8086 and 8088, Introduction to 80186 and 80286, Assembly Language Programming of 8086/8088 **9**

UNIT-IV

Data Transfer Schemes: Introduction, Types of transmission, 8257 (DMA), 8255 (PPI), Serial Data transfer (USART 8251), Keyboard-display controller (8279), Programmable Interrupt Controller (8259), Programmable Interval Timer/ Counter (8253/8254): Introduction, modes, Interfacing of 8253, applications, ADC and DAC **9**

LIST OF EXPERIMENTS

1. Write a program using 8085 Microprocessor for Decimal addition and subtraction of two numbers.
2. Write a program using 8085 Microprocessor for Hexadecimal addition and subtraction of two numbers.
3. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers.
4. To perform multiplication and division of two 8 bit numbers using 8085.
5. To find the largest and smallest number in an array of data using 8085 instruction set.
6. To write a program to arrange an array of data in ascending order.
7. To write a program to initiate 8251 and to check the transmission and reception of character.
8. To interface 8253 programmable interval timer to 8085 and verify the operation of 8253 in six different modes.
9. To interface 8255 with 8085 and verify the operation of 8255 in different modes.
10. To interface 8259 with 8085 and verify the operation of 8259.
11. Serial communication between two 8085 microprocessors through RS-232 C port.

Text and Reference Books

1. R. Singh and B. P. Singh: Microprocessor Interfacing and Application, New Age International Publishers, 2nd Edition.
2. D. V. Hall: Microprocessors Interfacing, TMH (2nd Edition).
3. R. S. Gaunkar: Microprocessor Architecture, Programming and Applications with 8085/8080, Penram Publication
4. Y.C. Liu and G.A. Gibson: Microcomputer Systems: The 8086/8088 Family Architecture Programming and Design, PHI 2nd Edition,

Course Code: Electromagnetic Field Theory
BEC-254

Course category	**:**	Program Core (PC)
Pre-requisite Subject	**:**	Nil
Contact hours/week	**:**	Lecture: 3, Tutorial:1, Practical: 0
Number of Credits	**:**	4
Course Assessment methods	**:**	Continuous assessment through tutorials, attendance, assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	:	This course is aimed to develop and understand the concepts of electromagnetic field theory and its applications.
Course Outcomes	**:**	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Understanding the basic mathematical concept related to electromagnetic vector fields and principles of electrostatic.

2. Apply the principles of magneto statics to the solutions of the problem relating to magnetic field.
3. Apply Maxwell's equations to solutions of problems relating to uniform plane wave propagation.
4. Understand characteristics and wave propagation on high frequency transmission lines.
5. Carryout impedance transformation on transmission line.
6. Use smith chart to find the solution of various transmission line problems.

UNIT-I 9

Electrostatics Fields: Various co-ordinate system, Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gauss's Law – Maxwell's equation, Electric dipole and flux lines, Divergence Theorem, Poisson's and Laplace's equation, Energy density in electrostatic fields. Electric field in material space: Properties of materials, Convection and conduction currents, conductors, Polarization in dielectrics, Dielectric Constants, continuity equation and relaxation time, Boundary condition. Method of images.

UNIT-II 9

Magneto-static fields, Biot-Savart's Law, Ampere's circuit law for a current element, magnetic scalar and vector potential, Magnetic dipole, Magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, Magnetic forces, materials and devices: Forces due to magnetic field, Magnetic torque and moment, a magnetic dipole, Magnetization in materials, magnetic boundary conditions, Magnetic energy. Waves and applications: Faraday's Law, Transformer and motional electromotive forces, Displacement current, Maxwell's equations in differential and integral form.

UNIT-III 9

Electromagnetic wave propagation: Derivation of wave equation and their general solution, Wave propagation in lossy dielectrics, Plane waves in lossless dielectrics, Plane wave in free space, Plain waves in good conductors, Poynting's theorem, Power and the Poynting vector, Reflection of a plane wave at normal and Oblique incidence.

UNIT-IV 9

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.

Text and Reference Books

1. W. H. Hayt and J. A Buck "Electromagnetic field Theory" 7th Ed. TMH
2. M. N. O. Sadiku, "Elements of Electromagnetics", 4th Ed, Oxford University Press

Course Code: BEC-255		**Electronic Software Tools**
Course category	:	Programming Language based Skill (PLBSE)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture :1, Tutorial : 0 , Practical: 2
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, practical work, record, viva voce, two minor tests and one major theory & practical examination.
Course Objectives	:	This course is intended to develop the skills on electronic software tools using Multisim and SPICE tools like Cadence, Mentor etc.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to familiarized with Multisim
2. Use Multisim to capture circuit schematics
3. Able to perform simulation and implementation of electronic circuits
4. Use interactive simulation to check circuit design
5. Perform circuit Analysis using SPICE
6. Able to transfer PSICE design to PCB layout

Topics Covered

UNIT-I

Introduction to MultiSim, Design procedures, Setting MultiSim simulation environment: Capture of schematics. 3

UNIT-II

Simulation and result display, Implementation of simple electronic circuits 3

UNIT-III

Work with design variants, Configuring application circuits, Analysis of circuits using MultiSim 3

UNIT-IV

design of Analog and Digital circuits, SPICE modelling and circuit analysis, Perform measurements and test on circuits, Comparison of simulated results with measured results of real circuit, Design transfer to PCB layout 3

List of Experiments: (8 practicals out of 13 will be conducted)

1) Design and simulation of RC based filter circuits.
2) Design and simulation of oscillator circuit.
3) Design and simulation of inverter circuit.
4) Simulation of diodes based circuit using SPICE simulator software
5) Simulation of transistors based circuit using SPICE simulator software
6) Circuit design and simulation using Cadence.

7) Circuit design and simulation using Mentor Graphics.

8) Introduction to VHDL and Verilog.

9) To layout the basic prototype of elevator in proteus simulation software program using Atmega16 microcontroller.

10) Developing domestic Home Automation Circuit using Atmega328p in proteus simulation software to enforce UART protocol.

11) Using Soil Moisture and DHT sensor build a IoT based irrigation system using Atmega328p as microcontroller in proteus simulation software (both schematic and PCB layout).

12) Simulation of smart street light in on proteus professional software.

13) Development of Humidity Sensor Unit using ATMega16 and Simulate on Proteus professional software.

Text and Reference Books

1. Electronic Devices and Circuits-Boylestad and Nashelsky, 6e, PHI, 2001
2. Neamen, Donald A. *Microelectronics: circuit analysis and design*. Vol. 43. New York: McGraw-Hill, 2007.
3. Salivahanan, S. *Electronic devices and circuits*. 5th edition, Oxford publication

Course Code:SEC-211 Microelectronics: Device to Circuit

Course category	:	Departmental Minor (DM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial :1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	:	This course is aimed to develop an understanding of modelling and fabrication technologies for BJT and MOSFET.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to understand fundamentals of fabrication technology.
2. Able to understand complete steps required in fabrication of microelectronic devices.
3. Able to identify challenges related to microelectronic devices
4. Able to solve problems using SPICE simulation.
5. Able to design and characterize MOS based structure.
6. Able to explain basic operation principles of MOS transistors and circuits based on it.

Topics Covered

UNIT-I

Basics of Fabrication Technology: Introduction, Current Trends in fabrication technology, EGS and MGS, Single crystalline and Polycrystalline crystal, SGS, Fabrication Principles: Epitaxial growth, Oxidation of silicon, Diffusion and Ion-implantation, Photolithography, Etching, Metallization. **9**

UNIT-II

Fabrication of Different Electronic Devices: Fabrication of resistor, capacitor and diode, Fabrication Steps for developing BJT and MOSFET on Silicon wafer. Characterization of electronic components. **9**

UNIT-III

Bipolar Junction Transistor: Physical Structure and modes of operation of BJT, BJT as an Amplifier and switch, Characteristics and current equations of BJT, Ebers Moll Model, Simple BJT inverter and Second Order Effects. SPICE model discussion of BJT based circuit. **9**

UNIT-IV

MOSFET : MOS transistor basic: physical structure, types, symbols and operation, MOS C-V characteristics, MOS as a diode, Analytical Model of MOSFET, MOS Parasitics&SPICE model discussion of MOSFET based circuit. **9**

Text and Reference Books

1. B.G.Streetman and S. Banerjee, Solid State Electronic Devices, Prentice Hall.
2. Sedra and Smith, Microlectronics Circuits, Oxford University Press, 1998.
3. S.M. Sze, "VLSI Technology", TMH
4. Weste and Eshraghian, Principles of CMOS VLSI Design Addison Wesley, Latest Edition

Course code:		**Programming in Python**
SEC-221		
Course category	:	DM
Pre-requisite Subject	:	IoT
Contact hours/week	:	Lecture : 3, Tutorial : 0 , Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, two minor tests and one major theory & practical examination.
Course Objectives	:	This course is intended to develop skills on Python programming language.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. To read and write simple Python programs.
2. To develop Python programs with conditionals and loops.
3. To define Python functions and to use Python data structures–lists, tuples, dictionaries.
4. To do input/output with files in Python.
5. To do searching, sorting and merging in Python.
6. To use Python Modules

Topics Covered

UNIT-I **9**

Introduction: The Programming Cycle for Python, Python IDE, Interacting with Python Programs, Elements of Python, Type Conversion. Basics: Expressions, Assignment Statement, Arithmetic Operators, Operator Precedence, Boolean Expression. Control Structure -Selection Control- If Statement - Indentation in Python - Multi-Way Selection - Iterative Control - While Statement - Input Error Checking - Infinite loops - Definite vs. Indefinite Loops

UNIT-II **9**

Function: Parts of A Function, Execution of A Function, Keyword and Default Arguments, Scope Rules. Strings: Length of the string and perform Concatenation and Repeat operations in it. Indexing and Slicing of Strings.

UNIT-III

Python Data Structure: Tuples, Unpacking Sequences, Lists, Mutable Sequences, List Comprehension, Sets, Dictionaries Higher Order Functions: Treat functions as first class Objects, Lambda Expressions. Sieve of Eratosthenes: generate prime numbers with the help of an algorithm given by the Greek Mathematician named Eratosthenes, whose algorithm is known as Sieve of Eratosthenes.

UNIT-IV **9**

File I/O: File input and output operations in Python Programming Exceptions and Assertions Modules : Introduction, Importing Modules, Abstract Data Types : Abstract data types and ADT interface in Python Programming. Classes: Class definition and other operations in the classes, Special Methods (such as _init_, _str_, comparison methods and Arithmetic methods etc.), Class Example, Inheritance, Inheritance and OOP.

List of Experiments:

1. Write a program to demonstrate different number datatypes in python.
2. Write a program to perform different arithematic operations on numbers in python.
3. Write a program to create, concatenate and print a string and accessing substring from a given string.
4. Write a python script to print the current date in following format “Sun May 29 02:26:23 IST 2017”.
5. Write a python program to create, append and remove lists in python.
6. Write a program to demonstrate working with tuples in python.
7. Write a program to demonstrate working with dictionaries in python.
8. Write a python program to find largest of three numbers.
9. Write a python program to convert temperature to and from Celsius to Fahrenheit.
10. Write a python program to print prim numbers less than 20.

Text and Reference Books

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/OReilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)
2. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python-Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

Course Code: BHM-302/ 305 **INDUSTRIAL MANAGEMENT**

Course category : M
Pre-requisite Subject : NIL
Contact hours/week : Lecture: 2, Tutorial: 0, Practical: 0
Number of Credits : 2
Course Assessment Methods : Continuous assessment through tutorials, attendance, home assignments, quizzes two Minor tests, and one Major Theory Examination
Course Objectives : To familiarize with the process of management and to provide the basic insights in effective and efficient running of an industry using its human and non-human resources to achieve its set goals and objectives.
Course Outcome: : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Students will become efficient and acquire acumen for more profitable business practices.
2. Able to understand concept of plant location and layout
3. Students will understand the importance of better customer service and product quality.
4. Able to make work safer, faster, easier, and more rewarding.
5. Able to help the industry in the production of more products that possess all utility factors.
6. Reducing costs associated with new technologies.

Syllabus

UNIT-I **6**

Introduction of Modern Management: Definition, Nature and Scope of Management, Process of Management, Elements of Management, Definition of Industrial Management, Scope and Application of Industrial Management.

Plant Location and Layout: Factors affecting Plant Location, Objectives and Principles of Plant Layout, Types of Plant-Layouts

UNIT-II **6**

Work Analysis and Measurement: Design of work Study, Steps involved in Work-study process, Definition and Concept of Method study, Procedure involved in Method Study, Objectives and techniques of Work Measurement, Work -sampling and its application, Selection of Personnel and wage payment plans.

UNIT-III **6**

Organizational Structures: Types of organizations, Functions, and objectives of industrial organizations, Ownership of Industries; Proprietorship, Partnership, Joint-stock companies, Public and Private undertakings, Co-operative organizations.

Sources of finance, Types of Bank accounts.

UNIT-IV **6**

Material Management: Meaning of Inventory management, Economic Order Quantity (EOQ) Model, ABC analysis, Just-in-time (JIT), Minimum Safety Stock

Industrial Safety: Occupational safety, safety programs; Safety aspects in work system design,

Text and Reference Books

1. P. Crowson. Economics for Managers, Macmillan, London.
2. J. Russell (Joseph Russell) Smith, "The Elements of Industrial Management", Hard Press
3. Rieske, David W., Asfahl and C. Ray, "Industrial Safety and Health Management", 6th Ed., Prentice Hall Professional Technical Ref.
4. Gavriel Salvendy, "Handbook of Industrial Engineering: Technology and Operations Management", John Wiley & Sons, Inc.
5. Herman B. Henderson, Albert E. Haas, "Industrial Organization and Management Fundamentals", Industrial Press, The University of California.

Course Code: Digital communication
BEC-301

Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:3, Tutorial:1 Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, two minor tests and one major theory & practical examination
Course Objectives	:	The objective of this course is to impart the knowledge on digital communication systems, probability concepts, digital modulation schemes and information theory and coding.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to compute the bandwidth and transmission power by analysing time and frequency domain spectra of signal required under various modulation schemes.

2. Able to apply statistical analysis of random variables
3. Able to understand and apply random process.
4. Able to analyze digital modulation techniques and transfer function of matched filter for optimized signal to noise ratio.
5. Able to understand the spread spectrum systems.
6. Able to identify and describe different coding techniques in modern digital communications, particularly in source coding, modulation and detection, carrier modulation, and channel coding.

Topics Covered

UNIT-I

Overview of digital communication, Pulse coding: Quantization and preprocessing, Differential PCM, Delta modulation, Adaptive Delta Modulation. Baseband Binary transmission, inter symbol interference (ISI), Nyquist criterion for zero ISI, pulse shaping and raised-cosine filter, duobinary coding, Modified Duobinary. **9**

UNIT-II

Probability theory and Random Variables, Random variable, Probability mass function, cumulative distribution function, Probability Density function, Statistical averages, Gaussian and binomial distribution, multiple random variables, sum of random, Function of a random variables. **9**

Random Process: Basic concepts- Introduction to Stochastic processes, Statistical averages, Autocorrelation and Cross-correlation, Stationary and Ergodic process.

UNIT-III

Digital Modulation Techniques: Digital Modulation formats, Digital carrier system, Gram Schmidt Orthogonalization procedure, Method of generation and detection of coherent & non-coherent binary ASK, FSK & PSK, Differential phase shift keying, quadrature modulation techniques. (QPSK and MSK), Mary Digital Carrier Modulation. Matched Filter, Overview of spread spectrum systems. **9**

UNIT-IV

Information Theory and Coding: Information Theory and Coding: Information Measurement, Average information and information rate, Coding for discrete memory less source, continuous channel capacity, Maximum entropy, Huffman and Shannon Fano coding, Discrete channel capacity, Trade –off between S/N and bandwidth, Error control coding, Block code, Hamming code, Cyclic code, Convolutional code: Tree diagram, State diagram, Trellis diagram. **9**

LIST OF EXPERIMENTS

1. To construct a pulse amplitude modulation (PAM) and demodulation circuit and to observe the waveform.
2. To understand and implement Pulse Width Modulation (PWM) using IC 555 by varying the amplitude of the modulating signal and plot the relevant waveforms.
3. To understand and implement Pulse Position Modulation (PPM) using IC 555 and plot the relevant waveforms.
4. Study of delta modulation and demodulation and observe effect of slope overload DCL07.
5. Study of pulse data coding techniques for NRZ formats.

6. Data decoding techniques for NRZ formats. ST21067
7. To Study and implement of amplitude shift keying modulator and demodulator and to observe the waveform.
8. To Study and implement of FSK modulator and demodulator and to observe the waveform.
9. Study of phase shift keying modulator and demodulator ST467.
10. Study of single bit error detection and correction using Hamming code. ST2103.
11. Implementing Convolutional Encoder/Decoder using MATLAB.
12. Investigate the characteristics of matched filter and implement matched filter-based signal detection. Investigate eye diagram.

Text and Reference Books

1. Haykin, Simon, "Communication Systems", John Wiley, 4e.
2. Singh, R.P. &Sapre, S.D. "Communication Systems: Analog & Digital", Tata McGraw-Hill.
3. Lathi, B.P, "Modern Digital & Analog Communication Systems", Oxford University Press.
4. Taub& Schilling, "Principles of Communication Systems", Tata McGraw-Hill.
5. Prokis J.J, "Digital Communications", McGraw Hill

Course Code: BEC-302 Control Systems

Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	:	This course is aimed to develop the concepts of control systems skills with introducing the components & their representation of control systems, analyzing the time & frequency response, and state variable analysis.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course

1. Describe the response characteristic and differentiate between the open loop and closed loop control system.
2. Measure and evaluate the performance of basic control systems in time domain.
3. Determine the response of a control system using poles and zeros to determine the response of a control system.
4. Determine the stability of a control system using Routh-Hurwitz method.
5. Measure and evaluate the performance of basic control systems in frequency domain.
6. Able to derive mathematical model for simple electrical and mechanical systems using transfer function and state variable method.

Topics Covered

UNIT-I

Basic Components of a control system, Feedback and its effect, Types of feedback control Systems, Block diagrams: representation and reduction, Signal Flow Graphs, Modeling of Physical Systems: Electrical Networks and Mechanical Systems, Force-voltage analogy, Force-current analogy. **9**

UNIT-II

Time response of continuous data systems, Different test Signals for the time response, Unit step response and Time-Domain Specifications, Time response of a first-order and second order systems for different test signals, Steady State Error and Error constants, Sensitivity, Control Actions: Proportional, Derivative, Integral and PID control. Introduction to Process Control Systems, Pneumatic hydraulics, Actuators. **9**

UNIT-III

Stability: Methods of determining stability, Routh Hurwitz Criterion, Root Locus, Frequency Domain Analysis: Resonant Peak, Resonant frequency and Bandwidth of the second order system, Effect of adding a zero and a pole to the forward path, Nyquist Stability Criterion, Relative Stability: Gain Margin and Phase Margin, Bode Plot **9**

UNIT-IV

State-Space Analysis of Control System: Vector matrix representation of state equation, State transition matrix, Relationship between state equations and high-order differential equations, Relationship between state equations and transfer functions, Block diagram representation of state equations, Decomposition Transfer Function, Kalman's Test for controllability and observability **9**

Text and Reference books

1. B.C. Kuo& Farid Golnaraghi, "Automatic Control Systems", 8e, John Wiley India, 2008.
2. I.J. Nagrath & M.Gopal, "Control System Engineering", New Age International Publishers.
3. William A. Wolovich, "Automatic Control Systems", Oxford University Press, 2010.
4. Katsuhiko Ogata, "Modern Control Engineering", 3e, PHI Publication,2000

Course Code: Digital Signal Processing
BEC-303

Course category	:	Program Core (PC)
Pre-requisite Subject	:	Principle of Communication Systems (BEC-255)
Contact hours/week	:	Lecture: 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests and one major theory examination.

Course Objectives : This course is aimed to develop an understanding of signals, mathematical operation on signals and digital filters.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to analyse signals using the discrete Fourier transform (DFT).
2. Understand circular convolution, its relationship to linear convolution, and how circular convolution can be achieved via the discrete Fourier transform.
3. Able to understand the decimation in time and frequency FFT algorithms for efficient computation of the DFT.
4. Able to understand the characteristics of IIR and FIR filters and learn the design of infinite and finite impulse response filters for filtering undesired signals.
5. Able to implement digital filters in a variety of forms:-Direct form I &II, Parallel, Cascade and lattice structure.
6. Able to understand the finite word length effects.

Topics Covered

UNIT-I

Discrete Fourier Transforms: Definitions, Relation between DTFT and DFT, Computational problem, Properties of the DFT, Circular Convolution, Linear Convolution **9**

Fast Fourier Transform Algorithms: Introduction, Radix-2 Decimation in Time (DIT) Algorithm, Radix-2Decimation in Frequency (DIF) Algorithm, Computational Efficiency of DIT and DIF algorithms.

UNIT-II

IIR Filter Design: Analog filter design-Butterworth and Chebyshev filter; Discrete time IIR filter design techniques: Impulse Invariance, Bilinear transformation, Approximation of derivatives, (LPF, HPF, BPF, BRF) filter design using frequency translation technique **9**

UNIT-III

FIR Filter Design: Characteristics of FIR Digital Filters, Phase and Frequency Response; FIR Filter design using Fourier Series Method, Frequency Sampling Technique, Effect of Windowing, Windowing Techniques-Rectangular Window, Hamming Window, Hanning Window, Blackman Window, Kaiser Window **9**

UNIT-IV

Realization of Discrete Time Systems: FIR Systems: Direct form, cascade, parallel and lattice structures, Realization of Linear Phase FIR Systems**;** IIR systems: Direct form, cascade, parallel, Transposed Forms, ladder structure realization **9**

Finite Word length Effects: Rounding and Truncation Errors, Quantization Effects in Analog-to-Digital Conversion of Signals, Quantization effect in filter coefficients

Text and Reference Books

1. John G Prokias, Dimitris G Manolakis, “Digital Signal Processing”, Pearson Education.
2. Oppenheim & Schafer, “Digital Signal Processing” PHI
3. Johnny R. Johnson, “Digital Signal Processing”, PHI Learning Pvt Ltd., 2009.
4. S. Salivahanan, ““Digital Signal Processing” Mc Graw Hill Education

Course Code: Internet of things (IoT)
BEC-304

Course category	:	PLBSE
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:2, Tutorial: 0, Practical: 0
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests and one major theory examination
Course Objectives	:	This course is intended to provide the concepts of Internet of things (IoT) skills and applications.
Course Outcomes	:	The Internet is evolving to connect people to physical things and also physical things to other physical things all in real time. The course enables student to understand the basics of Internet of things and protocols. It introduces some of the application areas where Internet of Things can be applied. Students will learn about the middleware for Internet of Things. To understand the concepts of Web of Things.

1. Understand the vision of IoT from a global context.
2. Understand the application of IoT.
3. Determine the Market perspective of IoT.
4. Use of Devices, Gateways and Data Management in IoT.
5. Building state of the art architecture in IoT.
6. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

Topics Covered

UNIT-I

IOT - What is the IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues. **6**

UNIT-II

IOT PROTOCOLS - Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer Security **6**

UNIT-III

IOT ARCHITECTURE - IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction. **6**

UNIT-IV

WEB OF THINGS - Web of Things versus Internet of Things – Two Pillars of the Web Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. **6**

IOT APPLICATIONS - IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.

Text and Reference Books

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet ofThings", Springer, 2011.
3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a HighlyConnected World", Cambridge University Press, 2010.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applicationsand Protocols", Wiley, 2012.

Course Code: OPTOELECTRONICS

BEC-326

Course category	:	Program Elective (PE1)
Pre-requisite Subject	:	Electronics materials and semiconductor physics
Contact hours/week	:	Lecture: 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	:	This course is aimed to develop the concepts of optoelectronics with the knowledge of optoelectronic devices and their applications.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand fundamental of physics and technology of semiconductor optoelectronic devices.
2. Acquire the knowledge of Semiconductor optoelectronic materials.
3. Demonstrate a mastery of basic mechanisms of light generation (including lasers) through detailed understanding and analysis of operation principles, characteristics, design

architectures and trade-offs of semiconductor lasers.

4. Understand and compare operation principles, characteristics, design architectures and trade-offs of optical detectors.
5. Understand basic system design of fiber optic communication link and fundamental theory of fiber optics.
6. Acquire the knowledge on Optoelectronic integrated Circuits

Topics Covered

UNIT-I

Review of Semiconductor Devices: **9**

Introduction to optoelectronics devices, Energy bands in solids, the E-k diagram, Density of states, Occupation probability, Fermi level and quasi Fermi levels, p-n junctions, Schottky junction and Ohmic contacts. Semiconductor optoelectronic materials, Bandgap modification, Heterostructures and Quantum Wells.

UNIT-II

Semiconductor Photon Sources: **9**

Electroluminescence. The LED: Device structure, materials and characteristics. The Semiconductor Laser: Basic structure, theory and device characteristics; direct current modulation. Quantum-well lasers; DFB-, DBR- and vertical-cavity surface-emitting lasers (VCSEL); Laser diode arrays. Device packages and handling.

UNIT-III

Semiconductor Photodetectors: **9**

Types of photodetectors, Photoconductors, Single junction under illumination: photon and carrier-loss mechanisms, Noise in photo detection; Photodiodes, PIN diodes and APDs: structure, materials, characteristics, and device performance. Photo-transistors, solar cells, and CCDs. Optoelectronic integrated circuits - OEICs.

UNIT-IV

Industrial Applications of Optoelectronics **9**

Gas and solid state LASERs, Solar cell, Fiber optic sensors, photonic sensors, introduction of optoelectronics in biomedical applications, Optoelectronic integrated Circuits (OEICs): Need for Hybrid and monolithic integration, OEIC transmitter and receivers.

Text and Reference Books

1. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley &Sons, Inc., 2nd Ed. Ch.16, 17, and 18.
2. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India.
3. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc.
4. G. Keiser, Optical Fiber Communications, McGraw-Hill Inc., 3rd Ed. Ch.4, 6.
5. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York, 6th Ed. Ch.15-17.
6. M. Senior, Optical Fiber Communication: Principles and Practice, Prentice Hall of India, 2nd Ed, Ch.6-8.

Course code: **INFORMATION THEORY & CODING**

BEC-327

Course category	:	Program Elective (PE1)
Pre-requisite Subject	:	Digital Communication (BEC-301)
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor tests and one major theory examination.
Course Objectives	:	This course is aimed to develop the concepts of Entropy, information rate, various source coding and error control coding.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will be introduced to the basics of Information theory.
2. Students will be introduced to the fundamental concept of source coding: Huffman, Lempel-Ziv algorithms and etc..
3. Students will be able to understand the concept of differential Entropy and channel Capacity.
4. Students will be introduced to basic principles of error control coding techniques.
5. Students will be understood how error control coding techniques are applied in communication systems.
6. Students will understand the basic concepts of cryptography.

Topics Covered

UNIT-I 9

Information Theory

Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Lempel-Ziv algorithm.

UNIT-II 9

Mutual Information and Channel Capacity

Text: Mutual information and its properties, Discrete memoryless channels – BSC, Channel Matrix, Channel Capacity of BSC Channel and three-input and three-output channel, Cascade of two BSCs and three BSC and determination of Channel Capacity, Differential Entropy, Channel capacity of Band-limited and Power-limited Channel.

UNIT-III 9

Error Control Coding: Block Codes

Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder – CRC.

UNIT-IV 9

Error Control Coding: Convolutional Codes

Convolutional codes – code tree, trellis, state diagram - Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding.

Text and Reference Books

1. R Bose, "Information Theory, Coding and Cryptography", TMH2007.
2. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Perason Education Asia,2002.
3. K Sayood, "Introduction to Data Compression" 3/e, Elsevier2006
4. S Gravano, "Introduction to Error Control Codes", Oxford University Press2007.
5. Amitabh Bhattacharya, "Digital Communication", TMH2006.

Course Code: Digital System Design
BEC-328

Course category	:	Program Elective (PE1)
Pre-requisite Subject	:	Digital Electronics and Circuits
Contact hours/week	:	Lecture: 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, practical examination, two minor tests and one major theory examination.
Course Objectives	:	This course is aimed to develop the concepts of digital systems design skills by providing the knowledge of modelling the digital systems using Verilog.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to model digital systems in Verilog at different levels of abstraction.
2. Partition a digital system into different subsystems.
3. Simulate and verify a design.
4. Transfer a design from a version possible to simulate to a version possible to synthesize.
5. Use modern software tools for digital design in Verilog.
6. Describe principal parts in programmable circuits (PLD, FPGA, ASIC) and describe how small designs are implemented in programmable circuits

Topics Covered

UNIT-I

Introduction to digital circuit design flow, Lexical Tokens, Gate-Level Modelling, language constructs, Building Blocks, variables, Data Types, operators, operands, modules **9**

UNIT-II

Behavioral modeling, timing control, Procedures: Always and initial blocks, functions, tasks, component inference, Finite state machine, compiler directives, system tasks and functions, test benches **9**

UNIT-III

Modeling combinational circuits using Verilog: Logic gates, Buffer, Adder, Subtractor, Gray, Binary, Code-conversion, MUX, Decoder, Encoder, Priority logic, Two's compliment **9**

UNIT-IV

Modeling sequential circuits using Verilog: Latch, Flip-flop, Edge triggered, Level sensitive, Asynchronous, Synchronous, Toggle, Up-down, Shift register, Ripple, Johnson, Ring,Memory **9**

LIST OF EXPERIMENTS

1. Design of Logic gates
2. Design of Buffers
3. Design of Binary Adders
4. Design of Binary Subtractors
5. Design of different code conversion logics
6. Design of Multiplexers and Demultiplexers
7. Design of Encoders and Decoders
8. Design of Priority logics
9. Design of compliments
10. Design of Flip-Flops
11. Design of Counters

Text and Reference Books

1. Digital logic design using verilog: coding and RTL synthesis, V. Taraate, Springer, 2016.
2. Design through Verilog HDL-T. R. Padmanabhan and B. Bala Tripura Sundari; WSE, IEEE Press, 2004
3. Advanced Digital Design with Verilog HDL- Michael D. Ciletti, PHI, 2005

Course Code: Data Communication Networks

BEC-329

Course category : Program Elective (PE1)
Pre-requisite Subject : Nill
Contact hours/week : Lecture: 3, Tutorial : 1 , Practical: 0

Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	:	This course is intended to develop an understanding of data communication networks concepts and its applications.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to describe communication protocols and layered network architectures.
2. Able to explain conventional computer system interfacing standards and peer to peer
3. data link communication protocols.
4. Able to design basic network systems and various components in a data communication system.
5. Able to describe how the physical, data link, and network layers operate in a typical data communication system.
6. Able to understand, define and explain data communications networks concepts.

Topics Covered

UNIT-I

Introduction to Networks & Data Communications: The Internet Protocols & Standards,Channel capacity for data Communication, Need for layered/modular architecture, Layering concept, OSI reference model, TCP/IP model. Review, Transmission Media: Guided and unguided Media Review **9**

UNIT-II

Switching: Datagram Networks, Virtual Circuit Networks, Structure of a switch, Ethernet Physical Layer, Data Link Layer: Error detection and Correction Data Link Control: Framing, Flow and Error Control Protocols, Noiseless and Noisy Channel Protocols, HDLC, Point-to-Point Protocol **9**

UNIT-III

Multiple Access: RANDOM, CDMA, ALOHA, CSMA, Collision free, limited contention, CSMA/CA and Ethernet, Channelization Wired LANs: IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11, Bluetooth IEEE 802.16 **9**

UNIT-IV

Network layer: Network layer: Design Issues. Routing Algorithms. Congestion control Algorithms, IPV4Addresses, Connecting Devices, IPV6 Addresses, Hardware Addressing versus IP Addressing, Transport Layer Protocol: UDP and TCP. Application Layer & Protocol: SIP, DNS, FTP, HTTP, SMTP and SNMP **9**

Text and Reference Books

1. Behrouz A. Forouzan (2006), Data communication and Networking, Tata McGraw-Hill, India.
2. A.S. Tanenbaum, Computer Networks (2003), 5 ed, Pearson Education/ PHI. New Delhi, India.

Course Code: Device and Circuit Simulation
SEC-311

Course category	:	Departmental Minor (DM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial : 0 , Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, viva, two minor tests and one major theory & practical examination.
Course Objectives	:	This course is aimed to develop an understanding of device modelling and circuit simulation concepts.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to analyze and solve electrical circuits using network laws and theorems.
2. Familiarity with the basic concepts of AC circuits.
3. Able to identify schematic symbols and understand the working principles of electronic devices, e.g., Diode, Zener Diode, and BJT
4. Able to understand the working principles of electronic circuits e.g., Rectifiers, Clipper, Clamper, Filters, Amplifiers also understand methods to analyze and characterize these circuits.
5. Able to understand the MOS Transistor Theory.
6. Able to design sequential circuits.

Topics Covered

UNIT-I

Introduction to circuit simulation, need of circuit simulation, basic physics, and circuit simulation software, TCAD and IC CAD software examples, components of TCAD and IC CAD tools, Simulation of some common circuit using known ICs, DC sweep and transient analysis. **9**

UNIT-II

Introduction to device simulator TCAD tools, TCAD tool coding platforms, Visualization tools, Basic MOS device simulation, non-conventional device simulations, analysis of devices with variation in different device structural parameters and materials, Modeling of devices, Applications of devices in digital and analog circuit designs. **9**

UNIT-III

MOS Transistor Theory, Challenges in design of nano size MOS transistor, Types of nano-size MOS transistors, MOS parasitics and its SPICE MODEL, CMOS Inverter Design; switching behavior, S/N ratio, power dissipation, Combinational Circuit Design using CMOS, MUX design, adder design **9**

UNIT-IV **9**

Logical Efforts, Sequential circuit design, Clocking strategies for sequential design, Different types of Memory design and behavior analysis.

LIST OF EXPERIMENTS

1. Design and implementation of an inverter
2. Design and implementation of universal gates
3. Design and implementation of full adder
4. Design and implementation of full subtractor
5. Design and implementation of RS-latch
6. Design and implementation of D-latch
7. Design and implementation asynchronous counter
8. Design and Implementation of static RAM cell
9. Design and Implementation of differential amplifier
10. Design and Implementation of ring oscillator

Text and Reference Books

1. Principles of Electrical Engineering, V. Del Toro,; Prentice Hall International
2. Basic Electrical Engineering, D P Kothari, I.J. Nagarath; Tata McGraw Hill
3. Electronic Devices and Circuits-Boylestad and Nashelsky, PHI,
4. Electronic Devices and Circuits, A Mottershead, PHI.

Course code:	**IOT ARCHITECTURE AND ITS PROTOCOLS**	
SEC-321		
Course category	:	DM
Pre-requisite Subject	:	Nil
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	:	This course is aimed to develop the concepts of IOT architecture and its protocols.
Course Outcomes	:	1. Identify the IoT networking components with respect to OSI layer. 2. Build schematic for IoT solutions. 3. Design and develop IoT based sensor systems. 4. Select IoT protocols and software. 5. Evaluate the wireless technologies for IoT. 6. Appreciate the need for IoT Trust and variants of IoT.

Topics Covered

UNIT-I 9

Evolution of IoT: Review of computer communication concepts (OSI layers, components, packet communication, Networks, TCP-IP, subnetting, IPV4 addressing and challenges). IPV6 addressing. IoT architecture reference layer.

Introduction to IoT components: Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, single board computers, open source hardware, Examples of IoT infrastructure

UNIT-II 9

IoT protocols and softwares: MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP, XMPP and gateway protocols,

IoT point to point communication technologies:

IoT Communication Pattern, IoT protocol Architecture, Selection of Wireless technologies (6LoWPAN, Zigbee, WIFI, BT, BLE,SIG,NFC, LORA, Lifi, Widi)

UNIT-III 9

IoT security: Need for encryption, standard encryption protocol, light weight cryptography, Quadruple Trust Model for IoT-A – Threat Analysis and model for IoT-A, Cloud security

UNIT-IV 9

Case studies: IoT for smart cities, health care, agriculture, smart meters.M2M, Web of things, Cellular IoT, Industrial IoT, Industry 4.0, IoT standards.

Text and Reference books

1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model", Springer Open, 2016
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014.
3. LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning, The Internet of Things: From RFID to the Next-Generation Pervasive Network, Aurbach publications, March,2008.

BHM-354 **BUSINESS MANAGEMENT**

Course category	:	M
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 2, Tutorial: 0, Practical: 0
Number of Credits	:	2

Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests, and one major theory examination.
Course Objectives	:	To help the students gain understanding of the functions and responsibilities of managers and provide them tools and techniques to be used in the performance of the managerial job so that they can be to analyze and understand the environment of the organization and importance of management principles.

Course Outcome:

1. Students will comprehend and correlate all the fundamental Management functions and the concepts and principles of Management.
2. Demonstrate Engineering students, demonstrate the roles, skills, and functions of Management.
3. Students will develop Interdisciplinary skills which can help them to thrive in the life- long changing environment in various fields of business.
4. One can analyze the effective application of management knowledge principles and practices to diagnose and solve organizational problems and develop optimal managerial decisions.
5. Demonstrate the acumen in organizing and understanding the staffing process.
6. Understand the complexities associated with management in the organizations and integrate the learning in handling these complexities

Topics Covered

UNIT-I **6**

Meaning and Definition, Need for business, Nature of Business, Scope, Objectives, Qualities of a Successful Businessman. Forms of Business Ownership, Public, Private, and Joint Sector Undertaking, Public-Private Partnership, NGO – only meaning.

UNIT-II **6**

Meaning, Emergence of Management Thought, Characteristics of Management, Bureaucracy, Scientific Management, Administrative Theories of Management, Principles of Management, Social Responsibility of Management, and Business Ethics.

UNIT-III 6

Meaning & Definition, Characteristics of a Good Plan, Planning Process, Types of Plans, MBO &MBE, Decision making: Types of Decisions, Steps involved in Decision Making, Communication, Importance of Communication and Types of Communication.

UNIT-IV 6

Meaning, characteristics, the importance of organization, steps in organization, organization structure, departmentation–meaning and basis for departmentation. The span of management-Meaning Only, Centralization vs. Decentralization, Definition, Staffing-Meaning, Functions, Selection Procedure and Instruments used in the selection.

Text and Reference Books

1. Business Management, Dr. P. Subba Rao, Roopa Traisa, Himalaya Publishing.
2. Management, Michael A Hitt, J Stewart Black, Lyman W - Prentice-Hall publishing – 2nd Revised edition.
3. Essentials of management, Harold Koontz Heinz Weihrich - Tata Mc Graw hill publishing.
4. Business management, R. K Sharma, Shashi K. Gupta – Kalyani publishers – 2009.
5. Business management, Appanniah Reddy - Himalaya publishers.2008.

Course Code: BEC-351 **Microcontroller and Embedded Systems**

Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	:	This course is aimed to develop the concepts of microcontroller and embedded systems.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Understand various embedded system related concepts, Memory classification, 8051 architecture and its Instructions.
2. Demonstrate the programming of I/O, Timers, Serial communication and Interrupt of 8051
3. Comprehend assembly language program for 8051.
4. Comparative study of higher versions of microcontroller e.g. PIC microcontroller.
5. Acquired knowledge about Communication protocol and demonstrate interfacing of microcontroller with peripheral devices such as LCD, motor and stepper motor.
6. Application and design real time operating system (RTOS) for various applications.

Topics Covered

UNIT-I

Introduction to Embedded system: Embedded system and codesign issues, Processor Embedded into a System, Embedded Hardware and Software in a system, Examples of ES, use of VLSI Circuit Design Technology, Use of software tools for development of an ES. **9**

Introduction to Microcontrollers and Embedded Processors: Microcontrollers survey, 4-bit,8-bit, 16-bit, 32-bit Microcontrollers, Comparing Microprocessors and Microcontrollers, Overview of the 8051 Microcontroller family.

UNIT-II

8051 Architecture: Hardware, Oscillator and clock-program counter, data pointer registers, stack and stack pointer, special function registers, memory organization, program memory, data memory, Input/Output Ports, External memory counter and timer, serial data Input/output Interrupts. **9**

UNIT-III

8051 Assembly Language Programming: Structure of Assembly language, Assembling and running an 8051 program, addressing modes, Accessing memory using various addressing modes **9**

Instruction set: Arithmetic operations and Programs, Logical operations and Programs, Jump and Call instructions and Programs, Input/Output Programs, Single bit instructions and Programs, Timer, counter and Programs.

UNIT-IV

8051 Serial Communication: Connection to RS-232, Serial Communication Programming, Interrupts Programming, **9**

Microcontroller Interfacing: Keyboard, Displays, Pulse Measurement, D/A and A/D conversion, Stepper Motor

Basic concept of PIC microcontroller and RTOS: Microcontroller Architecture–PIC16F Family and Introduction to RTOS.

Text and Reference books

1. Embedded System: Architecture, Programming and Design by Rajkamal,2ndedition,2010, Tata McGraw Hill.
2. The 8051 Microcontrollers and Embedded Systems: Muhammed Ali Mazidi, 2nd edition, Pearson Education India.
3. The 8051 Microcontrollers Architecture, Programming & Applications Kenneth J. Ayala
4. Design with PIC Microcontroller: John Petman.

Course Code: OPTICAL COMMUNICATION
BEC-352

Course category	:	Program Core (PC)
Pre-requisite Subject	:	
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and two minor tests and one major theory & practical examination.
Course Objectives	:	This course is aimed to develop and understanding of optical communication concepts and their basic components.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Fundamentals, advantages and advances in optical communication system.
2. Types, basic properties and transmission characteristic of optical fibers.
3. Knowledge of Signal distortion in optical fibers.
4. Knowledge of working and analysis of optical amplifiers and important parts at the transmitter (Semiconductor lasers/LEDs, modulators etc.) in the optical communications system.
5. Knowledge of working and analysis of optical detector in the optical communications system.
6. Configuration and architecture of coherent optical communication, advanced system techniques and nonlinear optical effects and their applications.

Topics Covered

UNIT-I

Overview of optical fiber communication- The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Optical fiber Modes and configuration, Mode theory for circular Waveguides, Step Index fibers, Graded Index fibers. Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index. Fiber Material and its Fabrication Techniques. **9**

UNIT-II

Signal distortion in optical fibers- Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses. Information capacity determination, Group delay, Attenuation Measurements Techniques, Types of Dispersion - Material dispersion, Wave-guide dispersion, Polarization mode dispersion, and Intermodal dispersion. Pulse broadening. Overall fiber dispersion in Multi mode and Single mode fibers, Fiber dispersion measurement techniques, Non linear effects. Optical fiber Connectors: Joints, Couplers and Isolators. **9**

UNIT-III

Optical sources- LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Laser Diodes- Basic concepts, Classifications, Semiconductor injection Laser Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, resonant frequencies, reliability of LED & ILD **9**

UNIT-IV

Optical detectors- Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors. **9**

Optical receiver operation- Fundamental receiver operation, optical amplifiers, noise in optical amplifiers, Higher modulation techniques, Optical OFDM

LIST OF EXPERIMENTS

A. Compulsory Experiments

1. To setting up fiber optic analog link.

2. To measurement and study of losses in optical fiber.

3. Study and measurement of numerical aperture of optical fiber.

4. Measurement of Intensity modulation techniques using analog input signal.

5. Study of Intensity modulation techniques using digital input signal.

6. To measure propagation loss in optical fiber using optical power meter.

7. Study of bending loss.

B. Optional Experiments

1. To Study of pulse width modulation and demodulation.

2. Study and measure characteristics of fiber optic LED and photo detector.

3. Setting a fiber optic voice link.

Text and Reference Books

1. Govind P. Agrawal, "Fiber Optic Communication Systems", John Wiley, 3e, ,2004.
2. John M. Senior, "Optical Fiber Communications", PEARSON, 3e, 2010.
3. Gerd Keiser, "Optical Fiber Communications", TMH, 4e
4. Joseph C. Plais, "Fiber Optic Communication", Pearson Education, 4e, 2004.

Course Code: MICROWAVE ENGINEERING
BEC-353

Course category	:	Program Core (PC)
Pre-requisite Subject	:	Electromagnetic Field Theory
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and two minor tests and one major theory & practical examination.
Course Objectives	:	This course is aimed to develop the concepts of microwave principles and skill to do the measurement at microwave frequencies.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to apply electromagnetic theory to calculations regarding waveguides and transmission lines.
2. Able to describe, analyze and design simple microwave circuits and devices e.g. matching circuits, couplers, antennas and amplifiers.
3. Able to describe and coarsely design common systems such as radar and microwave transmission links.
4. Able to describe microwave vacuum tubes.
5. Able to describe Microwave Solid-State Devices.

6. Able to handle microwave equipment and make measurements.

Topics Covered

UNIT-I

Rectangular Wave Guide: Field Components, TE, TM Modes, Dominant TE10 mode, Field Distribution, Power, Attenuation. Circular Waveguides: TE, TM modes. Wave Velocities, Micro-strip Transmission line (TL), Strip TL **9**

UNIT-II

Scattering Matrix, Passive microwave devices: Microwave Hybrid Circuits, Terminations, Attenuators, Phase Shifters, Directional Couplers: Two Hole directional couplers, S Matrix of a Directional coupler, Microwave Propagation in ferrites, Faraday Rotation, Isolators, Circulators **9**

UNIT-III

Microwave Tubes: Limitation of Conventional Active Devices at Microwave frequency, Two Cavity Klystron, Reflex Klystron, Magnetron, **9**

Microwave Solid-State Devices: Tunnel diode, Transferred electron devices, Avalanche Transit–time devices: IMPATT Diode, TRAPPAT Diode.

UNIT-IV

Microwave Measurements: General set-up of a microwave test bench, VSWR Meter, microwave power measurements techniques, frequency measurement, wavelength measurements, Impedance and Refection coefficient, VSWR, Insertion and attenuation loss measurements **9**

LIST OF EXPERIMENTS

A. Compulsory Experiment

1. To measure the frequency of a microwave source and demonstrate relationship among guide dimensions, free space wavelength and guide.
2. Measurement of guide wavelength and frequency of the signal in a rectangular waveguide.
3. Measurement of VSWR using slotted line.
4. Study of mode characteristics of reflex Klystron and determination of mode number, transit time & electronic tuning sensitivity.
5. Study of characteristics of Gunn oscillator.
6. Study of Gunn diode as modulated source (PIN modulation) and determination of modulation depth.
7. Measurement of coupling coefficient and directivity of a directional coupler.
8. Study of insolation & coupling coefficient of a magic T.

B. Optional Experiments

9. Measurement of attenuation using substitution method and plot of attenuation versus frequency characteristics.
10. Study of waveguide horn and its radiation pattern and determination of the beam width.
11. Study of a ferrite circulator and measurement of isolation, insertion loss, cross coupling and input VSWR.
12. Measurement of microwave power using power meter

Text and Reference Books

1. Liao, S.Y. / Microwave Devices & Circuits; PHI 3rd Ed.
2. Collin, R.E. Foundations for Microwave Engineering; TMH 2nd Ed.
3. Rizzi, Microwave Engineering: Passive Circuits; PHI.
4. A Das and S.K. Das, Microwave Engineering; TMH.

Course code: VLSI TECHNOLOGY

BEC-376

Course category	:	Program Elective (PE2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor tests and one major theory examination.
Course Objectives	:	This course is aimed to develop the concepts of VLSI technology and fabrication of the semiconductor devices.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to understand the fundamentals of CMOS VLSI and associated technologies.
2. Able to solve problems in the design of CMOS logic circuits, with particular reference to speed and power consumption.
3. Able to acquire hands-on skills of using CAD tools in VLSI design.
4. Able to appreciate the design process in VLSI through a mini-project on the design of a CMOS sub-system.
5. Able to explain basic operation principles of diodes and MOS transistors and their circuits level models
6. Able to design the fundamental blocks of a VLSI circuits, both by circuit schematic and physical layout and to analyze the influence of wires/interconnects on VLSI circuit performance.

Topics Covered

UNIT-I 9

Fundamentals of VLSI Technology: Introduction, Trends & Projections in microelectronics. Semiconductor materials and their merits and demerits. Monolithic chips trends. Advantages, limitations & classification of ICs.

Source of silicon; EGS and MGS, Single crystalline and Poly-crystalline crystal, SGS

UNIT-II 9

Fabrication Techniques: float zone method, Czocharalski method, Refining, Silicon Wafer Preparation & Crystal Defects.

Epitaxial Process: Need of epitaxial layer; VPE, MBE, merits and demerits of various epitaxial processes.

Oxidation Techniques: Importance of oxidation, types of oxidation techniques, growth mechanism, factors affecting the growth mechanisms, silicon oxidation model, dry & wet oxidation.

Diffusion and Ion Implantation: Diffusion mechanisms; diffusion reactor; diffusion profile; diffusion kinetics; parameters affecting diffusion profile; Dopants and their behaviors, choice of dopants; Ion Implantation- reactor design, impurity distribution profile, properties of ion implantation, low energy and high energy ion implantation.

UNIT-III 9

Lithography: Basic steps in lithography; lithography techniques-optical lithography, electron beam lithography, x-ray lithography, ion beam lithography; resists and mask preparation of respective lithographies, printing techniques-contact, proximity printing and projection printing.

Etching: Performance metrics of etching; types of etching- wet and dry etching; dry etching techniques-ion beam or ion-milling, sputter ion plasma etching and reactive ion etching (RIE).

Metallization: Desired properties of metallization for VLSI; metallization choices; metallization techniques –vacuum evaporation, sputtering.

UNIT-IV 9

Fabrication steps of Diodes and Transistors, MOSFETs, CMOS, Resistors, Capacitors.

Text and Reference Books

1. S.M. Sze, "VLSI Technology",TMH
2. S.K. Gandhi, "VLSI Fabrication Principles", John Willey &Sons
3. D. Nagchoudhuri, "Principles of Microelectronics Technology"PHI Botkar, "Integrated Circuits", KhannaPublishers

Course code: DSP ARCHITECTURE & APPLICATIONS

BEC-377

Course category	:	Program Elective (PE2)
Pre-requisite Subjects	:	Digital Signal Processing (BEC-42) Microprocessors & Application (BEC-32)
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5

Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and two minor tests and one major theory & practical Examination.
Course Objectives	:	This course is aimed to develop the concepts of DSP architecture and its applications .
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Comprehends the knowledge & concepts of digital signal processing techniques.
2. Acquire knowledge of DSP computational building blocks and knows how to achieve speed in DSP architecture or processor.
3. Develop basic DSP algorithms using DSP processors.
4. Acquire knowledge about various addressing modes of DSP and are able to program DSP processor.
5. Discuss about interfacing of serial and parallel communication devices.
6. Design Applications of DSP Using MATLAB

Topics Covered

UNIT-I 9

Introduction To Digital Signal Processing: Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.

UNIT-II 9

Architectures For Programmable Digital Signal Processors: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing.

UNIT-III 9

Programmable Digital Signal Processors: Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS32OC54xx., Memory Space of TMS32OC54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xxProcessor.

UNIT-IV 9

Implementation of Basic DSP And FFT Algorithms: Introduction, the Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case). Introduction, an FFT Algorithm for DFT Computation, Overflow and Scaling, Bit Reversed Index Generation & Implementation on the TMS32OC54xx.

Applications of DSP Using MATLAB: Mobile communication, medical, image processing, Acoustic Noise Canceller, Dynamic range compression, LPC analysis and synthesis, SSB modulation, Radar tracking implementation

EXPERIMENTS

1. Numbers representation. Fixed Point Representation (Qx, IQFormat).
2. Effect of sampling rate on waveform generation using DSP processor(Using CCS)
3. DFT computation using DSP processor
4. FIR filter design using MATLAB and find finite word length effect
5. FIR filter design using DSP processor
6. IIR filter design using MATLAB and find finite word length effect
7. IIR filter design using DSP processor
8. Analysis of speech signal
9. Application Development using CCS. Examples Signals Acquisition, DTMF tone detection techniques and the Goertzel algorithm, A GMSK Modulator Implementation

Text and Reference Books

1. Digital Signal Processing: A practical approach, Ifeachor E. C., Jervis B. W Pearson-Education, PHI,2002
2. "Digital Signal Processors", B Venkataramani and M Bhaskar TMH,2002
3. "Architectures for Digital Signal Processing", Peter Pirsch John Weily,2007
4. "Digital Signal Processing", S.kmitra,,TMH,2002
5. Applications to DSP UsingMatlab-Proakis
6. "Digital Signal Processing", Avatar Singh and S. Srinivasan, Thomson Learning,2004

BEC-378 ANTENNA DESIGN

Course category : Program Elective (PE2)

Pre-requisite Subject : Nil

Contact hours/week : Lecture: 3, Tutorial:1, Practical: 0

Number of Credits : 4

Course Assessment methods : Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests and one major theory examination

Course Objectives :This course is aimed to develop the concepts of antenna design, different type of antennas and array of the antennas .

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. To understand different antenna parameters.

2. To understand and analyze the radiation mechanism of antenna.
3. To have insight into the derivation of field quantities of various antennas and there by deducing the other quantities like gain, directivity, impedance etc.
4. To understand basic characteristics and feeding mechanisms of microstrip antenna
5. To understand and analyze antenna array.
6. To design, antennas for given applications.

UNIT-I **9**

Fundamental Concepts: Radiation pattern, near- and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

UNIT-II **9**

Radiation from Wires and Loops: Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

Aperture Antennas: Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Fourier transform method in aperture antenna theory

UNIT-III **9**

Horn and Reflector Antennas: Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Microstrip Antennas: Basic characteristics, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

UNIT-IV **9**

Antenna Arrays: Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Fourier transform method, and Woodward-Lawson method.

Text and Reference Books

1. Balanis, C.A., "Antenna Theory and Design", 3e., John Wiley & Sons.
2. Jordan, E.C. and Balmain, K.G., "Electromagnetic Waves and Radiating Systems", 2e, Prentice-Hall of India.
3. Stutzman, W.L. and Thiele, H.A., "Antenna Theory and Design", 2e, John Wiley & Sons.
4. Elliot, R.S., "Antenna Theory and Design", Revised edition, WileyIEEE Press.

Course code: **RADAR TECHNOLOGY**

BEC-379

Course category : Program Elective (PE2)

Pre-requisite Subject : Electromagnetic Field Theory (BEC-14)

Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor tests and one major theory examination.
Course Objectives	:	This course is aimed to develop the concepts of RADAR technology, different types of RADAR, tracking and monitoring RADAR.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Know about Radar and Radar Equations.
2. Understanding the working principle of MTI and Pulse Doppler Radar.
3. Know about Tacking Radar and limitation
4. Foster ability to work using Detection of Signals in Noise and Radio Direction Finding.
5. Foster ability to work using Instrument Landing System.
6. Learn about Satellite Navigation System.

Topics Covered

UNIT-I 9

Introduction to Radar: Basic Radar, The Simply Form of the Radar Equations, Radar lock Diagram, Radar Frequencies, Applications of Radar.

Radar Equation: Detection of Signals in Noise, Receiver Noise and the Signal-to-Noise Ratio, Probabilities of detection and False Alarm, Integration of Radar Pulses,

Radar Cross Section of Targets, Radar Cross-Section of Targets, Radar Cross-Section Fluctuations,Transmitter Power,Pulse Repetition Frequency

UNIT-II 9

MTI and Pulse Doppler Radar: Introduction to Doppler and MTI Radar, Delay-Line Cancelers,

Staggered Pulse Repetition Frequencies, Doppler Filter Banks, Digital MTI Processing, Moving Target Detector, Limitations to MTI Performance.

UNIT-III 9

Tracking Radar: Tracking with Radar, Monopulse Tracking, Conical Scan and Sequential Lobing,

Limitations to tracking Accuracy, Low- Angle Tracking, Tracking in Range, Other Tracking Radar Topics, Comparison of Trackers, Automatic Tracking with Surveillance Radars

UNIT-IV 9

Detection of Signals in Noise: Introduction, Detection Criteria, Detectors, Automatic Detection, Integrators, Constant-False-Alarm Rate Receivers. Information from Radar Signals: Basic Radar Measurements, Theoretical Accuracy of Radar Measurements, Ambiguity Diagram, Pulse Compression, Target Recognition, Land Clutter, Sea Clutter, Weather Clutter

Text and Reference Books

1. Merrill I. Skolnik, “Introduction to Radar Systems” Third Edition._
2. J.C. Toomay , Paul J. Hannen “ Principles of Radar” Third Edition.

Course Code: CMOS Analog Circuit Design
SEC-312

Course category	:	Departmental Minor (DM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial :1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	:	This course is aimed to develop the concepts of CMOS analog circuit design and its application as a comparator and A/D, D/A converters.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Understand the basic CMOS subcircuit design.
2. Able to understand the concept of Single Stage Amplifier design.
3. Able to understand the concept of Comparator circuits.
4. Able to understand the fundamental concepts of Switched capacitors Circuits, PLL and Data Converter.
5. Understand the concepts of Medium and High-Speed Analog-Digital Converters.
6. Understand concepts of the Oversampling Converters.

Topics Covered

UNIT-I

Analog CMOS Subcircuits: MOS Switch, MOS Diode/Active Resistor, Current Sinks and Sources, Current Mirrors, Current and Voltage References, Bandgap Reference **9**

CMOS Single Stage Amplifiers: Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers/Buffers

UNIT-II

Comparators: Characterization of a Comparator, Two-Stage, Open-Loop Comparator Design, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators, High-Speed Comparators **9**
circuits

UNIT-III

Switched Capacitor Circuits: Introduction to Switched Capacitor circuits basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor , switched capacitor integrators first order filters, Switch sharing, Biquad filters. **9**

UNIT-IV

Phased Lock Loop (PLL): Basic PLL topology, Dynamics of simple PLL, Concept of Charge **9**

pump PLLs, Lock acquisition, Phase/Frequency detector and charge pump, Basic charge pump PLL,

Digital-Analog & Analog-Digital Converters: Introduction and Characterization of Digital-Analog Converters, Current, Voltage and Charge Scaling Digital-Analog Converters, Introduction and Characterization of Analog-Digital Converters

Text and Reference Books

1. CMOS Analog Circuit Design –Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
2. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition, 2002
3. Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edition, 2013.
4. CMOS Mixed-Signal Circuit Design - R. Jacob Baker, Wiley Interscience, 2009.

Course code: CONCEPTS IN ARTIFICIAL INTELLIGENCE

SEC-322

Course category	:	DM
Pre-requisite Subject	:	Nil
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor tests and one major theory examination.
Course Objectives	:	This course is aimed to develop the concepts in artificial intelligence in the field of machine learning, deep learning along with the simulation tools.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Get familiar with different python libraries
2. Able to understand basics of artificial intelligence
3. Develop ability to formulate the problems
4. Able to relate playing game with AI
5. Able to understand basics of Machine Learning and Deep Learning
6. Apply AI techniques to real-world problems

Topics Covered

UNIT-I 9

Python Concept: What Is Python, Installation of Python on Windows and Other Systems, Python Data Structures, **Python Programming Fundamentals, Working with Data in Python.** Numpy: Introduction, Creating Numpy array, Accessing Numpy array-indexing and slicing, Manipulating Numpy array, Arithmetic operation between arrays. Pandas:

Introduction, Pandas Series, DataFrame- Filtering Data, Data Extraction, Merging, Joining, Concatenation, GroupBy and etc.
Integrated Development Environment (IDE): Google Colab, Jupyter, Anaconda Navigator.
Machine Learning Libraries: Scikit-learn, TensorFlow, Keras, PyTorch, Matplotlib.

UNIT-II 9

Artificial Intelligence: Introduction, The Foundations and History of AI, The State of the Art, Advantages and disadvantages of AI, Intelligent Agents, Structure of Intelligent Agents, Solving Problems by Searching, Adversarial Search and Games, Logical Agents, First-Order Logic, Inference in First-Order Logic, Forward and backward reasoning, Probabilistic reasoning

UNIT-III 9

Machine Learning: Supervised and unsupervised learning, Decision Trees, Model Selection and Optimization, Linear Regression and Classification, Nonparametric Models, Ensemble Learning, Developing Machine Learning System, Reinforcement learning, Parameter estimation methods - Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.

Case Study: Machine learning applications for communication systems, embedded systems, signal processing and electronics materials and etc.

UNIT-IV 9

Deep Learning: Simple Feedforward Networks, Computation Graphs for Deep Learning, Convolutional Networks, Learning Algorithms, Generalization, Recurrent Neural Networks, Unsupervised Learning and Transfer Learning

Case Study: Deep learning applications for communication systems, embedded systems, signal processing and electronics materials and etc.

Text and Reference Books

1. Russel &Norvig, Artificial Intelligence: A Modern Approach, Pearson Education
2. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-GrawHill.
3. Introduction to AI & Expert System: Dan W. Patterson, PHI.
4. Artificial Intelligence by Luger (Pearson Education)

Course Code: BEC-401	**VLSI Design**	
Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, practical work, record, viva voce, minor and major theory & practical Examination.
Course Objectives	:	The objective of this course is to impart the knowledge on fundamentals of CMOS VLSI, associated technologies, their circuit level models with principles of operation, design of the fundamental

blocks of VLSI circuits, and further to develop hands-on skills of using CAD tools in VLSI design.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to understand the fundamentals of CMOS VLSI and associated technologies.
2. Able to solve problems in the design of CMOS logic circuits, with particular reference to speed and power consumption.
3. Able to acquire hands-on skills of using CAD tools in VLSI design.
4. Able to appreciate the design process in VLSI through a mini-project on the design of a CMOS sub-system.
5. Able to explain basic operation principles of diodes and MOS transistors and their circuits level models
6. Able to design the fundamental blocks of a VLSI circuits, both by circuit schematic and physical layout with performance.

Topics Covered

UNIT-I

Introduction: Trends & Projections in VLSI Circuits, Flow diagram of VLSI Circuit Design, VLSI Design issues, Y-Chart, VLSI Design Styles, Full Custom and Semi Custom VLSI Design **9**

Electrical characterization of MOS transistor: Energy-band explanation for MOS structure, MOS Capacitors, C-V characteristics of MOS Capacitor, Long Channel and Short Channel MOSFETs, Short-Channel effects, SPICE parameters of MOS transistor.

UNIT-II

MOS Inverter Design: NMOS and CMOS inverter design, noise margin, VTC curve, Calculation of delay time, switching power dissipation in CMOS inverters, scaling in CMOS circuits, technology scaling and its impact on the inverter metrics, Super Buffer Design **9**

UNIT-III

Stick Diagrams: Physical Design Rules; Layout Designing; Euler's Rule for VLSI Physical Design, MOS logic circuits with depletion nMOS loads, CMOS logic circuits, complex logic circuits, Complementary CMOS, Ratioed Logic, CMOS Pass-Transistor Logic **9**

UNIT-IV

Dynamic CMOS circuits: Basic Principles of pass transistor and transmission gate, CMOS Transmission-Gate and Pass-transistor logic circuits, Domino CMOS Logic, NORA CMOS Logic,Zipper CMOS circuits, Basic Bi-CMOS behaviour **9**

LIST OF EXPERIMENTS

A) Compulsory Experiments:

1. To design a CMOS inverter and perform the DC and transient analysis.
2. To design a CMOS inverter [Wp/Lp:Wn/Ln = 3:1] and analyze the effect of following parameters on average power:

i. VDD (Supply voltage)
ii. CL (Output load capacitance)
iii. Frequency

3. To design XOR gate using transmission gate and perform its transient analysis.
4. To design a 2:1 Multiplexer and analyze its transient analysis.
5. Design the layout of XOR circuit using CMOS technology.
6. To design CMOS based NAND gate and perform its transient analysis.
7. To design CMOS based NOR gate and perform its transient analysis.
8. To design XNOR gate using transmission gate and perform its transient analysis.
9. Design the layout of CMOS inverter using CMOS technology.

B) Optional Experiments

1. Write a Verilog HDL code to design 4 to 2 Encoder and simulate on Questa simulator using Verilog test bench.
2. Write a Verilog HDL code to design 4 to 2 Decoder and simulate on Questa simulator using Verilog test bench.
3. Write a Verilog HDL code for binary to Gray Code Conversion and simulate on Questa simulator using Verilog test bench.
4. Write a Verilog HDL code for 4-bit SIPO register and simulate on Questa simulator using Verilog test bench

Text and Reference Books

1. S.M. Kang & Y. Leblibici, "CMOS Digital Integrated Circuits-Analysis & Design", TMH, 2nd Ed. 2003.
2. B.G. Streetman & S. Banerjee, "Solid State Electronic Devices", Pearson Education.
3. Neil H. Weste& David Harris, "CMOS VLSI Design: A Circuit and Systems Perspective", PHI.
4. J.M. Rabaey, A. Chandrakasan& B. Nikolic "Digital Integrated Circuits-A Design Perspective", Pearson.
5. DoughlasPucknell& Kamran Eshragian, "Basic VLSI Design", PHI.

Course Code: BEC-402		**Introduction to wireless and cellular communication**
Course category	:	PC
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	:	The objective of this course it to impart the knowledge on basics of cellular communication systems, wireless propagation mechanism, propagation losses, Small Scale fading & multipath effect and modeling, Diversity modeling and advance wireless

communication (CDMA/MIMO/OFDM).

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to understand the basic cellular system concepts.
2. Able to understand wireless propagation mechanism including Large scale effect.
3. Able to understand the outdoor propagation models
4. Able to understand the concept of scall scale fading modeling in multipath propagation.
5. Able to understand the Diversity modelling for Wireless Communications.
6. Able to understand the CDMA/MIMO/OFDM for advance wireless communication.

Topics Covered

UNIT-I

Introduction to Cellular Communication: Overview of Cellular Systems and evolution 2g/3G/4G/5G, Cellular Concepts – Frequency reuse, Channel assignment strategies, Cochannel and Adjacent channel Interference, C/I, Handoff, Improving Coverage and Capacity in cellular system: Cell splitting, Sectoring, Repeater for range extension, Trunking and Grade of service. **9**

UNIT-II

Large Scale Path Loss: Introduction to wireless propagation, Free space propagation model, Three basic propagation mechanism: Reflection, Diffraction, Scattering, Practical Link budget design path loss model: Log-distance path loss model, Log-Normal Shadowing, Determination of Percentage coverage area, Outdoor Propagation model: Okumura model, Hata model, Indoor Propagation model **9**

UNIT-III

Small Scale fading & multipath: Impulse Response of Multipath channel, Parameters of multipath channel - Time dispersion, Coherence BW, Doppler spread, Coherence time, Slow fading &Fast Fading, Flat fading & Frequency selective fading, Channel Modelling, Rayleigh/Rician Fading Channels, BER Performance in Fading Channels, Diversity modelling for Wireless Communications, BER Performance Improvement with diversity, Types of Diversity – Frequency, Time, Space, Statistical models for multipath fading channel, Clark's model, Jakes Model, Jakes Spectrum **9**

UNIT-IV

CDMA: Introduction to CDMA, Walsh codes, Variable tree OVSF, PN Sequences, Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization **9**

OFDM: Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues.

MIMO: Introduction to MIMO, MIMO Channel Capacity, SVD and Eigenmodes of the MIMO Channel, MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBC, MRT.

Text and Reference Books

1. Fundamentals of Wireless Communications – David Tse and Pramod Viswanath, Publisher - Cambridge University Press.
2. Wireless Communications: Andrea Goldsmith, Cambridge University Press.
3. Wireless Communications: Principles and Practice –Theodore Rappaport - Prentice Hall.
4. MIMO Wireless Communications – Ezio Biglieri – Cambridge University Press.

Course Code: **BEC-426**		**DIGITAL IMAGE PROCESSING**
Course category	:	Program Elective (PE3)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests and one major theory examination.
Course Objectives		The objective of this course is to impart the knowledge on fundamental concepts of image processing, basic analytical techniques, image restoration and reconstruction techniques, different image compression techniques and image segmentation techniques.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Apply knowledge for image understanding and analysis.
2. To study the fundamental steps and applications of *image processing* in real world.
3. Ability to design and analyze techniques/processes for image understanding.
4. Ability to learn different techniques employed for the enhancement of images.
5. Able to understand different image compression techniques.
6. Able to interpret image segmentation.

Topics Covered

UNIT-I

Introduction **9**

DIP Fundamentals, Human visual system, images as a 2D data, Image Representation- Gray scale and color images, image sampling & quantization, Image Enhancement: Basic Gray level transformations, Histogram processing techniques, Spatial filtering, low & high pass filtering.

UNIT-II

Image Restoration and Reconstruction **9**

Introduction, Noise models & Noise reduction in frequency domain. Inverse & Wiener filtering, difference between enhancement & restoration, Restoration-spatial filtering.

UNIT-III

Image Compression **9**

Fundamental of redundancies, basic compression Methods: Huffman coding, Arithmetic coding, LZW coding, JPEC Compression standard.

UNIT-IV

Image Segmentation **9**

Introduction, Point, Line & Edge Detection, Thresholding, Region Based Segmentation, Edge linking and boundary detection, Hough transform.

Text and Reference Books

1. Rafael C. Gonzalez Richard E Woods, "Digital Image Processing", Pearson, 3e, 2009.
2. Anil K Jain, "Fundamentals of Digital Image Processing", PHI.

Course code: **RF ICs**

BEC-427

Course category	:	Program Elective (PE3)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	:	The main objective of this course it to impart the knowledge on basics of RF systems, various circuit components for RF systems, LNA and power amplifiers.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this Course.

1. Possess a basic knowledge of RF systems used in telecommunication industries.
2. Understand the concepts of various components of circuits used in RF systems.
3. Understand the methodology of using analog and digital modulation of an RFcarrier.
4. Understand the basic RF characterization utilizing gain, bandwidth, noise, phase noise, S parameters.
5. Understand the amplifiers (LNA & power amplifiers), mixer, multipliers, oscillators used in RF systems.
6. Design RF system.

Topics Covered

UNIT-I 9

Introduction to RF and Wireless Technology: Complexity comparison, Design bottle necks, Applications, Analog and digital systems, Choice of Technology. Basic concepts in RF Design: Nonlinearity and time variance, ISI, Random process and noise, sensitivity and dynamic range, passive impedance transformation.

UNIT-II 9

Low Noise Amplifiers: Gain, Linearity, stability and bandwidth considerations; LNA Topologies.

Non-linearities calculation

UNIT-III 9

Mixers, Oscillators and Frequency synthesizers: performance parameters, noise figure, down conversion and up conversion mixers

UNIT-IV 9

Power Amplifiers: General considerations, linear and nonlinear PAs, classification, High Frequency
power amplifier, large signal impedance matching, linearization techniques.

Text and Reference Books

1. Behzad Razavi, RF Microelectronics Prentice Hall of India,2001.
2. Thomas H. Lee, The Design of CMOS Radio Integrated Circuits, Cambridge UniversityPress.

Course Code: BEC-428 **Application of ML in Wireless Communication**

Course category : Program Elective (PE3)
Pre-requisite Subject : NIL
Contact hours/week : Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits : 4
Course Assessment methods : Continuous assessment through tutorials, attendance, assignments, quizzes, two minor tests and major theory examination.
Course objectives : The objective of this course is to impart the knowledge on conventional machine learning algorithms and use of machine learning for application in wireless communication such as: physical layer channel estimation, channel modeling and signal identification.
Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to understand the fundamentals of Machine and Deep Learning
2. Use machine learning in the designing of physical layer techniques for wireless communications
3. Apply machine learning in channel prediction for wireless communications
4. Use machine learning in channel estimation for wireless communications
5. Able to use machine learning in channel modeling for wireless communications
6. Able to apply machine learning in signal identification for wireless communications

Topics Covered

UNIT-I

Supervised learning: k-Nearest neighbours method, Decision tree , Perceptron ,Unsupervised learning: k-Means, Density-based spatial clustering of applications with noise, Clustering by fast search and find of density peaks, Relative core merge clustering algorithm, Gaussian mixture models and EM algorithm , Principal component analysis, Autoencoder, Summary of unsupervised learning, Reinforcement learning: Markov decision process, Model-based methods, Model-free methods, Deep reinforcement learning, **9**

UNIT-II

Machine learning for physical layer design: Adaptive modulation and coding (AMC): classical AMC, using support vector machines, using k-nearest neighbours, using k-means, using reinforcement learning, Code Division Multiple Access (CDMA): classical design, using **9**

learning such as ACO/GA, Precoder design: classical design, channel prediction using deep learning.

UNIT-III

Channel prediction based on machine-learning algorithms: Introduction, Channel Measurements, Learning-based reconstruction algorithms: Batch algorithms, Online algorithms, Optimized sampling, Active learning, Channel prediction results with path-loss measurements. **9**

Machine-learning-based channel estimation: Channel model, Channel estimation in point-to-point systems, Deep-learning-based channel estimation, EM-based channel estimator

UNIT-IV

Machine-learning-enabled channel modelling: Introduction, Propagation scenarios classification, Machine-learning-based MPC clustering, Automatic MPC tracking algorithms, Deep learning-based channel modelling approach. **9**

Signal identification in cognitive radios using machine learning: Signal identification in cognitive radios using machine learning, Signal identification in cognitive radios using machine learning, Specific emitter identification via machine learning.

Text and Reference Books

1. Applications of Machine Learning in Wireless Communications, Ruisi He, Zhiguo Ding, The Institution of Engineering and Technology.
2. NPTEL :: Electrical Engineering - NOC:Applied Optimization for Wireless, Machine Learning, Big Data
3. Applied Linear Algebra for Signal Processing, Data Analytics and Machine Learning - Course (nptel.ac.in).
4. Molisch, A.F., 2012. Wireless communications (Vol. 34). John Wiley & Sons
5. Rappaport, T.S., 1996. Wireless communications: principles and practice (Vol. 2). New Jersey: prentice hall PTR.

Course Code: **NEURAL NETWORKS**

BEC-429

Course Category	:	Program Electives (PE3)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor tests and one major theory examination

Course Objectives : The objective of this course is to impart the knowledge on basic of neural networks, learning of neural networks, and application of neural networks in several areas.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To study the role of neural networks in engineering, artificial intelligence, and cognitive modelling.
2. To study the learning process of the neural networks of increasing complexity and learning the generalization theory.
3. Able to understand Feed forward & feedback architectures.
4. To study the single-layer perceptron learning algorithm.
5. To study the Multi-layered neural network architectures and their learning.
6. Able to apply neural networks to particular applications, and to know what steps to take to improve the performance.

Topics Covered

UNIT-I

Introduction to neural networks, human brain, biological neuron, models of neuron, signal flow graph of neuron, feedback, network architecture, knowledge representation, Artificial intelligence and neural networks. 9

UNIT-II

Learning Process: Error correction learning, memory based learning, Hebbian learning, competitive learning, Boltzmann learning, learning with and without teacher, learning tasks, memory and adaptation. Artificial neurons, Neural networks and architectures, neuron signal function, mathematical preliminaries, Feed forward & feedback architecture. 9

UNIT-III

Introduction to Rosenblatt's perceptron, perceptron learning algorithm, perceptron convergence theorem, Single-Layer Perceptron classifiers, LMS learning Algorithm, Back propagation and other learning algorithms Multi-layered architecture, structure growing algorithms, applications of feed forward neural networks. 9

UNIT-IV

Applications of Neural Algorithms and Systems: Linear Programming Modelling Network, Character Recognition Networks, Neural Networks Control Applications, Networks for Robot Kinematics, Neural Networks for nanotechnology applications. 9

Text and Reference Books

1. Kumar Satish, "Neural Networks", TMH
2. Simon Haykin, "Neural Networks", PHI
3. J. M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publishers,3e.

Course Code: HIGH SPEED DEVICES AND CIRCUITS
SEC-411

Course category	:	Departmental Minor (DM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial :1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	:	The objective of this course is to impart knowledge on Physics of high speed devices and circuits, High speed switching diodes, Heterojunction bipolar transistors and High speed field effect transistors.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to understand the concept of high speed switching diodes and FETs.
2. Able to design high speed switching diodes and FETs.
3. Able to evaluate the performance of heterojunction bipolar transistors
4. Able to analyze the electrical behavior of MESFETs and HEMTs.
5. Apply the concepts of high speed devices in circuits.
6. Able to understand the applications of high speed switching devices and circuits

Topics Covered

UNIT-I **9**

Physics of high speed devices and circuits: Detector/Mixer, Energy Band Theory, Motion of electrons in Energy Bands, Concept of Holes, Scattering in Semiconductors, Density of States, Finite Drac Statistic, Generation -Recombination process in semiconductors, Band to Band generation and recombination, Diffusion and Continuity Equation, Important parameters governing the high speed performance of devices and circuits: Transit time of charge carriers, junction capacitances, ON-resistances and their dependence on the device geometry and size, carrier mobility,

UNIT-II

High speed switching diodes: Model of PIN & Schottky Diode, Electrical parameters and switching behavior of PIN & Schottky diode, Applications of high speed switching diodes **9**

UNIT-III

Heterojunction bipolar transistors: Model of SiGeHBTs and GaAs based HBTs, Electrical parameters of SiGeHBTs and GaAs based HBTs & its applications **9**

UNIT-IV

High speed field effect transistors: Model of MESFETs, MOSFETs and HEMTs, Pinch off voltage and threshold voltage of MESFETs, MOSFETs and HEMTs, Electrical parameters of MESFETs and HEMTs and its applications, Introduction of high electron mobility transistors **9**

and some high speed circuits

Text and Reference Books

1. S.M. Sze, High Speed Semiconductor Devices, Wiley (1990) ISBN 0-471-62307-5.
2. C.Y. Chang, F. Kai, GaAs High-Speed Devices: Physics, Technology and Circuit Applications, Wiley, 1994
3. Gandhi S K, VLSI Fabrication Principles: Silicon and Gallium Arsenide, Wiley, NY, 1994.
4. Sze S M, Semiconductor Devices: Physics & Technology, John Wiley & Sons, 2008.
5. Achutan M K and Bhat K N, Fundamentals of Semiconductor Devices, Tata McGraw-Hill, New Delhi, 2007.

Course Code: WIRELESS TECHNOLOGIES FOR IoT
SEC-421

Course category	:	Departmental Minor (DM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial :1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	:	The objective of this course is to impart knowledge on RF basic, cellular standards, WLAN, WSN and WPN.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to understand the RF Basics.
2. Able to understand the concept of Communication Standards.
3. Able to understand the concept of Cellular Standards
4. Able to understand the concepts of Generation Cellular Systems
5. Able to analyze the concepts of WLAN, WSN & WPN
6. Able to design wireless technologies for IoT

Topics Covered

UNIT-I

RF Basics: Radio Frequency (RF) Fundamentals: Introduction to RF & Wireless Communications Systems, RF and Microwave Spectral Analysis, Communication Standards, Understanding RF & Microwave Specifications. Spectrum Analysis of RF Environment, Protocol Analysis of RF Environment, Units of RF measurements, Factors affecting network range and speed, Environment, Line-of-sight, Interference, Defining differences between physical layers- OFDM. **9**

UNIT-II

Cellular Standards: Cellular carriers and Frequencies, Channel allocation, Cell coverage, Cell Splitting, Microcells, Pico cells, Handoff, 1st, 2nd, 3rd and 4th Generation Cellular Systems (GSM, CDMA, GPRS, EDGE,UMTS), Mobile IP, WCDMA **9**

UNIT-III

WLAN: Wi-Fi Organizations and Standards: IEEE, Wi-Fi Alliance, WLAN Connectivity, WLAN QoS & Power-Save, IEEE 802.11 Standards,802.11- 2007,802.11a/b/g, 802.11e/h/I,802.11n Wi-Fi Hardware & Software: Access Points, WLAN Routers, WLAN Bridges, WLAN Repeaters, Direct-connect Aps, Distributed connect Aps, PoE Infrastructure, Endpoint, Client hardware and software, Wi-Fi Applications **9**

UNIT-IV

WSN & WPN: Wireless Personal Area Networks, Bluetooth, Bluetooth Standards, Blue Tooth Protocol Architecture, UWB, IEEE 802.15 standards, ZigBee, Sub1GHz, Sensor Networks, coexistence strategies in Sensor Networks, Routing protocols in Wireless Sensor Networks. **9**

Text and Reference Books

1. Wireless Communications – Principles and Practice; by Theodore S Rappaport, Pearson Education Pte. Ltd., Delhi
2. Wireless Communications and Networking; By: Stallings, William; Pearson Education Pte. Ltd., Delhi
3. Bluetooth Revealed; By: Miller, Brent A, Bisdikian, Chatschik; Addison Wesley Longman Pte Ltd., Delhi
4. Wilson, "Sensor Technology hand book," Elsevier publications 2005.
5. Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005
6. Mobile and Personal Communications Services and Systems; 1st Edition; By: Raj Pandya; PHI, New Delhi
7. Fundamentals of Wireless Communication by Tse David and Viswanath Pramod, Cambridge University press, Cambridge

OEC-401 BIOMEDICAL INSTRUMENTATION

Course category	:	Open Elective (OE)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 0, Practical: 0
Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor tests and one major theory examination.
Course Objectives	:	The objective of this course is to impart knowledge on human physiology system, operating principle of biomedical instruments, design of biomedical instruments, human body generated signals and measurements of various human body generated signals.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Students will have a clear knowledge about human physiology system.
2. They will have knowledge of the principal operation and design and the background knowledge of biomedical instruments and specific applications of biomedical engineering.
3. Learn several signals that can be measured from the human body. Specific examples include temperature, electrical, and pressure signals.
4. Review the cardiac, respiratory and neural physiological systems.
5. Study the designs of several instruments used to acquire signals from living systems.
6. Examples of instruments studied include ECG, blood pressure monitors, spirometers, EEG, MRI, and ultrasound. Integrate information learned about biomedical signals, sensors and instrumentation design to create a design of your own.

Topics Covered

UNIT-I 9

Introduction: Specifications of bio-medical instrumentation system, Man-Instrumentation system Components, Problems encountered in measuring a living system. Basics of Anatomy and Physiology of the body. Bioelectric potentials: Resting and action potentials, propagation of action potential, The Physiological potentials – ECG, EEG, EMG, ERG, EOG and Evoked responses. Electrodes and Transducers: Electrode theory, Biopotential Electrodes – Surface electrodes, Needle
electrodes, Microelectrodes, Biomedical Transducer.

UNIT-II 9

Cardiovascular Measurements: Electrocardiography – ECG amplifiers, Electrodes and Leads,ECG
–Single channel, Three channel, Vector Cardiographs, ECG System for Stresses testing, Holter recording, Blood pressure measurement, Heart sound measurement. Pacemakers and Defibrillators. Patient Care & Monitoring: Elements of intensive care monitoring, displays, diagnosis, Calibration
& Reparability of patient monitoring equipment.

UNIT-III 9

Respiratory system Measurements: Physiology of Respiratory system. Measurement of breathing mechanism – Spirometer. Respiratory Therapy equipments: Inhalators, Ventilators & Respirators, Humidifiers, and Nebulizers & Aspirators. Nervous System Measurements: Physiology of nervous
system, Neuronal communication, Neuronal firing measurements.

UNIT-IV 9

Ophthalmology Instruments: Electroretinogram, Electro - oculogram, Ophthalmoscope, Tonometer for eye pressure measurement. Diagnostic techniques: Ultrasonic diagnosis, Eco-cardiography, Eco-encephalography, Ophthalmic scans, X-ray & Radio-isotope diagnosis and therapy, CAT- Scan, Emission computerized tomography, MRI.
Bio-telemetry: The components of a Bio-telemetry system, Implantable units, Telemetry for

ECG measurements during exercise, for Emergency patient monitoring.

Text and Reference Books

1. R. S. Khandpur, "Biomedical Instrumentation",TMH
2. S. K. Venkata Ram, "Bio-Medical Electronics &Instrumentation (Revised)",Galgotia.
3. J. G. Webster (editor), "Medical Instrumentation Application & Design", 3rd Ed WILEY,India
4. Cromwell, "Biomedical Instrumentation and Measurements"PHI
5. J. G. Webster, "Bio- Instrumentation",Wiley
6. S. Ananthi, "A Text Book of Medical Instruments", New AgeInternational
7. Carr& Brown, "Introduction to Biomedical Equipment Technology",Pearson

Course Code: OEC-402 **Evolution from 1G to 5G Communication**

Course category : Open elective
Pre-requisite Subject : NIL
Contact hours/week : Lecture:3, Tutorial: 0, Practical: 0
Number of Credits : 3
Course Assessment methods : Continuous assessment through tutorials, attendance, assignments, quizzes, record, viva voce, two minor and major theory examination.

Objective : The objective of this course is to impart knowledge on mobile radio communication and different generation technologies.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Get the knowledge of wireless communication
2. Able to differentiate common wireless communication system
3. Able to understand 2G wireless communication
4. Able to understand 3G wireless communication
5. Able to understand 4G wireless communication
6. Able to understand 5G wireless communication

Topics Covered

UNIT-I

Evolution of mobile radio communication, mobile radio system around world, example of wireless communication system: paging system, cordless telephone system, how a cellular call is made, comparison of common wireless communication system. **9**

UNIT-II

Second generation (2G) cellular network, evolution of 2.5G mobile radio networks, evolution of 2.5 TDMA standards, HSCSD for 2.5G GSM, GPRS for 2.5G GSM and IS-136, EDGE for **9**

2.5G GSM and IS-136, IS-95B for 2.5G CDMA, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLAN), Bluetooth and Personal area network (PAN)

UNIT-III

Third generation (3G) cellular network, evolution of 3G mobile radio networks, Requirement of 3G communication, 3gpp, UMTS, Frequency Division Duplex (FDD), Wideband CDMA,Time Division Duplex (TDD),high-speed download packet access (HSDPA), Multiple Input Multiple Output Antennas (MIMO, **9**

UNIT-IV

Fourth generation (4G) cellular network, evolution of 4G mobile radio networks, requirement of 4G communication, feature of 4G wireless system, LTE Technology, Volte technology, Fifth generation (5G) wireless communication, requirements and feature of 5G network. **9**

Text and Reference Books

1. Rappaport, T.S., 1996. Wireless communications: principles and practice (Vol. 2). New Jersey: prentice hall PTR.
2. Molisch, A.F., 2012. Wireless communications (Vol. 34). John Wiley & Sons.

Course Code: IEC-401 **SATELLITE COMMUNICATION**

Course category	:	IE
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, record, viva voce and two minor tests and one major theory examination.
Course Objectives	:	The objective of this course is to impart the knowledge on satellite communication systems, their benefits, principles of orbital mechanics, satellite sub-system, satellite link design, earth station technology, multiple access techniques and Indian satellite systems.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Define and list the benefits of satellite communication.
2. Demonstrate orbital mechanics principles of satellite communication systems and solve problems related to it.
3. Describe a satellite link and identify ways to improve the link performance.

4. Classify new technologies of satellite communication systems as per given specifications.
5. Able to understand the Earth station technologies.
6. Examine advanced technologies of satellite launching and describe the Indian satellite system.

Topics Covered

UNIT-I

Introduction to Satellite Communication: History, Overview of Satellite Communication, Types of Satellite, Types of Orbit, Satellite services, Advantages & Applications of Satellite communication, Satellite Life phases, Space Debris, Introduction to Geo-synchronous and Geo-stationary satellites. **9**

UNIT-II

Orbital Mechanics: Orbital Mechanics, Kepler's Three laws of Planetary Motion, Developing the Equations of the orbit, Look Angle Determination, Earth Stations, Orbital Perturbations, Orbital effects in Communication system performance. **9**

Satellite Sub-systems: Seven segments of Satellite communication, Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system.

UNIT-III

Satellite Link Design: Basic transmission theory, System noise temperature and G/T ratio, Design of down link and uplink, Design of satellite links for specified C/N. **9**

Earth Station Technology**:** Earth Station Design, Design of Large Antennas, Tracking, Small earth station Antennas, Equipment for earth station

UNIT-IV

Multiple Access:FDMA, TDMA, CDMA, SSMA, Demand Assignment Multiple Access, Satellite Applications: VSAT, Direct broadcast satellite television and radio, Satellite navigation and the Global positioning systems (GPS). Mechanism of Satellite launching, Launch Vehicles, Advanced launching tech like Space X, Indian Satellite Systems: History and Overview of Indian Satellite System, Achievements, GSLV, PSLV, Advanced Technology Vehicle. **9**

Text and Reference Books

1. B.Pratt, A.Bostian, "Satellite Communications", Wiley India, 2nd Edition,2006.
2. D. Roddy, "Satellite Communications", TMH, 4th Edition, 2001.
3. Digital Satellite Communications/ Tri T. Ha./ McGraw-Hill, 2nd Edition
4. D.C. Agrawal, Satellite communication, Khanna Publishers; 7th Edition.

Course Code:	**Optical Fiber Sensor**
IEC-402	
Course category	: Program Elective (PE-IV)
Pre-requisite Subject	: NA
Contact hours/week	: Lecture: 3, Tutorial : 1 , Practical: 0
Number of Credits	: 4
Course Assessment methods	: Continuous assessment through attendance, home assignments, quizzes, two minor tests and one major theory examination.

Course Objectives : The objective of this course is to impart the knowledge on fundamental of optical sensor technology, their applications, performance characteristics, sensor design requirements and finding optimal sensing solution.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Possess a fundamental knowledge for different types of optical sensor technology and their applications.
2. Understand the important performance characteristics of optical fiber sensor such as Phase noise analysis and mitigation, Sensitivity limits etc.
3. Analyze a given sensing requirement and design appropriate sensor.
4. Able to understand the amplitude and wavelength modulated sensors
5. Able to understand the distributed fiber sensors
6. Able to apply optimal sensing solution for a given requirement.

Topics Covered

UNIT-I 9

Introduction to optical sensors, Different types Sensors & Instrumentation metrics, Optical receiver design, noise issues.

UNIT-II **9**

Amplitude Modulated sensors, Lock-in detection, Phase modulated sensors, Phase noise analysis and mitigation, Sensitivity limits.

UNIT-III 9

Wavelength modulated sensors, Interrogator design, sensitivity limits. Polarization Modulated Sensors, Analysis of current sensor.

UNIT-IV **9**

Distributed Fiber Sensors, Distributed strain & temperature Sensors, Optical Time Domain Reflectometer (OTDR), Raman & Brillouin scattering-based sensors.

Text and Reference Books

1. Fiber Optic Sensors: An Introduction for Engineers and Scientists edited by Eric Udd, William B. Spillman, Jr., 2nd edition, Wiley Optical.
2. Fiber Sensors: Advanced Techniques and Applications edited by GinuRajan, CRC Press, 2017
3. Fiber Optic Sensors, edited by Shizhuo Yin, Paul B. Ruffin, Francis T.S. Yu, 2nd edition, CRC Press, 2017 Optical Fiber Sensors by John Dakin and Brain Culshaw, Artech House, 1997
4. Optical Fiber Sensor Technology by K.T.V. Grattan & B.T. Megitt, Kluwer Academic Publishers, 1999.

IEC-405 DIGITAL CMOS DESIGN

Course category : Program Elective (PE-IV)

Pre-requisite Subject	:	VLSI Design (BEC-401)
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, home assignments, quizzes, two minor tests and one major theory examination.
Course Objectives	:	The objective of this course is to impart knowledge on fundamental of MOS with associated technologies, estimation of CMOS circuits performance, design of static & dynamic circuits using CMOS, clock strategies and Memory design.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to understand the fundamentals of MOS and associated technologies
2. Apply the fundamentals in estimating performance of CMOS circuits
3. Able to analyze CMOS logic circuits, with particular reference to speed and power consumption.
4. Able to design CMOS based static and dynamic circuits
5. Able to understand the fundamental blocks of a clock circuits and its impact on sequential circuits
6. Able to understand the working of Memory circuits

Topics Covered

UNIT-I 9

Introduction: Trends & Projections in MOS transistor, MOS parasitic and SPICE models, Design limitation of MOS and CMOS circuits, CMOS inverter circuits: Noise Margin calculation, switching speed Power analysis, SPICE Simulation of MOS and CMOS circuits

UNIT-II 9

Combination logic circuit design using CMOS: Static and Dynamic logic design, Choice of Pull-up and Pull-down network, Logic gate design using CMOS, design techniques for large Fan-in

UNIT-III 9

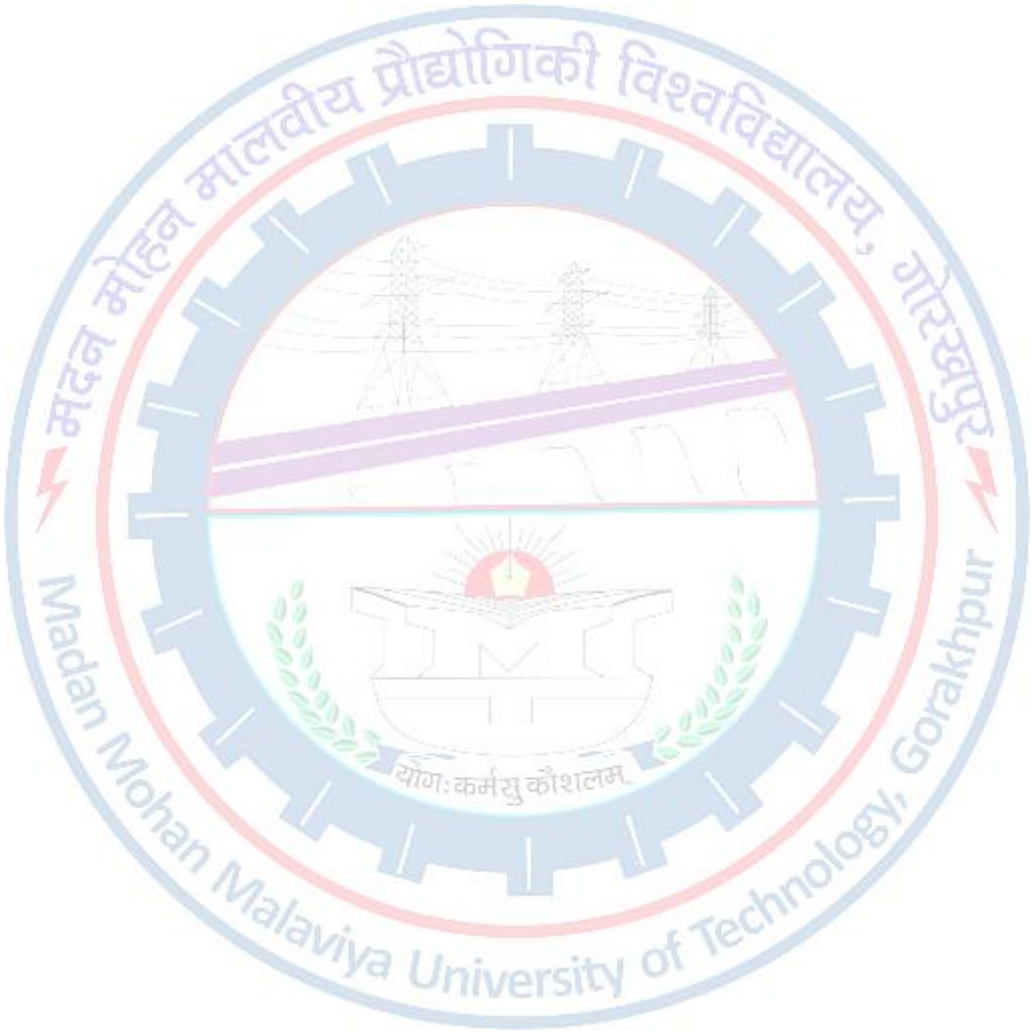
Logic Efforts and Sequential Circuit Design: Basics of logic efforts, Calculation of Logical efforts for symmetric and asymmetric logic gates, Timing metrices for Sequential circuits**,** Latches, Static latches and Registers, Multiplexer based latches**,** Pipeline approach, pipelining using pass transistor Optimized sequential circuit design,

UNIT-IV 9

Clock Strategies and Memory Design: Clock strategies for sequential circuit design, Clock skew, clock jitter, Architecture of the memory, Memory Classifications, Various parameters of memory, Performance enhancement of the memory. ROM and RAM design, 6-T SRAM Cell Design.

Text and Reference Books

1. Weste and Harris, “CMOS VLSI Design”, Pearson
2. S.M. Kang & Y. Leblibici, “CMOS Digital Integrated Circuits-Analysis & Design”, TMH, Ed. 2003.
3. K. Eshraghian&Pucknell, “Introduction to VLSI”, PHI.
4. R.Jacob Baker, “CMOS: Circuit Design, Layout, and Simulation”, Wiley
5. John P. Uyemura “CMOS Logic Circuit Design”, Kluwer Academic Press



Syllabus of Audit Courses

CONSTITUTION OF INDIA

Course Code: : **AUC 01** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit
Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

COURSE OUTCOME:
At the end of the course, learners should be able to
CO1- Student will Identify and explore the basic features and modalities about Indian constitution
CO2- Students will be able to differentiate and relate the functioning of Indian parliamentary system at the center and state level.
CO3- Student will be able to differentiate different aspects of Indian Legal System and its related bodies.

UNIT 1--Introduction and Basic Information about Indian Constitution: Historical Background of the Constituent Assembly, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System.

UNIT 2-Union Executive and State Executive: Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Powers and Functions of the Prime Minister, Judiciary.

UNIT 3- Introduction and Basic Information about Legal System: The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court).

UNIT 4- Intellectual Property Laws and Regulation to Information: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright, Information Technology Act, 2000. The Company's Act:

Reference:

1) G. Austin (2004) Working of a Democratic Constitution of India, New Delhi: Oxford University Press.
2) Basu, D.D (2005), An Introduction to the Constitution of India, New Delhi, Prentice Hall.
3) N. Chandhoke & Priyadarshini (eds) (2009) Contemporary India: Economy, Society, Politics, New Delhi: Oxford University Press.
4) N.G Jayal and P.B. Maheta, (eds) (2010) Oxford Companion to Indian Politics, New Delhi: Oxford University Press.

Indian Culture and Heritage

Course Code: : **AUC 02** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit
Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Unit-I
Indian Culture: An Introduction, Characteristics of Indian culture, Significance of Geography on Indian Culture, Society in India, Religion and Philosophy in India.

Unit-II
Indian Languages and Literature, Evolution of script and languages in India, Harappan Script and Brahmi Script, History of Buddhist and Jain Literature.

Unit-III
A Brief History of Indian Arts and Architecture, Indian Art & Architecture: Gandhara School and Mathura School of Art; Hindu Temple Architecture, Buddhist Architecture, Medieval Architecture and Colonial Architecture. Indian Painting Tradition: ancient, medieval, modern Performing Arts: Divisions of Indian classical music: Hindustani and Carnatic, Dances of India: Various Dance forms: Classical and Regional, Rise of modern theatre and Indian cinema.

Unit-IV
Spread of Indian Culture Abroad, Causes Significance and Modes of Cultural Exchange - Through Traders, Teachers, Emissaries, Missionaries and Gypsies, Indian Culture in South East Asia, India, Central Asia and Western World.

Recommended Readings:

1. Barua, B. 1934-37. Barhut Vol. I-III. Calcutta: Indian Research Institute.
2. Cunningham, Alexander 1966. The Bhilsa Topes. Varanasi: Indological Book Corporation.
3. Cunningham, Alexander 1965. The Stupa of Bharhut. Varanasi: Indological Book Corporation.
4. Dallapiccola, L.S.Z. Lallemant. 1980. The Stupa : Its Religious, Historical, and Architectural Significance. Wiesbaden: Franz Steiner Verlag.
5. Dehejia, Vidya 1972. Early Buddhist Rock Temples A Chronological Study. London: Thames and Hudson

Indian Architecture

Course Code: : **AUC 03** **Credits (0-0-0)**
Course Category : **Audit**

Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit
Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Course outcome
CO1- This course will help student learn about the development of Indian architecture and its contextual and traditional aspects.
CO2- The learner will gain knowledge of the development of architectural forms with reference to technology, style and character in various aspects of Hindu architecture.
CO3- The students will comprehend and relate to the theoretical basis of Budhdhist and Jain Architectures.

UNIT 1; Indus Valley Civilization: Town planning principles, cultural ethos, economy exemplified. The Aryan civilization: With its emphasis on the Vedic town plan.
UNIT 2: Buddhist Architecture Typology of lats, eddicts, stupas, viharas, and chaityas, both in rock-cut or other wise. The Buddhist philosophy and its imprint

UNIT3; Hindu Architecture, Indo Aryan: The evolution of the temple form, evolution of the shikhara in north India. The three schools of architecture - the Gujarat, the Khajuraho, and the Orrisan styles, Introduction to Dravidian Hindu Architecture.

UNIT 4: Jain Architecture : The temple cities of Palitana, Mount Abu and Girnar. Jain Theory The Jain philosophy and its imprint in built form.

REFERNCE BOOKS

1. Stella Kramrisch, The Hindu temple, Volume 1 & 2, Motilal Banarsidass Publications, 1996.
2. Percy Brown, Indian Architecture (Buddhist and Hindu period), D.B.Taraporewala Sons & co Pvt. Ltd. 1965
3. Volwahsen, Andreas, Living Architecture
4. Satish Grover, The Architecture of India- Volume 2, Vikas, 1980.
5. Henri Stierlin, Anne Stierlin, Hindu India: from Khajuraho to the temple city of Madurai, Taschen, 1998.
6. James Fergusson, History of Indian & Eastern Architecture, 2007
7. C. Batley, Design Development of Indian Architecture, John murray, London, 1934.

Indian Festivals

Course Code: : **AUC 04** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : ½ Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Course Outcomes:

CO1-Students will learn about rich cultural aspects associated with Indian religions

CO2-The course will give deep insight in to understand the importance of festivals.

UNIT 1; Indian Festivals: Introduction to major Indian festivals Bihu, Raksha Bandhan , Onam, Pongal, Holi, Dipawali, Dushehra, Easter, Good Friday, Christmas , Eid-ul-fitr and Eid-ul-Azha , Cultural aspects of festivals .

UNIT 2 ; **Characteristics of Indian festivals** ; Seasonal in nature, seasonal festival are Agro based, worships of animals.

UNIT 3; festivals observed at same time but with different names in different parts of country.

UNIT3 : Artificial or non religious festivals- like Jaisalmer desert festivals, Mango festivals in Delhi, Elephant festivals in India. Etc.

REFERENCE BOOKS

1) Discover India; Festival of India by Sonia Mehta

2) Hindu Festival : Origin, sentiments and Rituals by Mukuncharan Das.

VAIDIC MATHEMEATICS

Course Code: : AUC 05 Credits (0-0-0)
Course Category : Audit
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit
Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Course outcomes:

● Vedic mathematics methods are used in coding and VLSI implementation of encryption.
● Vedic mathematics method of division, exponentiation and multiplication are used in internet security and cryptographic algorithms for making these calculations faster than before.
● Arithmetic and logic unit (ALU) is responsible for all mathematical and logical calculations in computers. Some sutras like udharvtriyakbhyam and nikhilam are used for implementing multiplication methods.
● Digital Signal Processing (DSP) includes face recognition, text speech conversion, image processing and audio -video processing and also filtering of noise. In this area VM methods are very useful to improve the performance of DSP algorithms.

UNIT-I

Introduction & history of Vedic mathematics, Arithmetic and number, Vedic Maths Formulae, Addition and Subtraction: Addition - Completing the whole , Addition from left to right , Addition of list of numbers - Shudh method , Subtraction - Base method , Subtraction - Completing the whole, Subtraction from left to right

UNIT-II

Multiplication: Ekadhikenpurven method (multiplication of two numbers of two digits), Eknunenpurven method (multiplication of two numbers of three digits), Urdhvatiragbhyam method (multiplication of two numbers of three digits), Nikhilam Navtashchramam Dashtaha (multiplication of two numbers of three digits), Combined Operations

Division and Divisibility: Division, Nikhilam Navtashchramam Dashtaha (two digits divisor), Paravartya Yojyet method (three digits divisor)

Divisibility: Ekadhikenpurven method (two digits divisor), Eknunenpurven method (two digits divisor)

UNIT-III

Least Common Multiple **(LCM)** and Highest Common Factor **(HCF)**

Power and Root Power: Square (two digit numbers), Cube (two digit numbers).

Root: Square root (four digit number), Cube root (six digit numbers)

UNIT-IV

Contribution of Indian Mathematicians (In light of Arithmetic) , Aryabhatt , Brahmagupt , Mahaveeracharya , Bharti Krishna Tirtha

Reference Books:

1. Vedic Mathematics, Motilal Banarsi Das, New Delhi.

2. Vedic Ganita: Vihangama Drishti-1, Siksha Sanskriti Uthana Nyasa, New Delhi.

3. Vedic Ganita Praneta, Siksha Sanskriti Uthana Nyasa, New Delhi.

4. Vedic Mathematics: Past, Present and Future, Siksha Sanskriti Uthana Nyasa, New Delhi.

5. Leelavati, Chokhambba Vidya Bhavan, Varanasi.

6. Bharatiya Mathematicians, Sharda Sanskrit Sansthan, Varanasi.

ASTRONOMY

Course Code: : **AUC 06** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit
Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

UNIT-I

Historical introduction: Old Indian and western – astronomy – Aryabhatta, Tycho Brahe, Copernicus, Galileo – Olbers paradox – solar system – satellites, planets, comets, meteorites, asteroids.
Practical astronomy – telescopes and observations & techniques – constellations, celestial coordinates, ephemeris.
Celestial mechanics – Kepler's laws – and derivations from Newton's laws.
Sun: Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.

UNIT-II

Stellar astronomy: H-R diagram, color-magnitude diagram – main sequence – stellar evolution – red giants, white dwarfs, neutron stars, black holes – accretion disc – Schwartzchild radius – stellar masses Saha–Boltzman equation – derivation and interpretation.

Variable stars: Cepheid, RR Lyrae and Mira type variables – Novae and Super novae. Binary and multiple star system – measurement of relative masses and velocities. Interstellar clouds – Nebulae.

UNIT-III

Transformations Generalized Coordinates, Canonical transformations, Conditions for canonical transformation and problem, Poisson brackets, invariance of PB under canonical transformation, Rotating frames of reference, inertial forces in rotating frames.

UNIT-IV

Relativity and Application Concept of Special Theory of Relativity, Lorentz Transformation, Length Contraction and time dilation, Relativistic addition of velocities, conservation of mass and momentum, Concept of General Theory of Relativity, Equivalence of mass and energy, Relativistic Doppler shift and aberration of light. Lagrangian and Hamiltonian of relativistic particles, Relativistic degenerate electron gas.

Reference Books:

- "Textbook of Astronomy and Astrophysics with elements of Cosmology", V. B. Bhatia, Narosa publishing 2001.
- William Marshall Smart, Robin Michael Green "On Spherical Astronomy", (Editor) Carroll, Bradley W Cambridge University Press ,1977
- Bradley W.Carroll and Dale A. Ostlie. "Introduction to modern Astrophysics" Addison-Wesley, 1996.
- Bradley W.Carroll and Dale A. Ostlie, "An Introduction to Modern Astrophysics" Addison Wesley Publishing Company,1996
- 'Stellar Astronomy' by K. D Abhayankar.
- 'Solar Physics' by K. D Abhayankar.

ARTS OF INDIA

Course Code: : **AUC 07** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Course Outcomes:

CO1- Students will be introduced to emergence and development of art traditions upto 6th century C.E. Monuments will be studied in their cultural context.

CO2-Students will able to understand the monuments in their religious, regional and stylistic context. Students will be able to prepare plans of the monuments.

Unit 1:

Introduction to traditions of Art and Architecture in India . Introduction to Art and Architecture and prelude to historical art. ii. Art of the pre-Mauryan period. iii. Art and Architecture of Mauryan Period iv. Sources of Inspiration of Mauryan Art and Architecture: Foreign and Indigenous.

Unit 2:

Emergence and Development of Structural Stupa Architecture . Origin of Stupa Architecture. ii. Stupa Architecture - Pre-Mauryan and Mauryan periods. iii. North India, Central India, Deccan and Gandhara iv. Structural monasteries and Chaityas.

Emergence and Development of Rock-cut Architecture. Origin of Rock-cut Architecture. ii. Eastern India, Western Deccan, Eastern Deccan, Central India.

Unit 3:

Unit 4: Emergence and Development of Temple Architecture (08 hrs) i. Origin of Temple Architecture- Theoretical aspects. ii. Concept and symbolism of Temple. iii. Archaeological remains of structural temples. iv. Temple Architecture during the Gupta period. v. Temple Architecture during the Vakataka period.

Unit 4:

Sculptural Art and Paintings - Emergence and Development (10 hrs) i. Sculptural Art and Paintings -Concept and Symbolism. ii. Terracottas, Ivories and Bronzes iii. Paintings iv. Stone sculptures- Gandhara, Mathura, Sarnath and Andhra schools of Art. v. Art during the Gupta-Vakataka period.

Recommended Readings:

1. Barua, B. 1934-37. Barhut Vol. I-III. Calcutta: Indian Research Institute.
2. Cunningham, Alexander 1966. The Bhilsa Topes. Varanasi: Indological Book Corporation.
3. Cunningham, Alexander 1965. The Stupa of Bharhut. Varanasi: Indological Book Corporation.
4. Dallapiccola, L.S.Z. Lallemant. 1980. The Stupa : Its Religious, Historical, and Architectural Significance. Wiesbaden: Franz Steiner Verlag.
5. Dehejia, Vidya 1972. Early Buddhist Rock Temples A Chronological Study. London: Thames and Hudson

INTELLECTUAL PROPERTY RIGHTS

Course Code:	**:**	**AUC 08**	**Credits (0-0-0)**
Course Category	**:**	**Audit**	
Pre-requisite Subject	:	NIL	
Contact Hours/Week	:	1/2 Lecture : , Tutorial : , Practical:	
Number of Credits	:	0 Credit	

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

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

CO1: Create an understanding on Intellectual Properties and the importance of it.

CO2: Understand Trademarks and Trade secrets. To create awareness of unfair completion and methods of it.

CO3: Create awareness on the protection copyrights and patents. Understand the Ownership rights and transfer.

CO4: Create awareness of Cyber laws, Cyber Crime and get understanding of Privacy of Data.

CO5: To create awareness international aspects of IPR and the Emerging Trends in IPR.

Course Content

UNIT – I: Introduction to Intellectual property: Introduction, types of intellectual property—Patent, Trademarks, Copy rights, IPR and World Trade Organization, other international organizations,

agencies and treaties, importance of intellectual property rights. Creating Intellectual Property. Intellectual Property Management. Emerging Issues in IPR. Research and Development in India.

UNIT – II: Fundamentals of Patent: Historical Overview of Patent Law; Concept of Patent; Patentable Inventions; Procedure for Obtaining Patent; Rights and Obligations of Patent Holder; Transfer and Infringement of Patent Rights, Geographical Indications, Case Study: Apple versus Samsung Patent Dispute.

UNIT – III: Trademarks: Purpose and function of trademarks, acquisition of trademark rights, protectable matter, selecting, and evaluating trademark, trade mark registration processes.

UNIT – IV: Copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

Textbooks

- Textbook of Intellectual Property Rights, N.K. Acharya. Asia Law House, ed. 2021.
- Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
- Intellectual Property Rights–Pandey Neeraj, Dharni Khushdeep. PHI.
- Intellectual Property Rights: Text and Cases R. Radhakrishnan, S. Balasubramanian. Excel Books.

Reference Books

1) Intellectual property right – Unleashing the knowledge economy, Prabuddha Ganguli, Tate McGraw Hill ltd.

2) A short course in International Intellectual Property Rights – Karla C. Shippey, World Trade Press.

3) Intellectual Property Rights – Heritage, Science, & Society under international treaties – A. Subbian, - Deep & Deep Publications – New Delhi.

HUMAN RIGHTS

Course Code:	**:**	**AUC 09**	**Credits (0-0-0)**
Course Category	**:**	**Audit**	
Pre-requisite Subject	:	NIL	
Contact Hours/Week	:	1/2 Lecture : , Tutorial : , Practical:	
Number of Credits	:	0 Credit	

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Course Outcomes:

On completion of the course, students will be able to:

1. Simply put, human rights education is all learning that develops the knowledge, skills, and values of human rights.
2. Strengthen the respect for human rights and fundamental freedoms.
3. Enable all persons to participate effectively in a free society.
4. Learn about human rights principles, such as the universality, indivisibility, and interdependence of human rights.

UNIT-I

The Basic Concepts: Individual, Group, Civil Society, State, Equality, Justice, Human Values: Humanity, Virtues, Compassion.

UNIT-II **Human Rights and Human Duties:**

i) Philosophical and historical foundation of human rights and duties
ii) Theories of rights
iii) Concept and classifications of human rights and duties
iv) Human rights and duties

1. Correlation of rights and duties/responsibilities
2. Tensions between rights inter se, duties inter se, and rights and duties

UNIT-III

Society, Religion, Culture, and their Inter-Relationship: Impact of Social Structure on Human behavior, Roll of Socialization in Human Values, Science and Technology, Modernization, Globalization, and Dehumanization.

UNIT-IV

Social Structure and Social Problems: Social and Communal Conflicts and Social Harmony, Rural Poverty, Unemployment, Bonded Labour, Migrant workers and Human Rights Violations, Human Rights of mentally and physically challenged.

Books & References:

1. Shastry, T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd), 2005.
2. Nirmal, C.J., Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.

LOGICAL RESEARCH

Course Code: : **AUC 10** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination

Course outcome: In this course you should develop the following competencies:

CO1: To understand about research methodology with its different aspects, about logical reasoning, and types of research.
CO2: It will also result in knowledge appraisal from data collection to data interpretation.
CO3: Mathematical reasoning will also help them to acquire several skills required for the placement.

Course Content

UNIT1- Research Methodology: meaning, characteristics, Types of research; Process of research; Research methods and Ethical issues in research.

UNIT2- Logical Reasoning: arguments, deductive and inductive research, quantitative and qualitative research, scientific research; logical approach in research - Venn diagram; Inferences; analogies.

UNIT3- Data collection, Organization of data, Data analysis and mapping, Parametric and non-parametric; Data Interpretation.

UNIT4- Mathematical Reasoning, number series, letter series, codes; relationships, classification.

References:
1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology – C.R.Kothari
4. Marketing Research- G C Beri
5. Logical reasoning- R S Agarwal

PROFESSIONAL ETHICS

Course Code: : **AUC 11** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:

Number of Credits : 0 Credit

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Course Outcomes

Course Outcomes: After the completion of the course the student will be able to-

CO1: Understand the core values that shape the ethical behaviour of a professional.

CO2: Identify the multiple ethical interests at stake in a real-world situation or practice.

CO3: Explain the role and responsibility in technological development by keeping personal ethics and legal ethics.

CO4: Solve moral and ethical problems through exploration and assessment by established experiments.

CO5: Apply the knowledge of human values and social values to contemporary ethical values and global issues.

Course Content

Unit I:

Understanding Professional Ethics and Human Values: Morals, values and Ethics – Integrity- Academic integrity-Work Ethics- Service Learning- Civic Virtue Respect for others- Living peacefully- Caring and Sharing- Honestly- courage-Cooperation commitment Empathy-Self Confidence -Social Expectations.

Unit II:

Ethics for Engineers: Ethics – its importance – code of ethics – person and virtues – habits and morals – 4 main virtues – ethical theories – Kohlberg's theory – Gilligan's theory – towards a comprehensive approach to moral behaviour – truth – approach to knowledge in technology.

Unit III:

Environmental Ethics and Sustainability: Problems of environmental ethics in engineering – engineering as profession serving people – engineer's responsibility to environment – principles of sustainability – industrial, economic, environmental, agricultural, and urban sustainability – Sustainable development. - Global Ethical Issues.

Unit IV:

Social Experimentation, Responsibility and Rights: Engineers and responsible experiments – safety and risk – confidentiality – knowledge gained confidentiality – experimental nature of engineering – Intellectual Property Rights – professional rights – employee rights – occupational crime.

Textbooks

- Mike W Martin, Roland Schinzinger, " Ethics in Engineering", Tata McGraw –Hill.
- Govindarajan M, Natarajan S, Senthil Kumar V S, "Engineering Ethics" PHI India.
- R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi.

Reference Books

- Aarne Vesblind, Alastair S Gunn, "Engineering Ethics and the Enviornment".

- Edmund G Seebauer, Robert L Barry, "Fundamentals of Ethics for scientists and engineers" Oxford University Press.
- B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

ENVIRONMENTAL LAWS

Course Code: : **AUC 12** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits :
Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.
Course Outcomes:

The course gives students the opportunity to grapple with contemporary legal debates in environment law. Therefore, the learning outcomes of this course can be encapsulated as follows:

1) The primary learning outcome is to sensitize the students towards human activities that adversely affect the environment and the need for regulation of such activities.
2) Students will develop a thorough understanding of practice and procedure followed by various environmental law enforcing agencies/bodies.
3) Students will be able to pursue environmental litigation before the National Green Tribunal and assist the Tribunal as a researcher or in any other capacity.
4) Students will be able to assist industries and projects in obtaining environmental clearance and compliances with other environmental laws.

UNIT-I

Development of Environmental Laws and Policies in India:

I. Concept of 'environment' and understanding scope of environmental law.
II. Two approaches towards environmental protection- 'Eco-centric approach' and 'Anthropocentric' approach.
III. Impact of IEL on environmental law in India.
IV. Significance of Environmental Protection in Five Year Plans.
V. Development of the 'Right to Environment' as a Fundamental Right and challenges.

UNIT-II **Judicial remedies and the role of National Green Tribunal:**

I. Civil Remedies i.e. Tortious remedy and Class Action

II. Criminal Law Remedies under relevant provisions of Indian Penal Code, 1860 and Criminal Procedure Code, 1973
III. Constitutional Law Remedies i.e. Writ Jurisdiction & Public Interest Litigation
IV. Statutory Remedies i.e. Remedies under Public Liability Insurance Act 1991, National Environment Tribunal Act, 1995, National Green Tribunal Act, 2010

UNIT-III

Statutory framework for Prevention of Environmental, Air and Water Pollution:

I. Water (Prevention and Control of Pollution) Act 1974 [Framework of the Act, Criminal Liability and Judicial relief under the Act, Constitutional Challenges of Restraining Orders under Section 33]
II. The Air (Prevention and Control of Pollution) Act 1981 [Framework of the Act, Criminal Liability and Judicial relief under the Act, Noise Pollution]
III. Environment (Protection) Act, 1986 [Framework of the Act, Enforcement mechanisms and Role of Pollution Control Boards, Environment Impact Assessment, Coastal zone regulations Notifications]
IV. Law on Waste Management and Handling
V. Procedural environmental rights under various environmental laws
   - Right to Information
   - Right to public consultation
   - Right of access to justice

UNIT-IV

Statutory framework governing Forest, Wildlife and Biodiversity:

II. Statutory Framework on Forest Preservation [The Indian Forest Act, 1927; Forest (Conservation) Act, 1980; National Forest Policy, 1988; The Scheduled Tribe and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006]
III. Statutory Framework on Wildlife & Biodiversity Protection [The Wildlife (Protection) Act, 1972; Implementation and gaps and Judicial Perspective; Biological Diversity Act, 2002]

Books & References:

1) Shyam Divan & Armin Rosencranz, Environmental Law & Policy in India (2 nded, Oxford University Press, 2014)
2) P. Leelakrishnan, Environmental law in India (4th ed, LexisNexis, 2016)
3) Lavanya Rajamani and Shibani Ghosh, Indian Environmental Law: Key Concepts and Principles (Orient Blackswan, 2019)
4) Gitanjali Nain Gill, Environmental Justice in India: The National Green Tribunal (Routledge, 2017)
5) Patricia Birnie, Alan Boyle and Catherine Redgwell, International Law and the Environment (3rd ed., Oxford University Press, 2009)
6) Philippe Sands, Principles of International Environmental Law (2nd ed, Cambridge University Press, 2003)

HEALTH LAW

Course Code: : **AUC 13** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : ½ Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination

Course Outcome: In this course you should develop the following competencies:
CO1: Knowledge and understanding of the values and policies underlying Health Law.
CO2: Knowledge and understanding of substantive law related to health care, health care insurance markets as well as related procedural law.
CO3: Written and oral communication in the legal context.

Course Content

UNIT-1 BASICS OF HEALTH LAW- Basic of Health and its provider, Origin & Evaluation, All Council Acts.

UNIT-2 NEED FOR HEALTH LAW -Fraudulence, Negligence and Abuse, Human Rights, Rights & Duties of Health Care Provider (Public & Private Activities).

UNIT-3 LEGAL ASPECTS OF HEALTH LAW- Role of Health Policy & Health Care Delivery, General Laws on Health Law (Medical Allied Agencies), Specific Laws on Health Law (NDT, PWD/etc.).

UNIT-4 MEDICAL INSURANCE –Introduction-Various types, Significance and Kind of Medical Insurance/Policies, Insurance & Assurance, General Principles of Law and Contract, Medical Insurance Regulations.

REFERENCES:
1)Jonathan Herring- Medical Law and Ethics
2)Mason and Mc Call Smith- Law and Medical Ethics
3)S. V. Jogarao- Current Issues in Criminal Justice and Medical Law

National Cadet Corps (NCC)

Course Code: : **AUC 14** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : ½ Lecture : , Tutorial : , Practical:

Number of Credits : 0 Credit

Course Outcome: In this course you should develop the following competencies:

CO1: Imbibe the conduct of NCC cadets.
CO2: Respect the diversity of different Indian culture.
CO3: Perform his/her role in Nation Building
CO4: Do the social services on different occasions.
CO5: Practice togetherness and empathy in all walks of their life.
CO6: Do the asana and gain the physical& mental fitness

Course Content

UNIT 1
NCC General

History, Aims, Objective of NCC, NCC as Organization. Incentives of NCC, Duties of NCC Cadet, NCC Camps: Types & Conduct.

UNIT 2
National Integration & Awareness

National Integration: Importance & Necessity, Factors Affecting National Integration, Unity in Diversity & Role of NCC in Nation Building, Threats to National Security

UNIT 3
Social Service and Community Development

Celebration of Days of National & International Importance, Social Service and Community Development Activities to be conducted.

UNIT 4
Health & Hygiene:

Yoga- Introduction, Definition, Purpose, Benefits.
Asanas-Padamsana, Siddhasana, Gyan Mudra, Surya Namaskar, Shavasana, Vajrasana, Dhanurasana, Chakrasana, Sarvaangasana, Halasana etc.

Textbooks:

1. R. Gupta, "NCC: Handbook of NCC Cadets for 'A', 'B' and 'C' Certificate Examinations" 1st Edition (English, Paperback, RPH Editorial Board)

Basics of Human Health and Preventive Medicines

Course Code:	**:**	**AUC 15**	**Credits (0-0-0)**
Course Category	**:**	**Audit**	
Pre-requisite Subject	:	NIL	
Contact Hours/Week	:	1/2 Lecture: , Tutorial : , Practical:	
Number of Credits	:	0 Credit	

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

UNIT- 1

Health- Definition, dimensions, concept of wellbeing, Physical quality of life index, Spectrum of health, Determinants of health.

Concept of disease- Epidemiological triad, Natural history of disease, Risk factors, risk group, Iceberg of disease, Disease control, Disease elimination, Disease eradication, **Monitoring and surveillance-** Concept of prevention, Primary, Secondary and Tertiary, Modes of Intervention.

UNIT- 2

Communicable diseases- Type of microorganisms, Mode of transmission, Prevention of infectious diseases, Vaccination/immunization**.**

Diarrheal diseases and dehydration- Prevention and role of ORS**.**

Fever- cause and how to deal with.

Respiratory problems and cough

UNIT - 3

Non communicable diseases/ Lifestyle related disorder- Risk factors, CAD, risk and prevention, Hypertension, Diabetes mellitus, Obesity, Cancer, Accidents.

UNIT – 4

Nutrition and health- Classification of food, Balance diet.

Occupational hazards

Mental health and substance abuse

Medical Emergencies- BLS and ALS.

Reference Textbook

1) K. Park – "Park's Textbook of Preventive and Social Medicine"
2) Yash Pal Bedi & Pragya Sharma– "Handbook of Preventive and Social Medicine, Seventeenth Edition, CBS Publication".
3) Sunder Lal, Adarsh, Pankaj – "Update on Textbook of Community Medicine Preventive and Social Medicine with Recent Advances" 5th Edition, Publication 2018.
4) Dr. B. Saha- "Preventive and Social Medicine Communicable Disease Hygiene".
5) Rabindra Nath Roy, Indernil Saha- "Mahajan and Gupta Textbook of Preventive and Social Medicine" 4th Edition, Japee

Detail Syllabus of Extra Curricular Activities (ECA) Courses under Council of Student Activities

Skill Development- I (ECA-151)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Participation and Training
Course Outcome	:	Students are expected to learn and develop their skill and their personality through the activities and trainings under the council and should be well versed with the listed activities and events.

UNIT- 1

- **Introduction to TSC and IEEE:** An introduction to technical sub-council and IEEE. An overview of IEEE and the events conducted by them.

UNIT- 2

- **Robotics Classes:** Informative classes conducted on by the students of IEEE about Bot modelling and electronics as well as embedded. It is conducted for both Wired and Wireless Robotics.

UNIT- 3

- **Introduction to Workshops by IEEE:** *Workshop* is a brief intensive course for a small group which emphasizes problem solving. A number of workshops are conducted by IEEE like Ethical hacking, Soft skills, Artificial Intelligence etc.

UNIT- 4

- **Events under TechSrijan:** Techsrijan is the annual techno-management fest held every year like Enigma, Robotics, Incognito, Quizzes, World Parliament, etc.

Skill Development- II (ECA-201)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Participation and Training
Course Outcome	:	Students are expected to learn and develop their skill and their personality through the activities and trainings under the council and should be well versed with the listed activities and events.

UNIT- 1

- **Introduction to TSC and SAE:** An introduction to technical sub-Council and SAE. An overview of SAE and the events conducted by them.

UNIT- 2

- **Aeromodelling Classes:** Informative classes and workshop conducted on by the students of SAE about Drone and remote-controlled modeling and electronics as well as embedded.

UNIT -3

- **Introduction to Workshops by SAE:** *Workshop* is a brief intensive course for a small group which emphasizes problem solving. A no. of workshops is conducted by SAE like Aeromodelling workshop, Bridge modeling etc.

UNIT- 4

- **Events under TechSrijan by SAE:** Techsrijan is the annual techno-management fest held every year. SAE conducts a number of events in TechSrijan like Junkyard Wars, Bride Kriti, El Tiro etc.

Skill Development- III (ECA-251)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Participation and Training
Course Outcome	:	Students are expected to learn and develop their skill and their personality through the activities and trainings under the council and should be well versed with the listed activities and events.

UNIT- 1

- **Introduction to TSC and UIC:** The University Innovation Cell supports and provides opportunity for Innovation works. You will get to learn about the things they do and promote.

UNIT -2

- **Introduction to Innowizion:** Every year University Innovation Cell organizes a national level event that provides opportunities for students across all disciplines to team up and use their creativity, passion, and knowledge of technology. Events like I-Expo and I-Quiz.

UNIT- 3

- **Introduction to Spectra:** It is a special event organized by University Innovation Cell which foster an opportunity for students to showcase their creativity and talent. It comprises of three events InQUIZitive, Replica and MindBuzz**.**

UNIT- 4

- **Learnings and Innovation:** Innovation increases your chances to react to changes and discover new opportunities. It can also help foster competitive advantage as it allows you to build better products and services for your customers in the industry.

Skill Development- IV (ECA-301)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Participation and Training
Course Outcome	:	Students are expected to learn and develop their skill and their personality through the activities and trainings under the council and should be well versed with the listed activities and events.

UNIT- 1

- **Introduction to TSC and SEB:** The Social Engineers Board (SEB) tries to achieve its goals by series of various events conducted throughout the academic year, both inside and outside the university.The members of the board are highly motivated individuals striving for noble cause, and voluntarily take initiatives which ensure betterment of the people and society in any way possible.

UNIT- 2

- **Introduction to Drishya:** A career counselling event by college final year, and an event designed to crave out the creativity inside the students and their ability to make something novel out of normality in situation

UNIT- 3

- **Introduction to Dhishan:** Bringing out the oration skill and leadership personality among the students by providing them chance to stand and represent themselves by this event.

UNIT -4

- **Introduction to Paravartan and NGOs:** Paravartan consists of a audio visual round and the second round is a skit presentation developing character of a student. They also collab with NGOs for social works.

Skill Development- Vth (ECA-351)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Participation and Training
Course Outcome	:	Students are expected to learn and develop their skill and their personality through the activities and trainings under the council and should be well versed with the listed activities and events.

UNIT- 1

- **Introduction to TSC and E CELL:** E-Cell of Madan Mohan Malaviya University of Technology promotes entrepreneurship abilities among the students of the university and conducts events to promote these ideas.

UNIT- 2

- **Introduction to Fresher's Talk:** A creative talk with the freshers of our university in which the fresher students provide some insights of what and how are they feeling about the college and its environment.

UNIT- 3

- **Introduction to Start Up Week:** Understanding the aspects of and entrepreneurial background and train to become one, through various personality developing as well as professionally balanced events.

UNIT- 4

- **Entrepreneurship Development:** It is the process of enhancing the skillset and knowledge of entrepreneurs regarding the development, management and organization of a business venture while keeping in mind the risks associated with it. Students will learn and cultivate skills which will promote entrepreneurship.

Skill Development-VIth (ECA-401)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Participation and Training
Course Outcome	:	Students are expected to learn and develop their skill and their personality through the activities and trainings under the council and should be well versed with the listed activities and events.

UNIT- 1

- **Introduction to TSC and Robotics Club:** Robotics Club speaks a name for itself in this domain with a sheen of itself that has been set by the high standards of the club members and strict adherence to the tagline Transforming ideas into reality, Events Details

UNIT- 2

- **Introduction to Web D Classes:** Classes on web development helps students to develop skills like Front-end and Back-end development which they can use to make websites.

UNIT -3

- **Introduction to Engineers Week:** a seven-day event paying tribute to all the engineers across the globe by conducting a no. of exciting events for technical development of students.

UNIT- 4

- **Robomania:** Develop the knowledge of robotics and circuitry in the students through training of students on circuits and the conduction of Robo Wars, Electronic chess, diffusion of a bomb in a set up made by students, demonstration of live game of the virtual events of NFS and Tekken, Lazer strike, Designing of Lazer maze.

Unity and Discipline (NCC)-I (ECA-171)

Course Category	:	NCC
Pre Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Lecture & Practical
Course Outcome	:	After completing this course, the students will be able to:

- Imbibe the conduct of NCC cadets.
- Do the social services on different occasions.

UNIT -1
Introduction of NCC: History, Aims, Objective of NCC.

UNIT -2
NCC as Organization. Incentives of NCC, Duties of NCC Cadet.
UNIT -3
Celebration of Days of National & International Importance, Social Service and Community Development Activities
UNIT- 4
NCC Parade on Independence Day.

Unity and Discipline (NCC)-II – (ECA- 221)

Course Category	:	NCC
Pre Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Lecture & Practical
Course Outcome	:	After completing this course, the students will be able to: -

- Respect the diversity of different Indian culture.
- Do the social services on different occasions.

UNIT- 1
National Integration & Awareness, Importance & Necessity

UNIT- 2
Factors Affecting National Integration, Unity in Diversity

UNIT -3
Celebration of Days of National & International Importance, Social Service and Community Development Activities
UNIT- 4
NCC Parade on Republic Day.

Unity and Discipline (NCC)-III – (ECA-271)

Course Category	:	NCC
Pre Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Lecture & Practical
Course Outcome	:	After completing this course, the students will be able to: - • Perform his/her role in Nation Building. • Do the social services on different occasions.

UNIT- 1
Role of NCC in Nation Building.

UNIT- 2
Threats to National Security.

UNIT -3
Celebration of Days of National & International Importance, Social Service and Community Development Activities

UNIT- 4
NCC Parade on Independence Day.

Unity and Discipline (NCC)-IV- (ECA-321)

Course Category	:	NCC
Pre Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Lecture & Practical
Course Outcome	:	After completing this course, the students will be able to: - • Contribute to environmental awareness and conservation activities. • Develop Leadership Qualities. • Do the social services on different occasions.

UNIT -1
Environmental Awareness and Conservation.

UNIT -2
Leadership Development: Important Leadership traits, Indicators of leadership.

UNIT- 3
Celebration of Days of National & International Importance, Social Service and Community Development Activities

UNIT -4
NCC Parade on Republic Day.

National Service Scheme-I (ECA-172)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Continuous assessment through National Service Scheme related tasks, participation in different events organized, attendance, home assignments.
Course Outcome	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes in achieving NSS motto after completing this course:

- The Motto of NSS "Not Me but You", reflects the essence of democratic living and upholds the need for self-less service.
- NSS helps the students' development & appreciation to other person's point of view and also show consideration towards other living beings.
- The philosophy of the NSS is a good doctrine in this motto, which underlines on the belief that the welfare of an individual is ultimately dependent on the welfare of the society as a whole and therefore, the NSS volunteers shall strive for the well-being of the society.

Introduction to National Service Scheme:

UINIT-I: History and its Objectives
UNIT-II: Organizational structure of N.S.S. at National, State, University and College Levels

UNIT-III: Advisory committee and their functions with special reference to University CSA, Program officer, N.S.S. group leader and N.S.S. volunteers in the implementation**.**

UNIT-IV: Organization/ Participation in "Tree-Plantation Drive"

National Service Scheme- II (ECA-222)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Continuous assessment through National Service Scheme related tasks, participation in different events organized, attendance, home assignments.
Course Outcome	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes in achieving NSS motto after completing this course:

- The Motto of NSS "Not Me but You", reflects the essence of democratic living and upholds the need for self-less service.
- NSS helps the students' development & appreciation to other person's point of view and also show consideration towards other living beings.
- The philosophy of the NSS is a good doctrine in this motto, which underlines on the belief that the welfare of an individual is ultimately dependent on the welfare of the society as a whole and therefore, the NSS volunteers shall strive for the well-being of the society.

UNIT-I: National Integration, Need and importance of National integration

UNIT-II: Various obstacles in the way of National Integration, such as caste, religion, language and provisional problems etc.

UNIT-III: NSS related Activities: Awareness to various activities under NSS.

UNIT-IV: Organization/Participation in "Cleanliness Drive" at home, hostel, Department and University

UNIT-V: Organization/Participation in "Winter cloth collection and distribution to needy people"

National Service Scheme- III (ECA-272)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0

Course Assessment Method : Continuous assessment through National Service Scheme related tasks, participation in different events organized, attendance, home assignments.

Course Outcome : The students are expected to be able to demonstrate the following knowledge, skills and attitudes in achieving NSS motto after completing this course:

- The Motto of NSS "Not Me but You", reflects the essence of democratic living and upholds the need for self-less service.
- NSS helps the students' development & appreciation to other person's point of view and also show consideration towards other living beings.
- The philosophy of the NSS is a good doctrine in this motto, which underlines on the belief that the welfare of an individual is ultimately dependent on the welfare of the society as a whole and therefore, the NSS volunteers

shall strive for the well-being of the society.

UNIT-I: Special Programme in NSS-I

A) Legal awareness
B) Health awareness
C) First-aid

UNIT-II: Special Programme in NSS-II

A) Career guidance
B) Leadership training-cum-Cultural Programme
C) Globalization and its Economic Social Political and Cultural impacts.

UNIT-III: Special Camping programme in NSS-I

A) Nature and its objectives
B) Selection of campsite and physical arrangement
C) Organization of N.S.S. camp through various committees and discipline in the camp.

UNIT-IV: Special Camping programme in NSS-I

A) Activities to be undertaken during the N.S.S. camp.
B) Use of the mass media in the N.S.S. activities.

National Service Scheme- IV (ECA-322)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Continuous assessment through National Service Scheme related tasks, participation in different events organized, attendance, home assignments.
Course Outcome	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes in achieving NSS motto after completing this course:

- The Motto of NSS "Not Me but You", reflects the essence of democratic living and upholds the need for self-less service.
- NSS helps the students' development & appreciation to other person's point of view and also show consideration towards other living beings.
- The philosophy of the NSS is a good doctrine in this motto, which underlines on the belief that the welfare of an individual is ultimately dependent on the welfare of the society as a whole and therefore, the NSS volunteers shall strive for the well-being of the society.

UNIT-I: N.S.S. Regular Activities-I

A) Traffic regulation
B) Working with Police Commissioner's Office
C) Working with Corporation of Gorakhpur District

UNIT-II: N.S.S. Regular Activities-II

A) Working with Health Department
B) Blind assistance
C) Garments collection and distribution

UNIT-III: N.S.S. Regular Activities-III

A) Non-formal Education
B) Environmental Education Awareness and Training (EEAT)'
C) Blood donation

UNIT-IV: N.S.S. Regular Activities-IV

A) Adopted Village related works
B) Disaster/Pandemic management

GAMES & SPORTS-I (ECA-181)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	Physical Education at 12th standard
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Training and Practices.
Course Outcome	:	The students are expected to be able to perform the following Knowledge, skills, and attitudes after completing this course. • Understand the concept of skill. • Acquire the required motor skills. • Demonstrate and assess various techniques of starts and finish. • Interpret the rules & regulations. • Acquire skill of marking track.

Track & Field-

UNIT- 1

- **INTRODUCTION:**

Historical development

- National
- International

Structure and functions of Controlling Bodies

- National
- International

UNIT- 2

- **FUNDAMENTAL SKILLS:**

- Starting techniques: Standing start, Crouch start and its variations, Proper use of blocks.
- Finishing Techniques: Run, Through, Forward lunging, Shoulder Shrug.

UNIT- 3

- **FUNDAMENTAL SKILLS-II:**

- Various patterns of Baton Exchange.
- Understanding of Relay Zones.
- Rules & their interpretation.

UNIT- 4

- **FUNDAMENTAL SKILLS-III:**

- Drills and Lead-up Games.
- Marking and Layout of Track & Field

Books & References

1. Latest Official Rule Books of International Federation
2. Coaching Manuals of International Federation
3. Official Website

GAMES & SPORTS-II (ECA-231)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	Physical Education at 12th standard
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Training and Practices.
Course Outcome	:	The students are expected to be able to perform the following Knowledge, skills and attitudes after completing this course.

- Understand the concept of skill.
- Acquire the required motor skills.
- Demonstrate and assess various techniques of starts and finish.
- Interpret the rules & regulations.
- Acquire skill of marking track.

Basketball-

UNIT- 1

- **INTRODUCTION:**

Historical development

- National
- International

Structure and functions of Controlling Bodies

- National
- International

UNIT- 2

- **FUNDAMENTAL SKILLS- I:**

- Player stance and ball handling.
- Passing-Two Hand chest pass, Two hand Bounce Pass, One Hand Baseball pass, Side Arm Pass, Over Head pass, Hook Pass.
- Receiving-Two Hand receiving, One hand receiving, Receiving in stationary position, Receiving while jumping, Receiving while running.

UNIT- 3

- **FUNDAMENTAL SKILLS- II:**

- Dribbling-How to start dribble, how to drop dribble, High dribble, Low dribble, Reverse dribble, Rolling dribble.
- Shooting-Lay-up shot and its variations, one hand set shot, one hand jump shot, Hook shot, and Free throw.
- Individual Defensive-Guarding the man with and without the ball, pivoting.

UNIT- 4

- **FUNDAMENTAL SKILLS-III:**

- Drills and Lead-up Games.
- Marking and Layout of Court.

Books & References

1. Latest Official Rule Books of International Federation
2. Coaching Manuals of International Federation
3. Official Website

GAMES & SPORTS-III (ECA-281)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	Physical Education at 12th standard
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Training and Practices.
Course Outcome	:	The students are expected to be able to perform the following Knowledge, skills and attitudes after completing this course. • Understand the concept of skill. • Acquire the required motor skills. • Demonstrate and assess various techniques of starts and finish. • Interpret the rules & regulations. • Acquire skill of marking track

Volleyball-

UNIT- 1

- **INTRODUCTION:**

Historical development

- National
- International

Structure and functions of Controlling Bodies

- National
- International

UNIT- 2

- **FUNDAMENTAL SKILLS-I:**

- Service-Under Arm Service, Tennis Service, Floating Service.
- Overhead finger pass.
- The Dig (Under Arm pass).

UNIT- 3

- **FUNDAMENTAL SKILLS –II:**

- Back court defense.
- Defensive and Offensive strategies.
- Smash
- Block–individual and team.

UNIT- 4

- **FUNDAMENTAL SKILLS-III:**

- Drills and Lead-up Games.
- Marking and Layout of Field.

Books & References

1. Latest Official Rule Books of International Federation
2. Coaching Manuals of International Federation
3. Official Website

GAMES & SPORTS-IV (ECA-331)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	Physical Education at 12th standard
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Training and Practices.
Course Outcome	:	The students are expected to be able to perform the following Knowledge, skills and attitudes after completing this course. • Understand the concept of skill. • Acquire the required motor skills. • Demonstrate and assess various techniques of starts and finish. • Interpret the rules & regulations. • Acquire skill of marking track for running events.

Hockey-

UNIT-1

- **INTRODUCTION:**

Historical development

- National
- International

Structure and functions of Controlling Bodies

- National
- International

UNIT- 2

- **FUNDAMENTAL SKILLS-I:**

- Player stance & Grip,
- Rolling the ball, Dribbling.
- Push, Stopping.
- Hit, Flick, Scoop.
- Reverse hit.

UNIT- 3

- **FUNDAMENTAL SKILLS-II:**

- Passing–Forward pass, square pass, triangular pass, diagonal pass, return Pass.
- Goalkeeping–Hand defense, foot defense.
- Positional play in attack and defense.

UNIT- 4

- **FUNDAMENTAL SKILLS-III:**

- Drills and Lead-up Games.
- Marking and Layout of Court.

Books & References

1. Latest Official Rule Books of International Federation
2. Coaching Manuals of International Federation
3. Official Website

GAMES & SPORTS- V (ECA- 381)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	Physical Education at 12th standard
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Training and Practices.
Course Outcome	:	The students are expected to be able to perform the following Knowledge, skills and attitudes after completing this course.

- Understand the concept of skill.
- Acquire the required motor skills.
- Demonstrate and assess various techniques of starts and finish.
- Interpret the rules & regulations.
- Acquire skill of marking track for running events.

UNIT 1

- **YOGA- HOLISTIC HEALTH:**

 Health- Concept of Health, its importance in human life.
 Components of health.

UNIT-II

- **YOGA AND ITS IMPORTANCE:**

- Definition of Yoga.
- Importance of Yoga in daily life.
- Aims and Objective of yoga.
- Misconception of yoga.

UNIT-III

- **SURYA NAMASKAR:**

- Benefits of Surya Namaskar
- Practices of Surya Namaskar

Unit- IV

- **YOGA PRACTICES:**

 Asana- Meditative
  i) Sukhasana
  ii) Padmasana
  iii) Swastikasana
 Cultural- Trikonasana, Makarasana, Bhujangasana, Sarpasana, Dhanurasana.
 Pranayama- Yogic Breathing, Anulom-Vilom.

Books & References

1. Indra Devi, “Yoga For You”, Gibbs, Smith publishers, Salt Lake City, 2002 Domen& Publishers, New Delhi-2001.
2. Yoga se Arogya, Indian Yoga Society, Sagar.

Games & Sports -VI (ECA- 431)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	Physical Education at 12th standard
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Training and Practices.
Course Outcome	:	The students are expected to be able to perform the following Knowledge, skills and attitudes after completing this course. • Understand the concept of skill. • Acquire the required motor skills. • Demonstrate and assess various techniques of starts and finish. • Interpret the rules & regulations. • Acquire skill of marking track for running events.

UNIT- 1

- **Badminton**

INTRODUCTION:

Historical development

- National
- International

Structure and functions of Controlling Bodies

- National
- International.

UNIT-II

- **FUNDAMENTAL SKILLS-I:**

- Racket parts, Racket grips, Shuttle (dimensions).
- The basics stances.
- Basic foot movements.

UNIT-III

- **FUNDAMENTAL SKILLS-II:**

- The basic strokes-Serves.
- Forehand-overhead and underarm.
- Backhand-overhead and underarm.
- Types of games-Singles, doubles, including mixed doubles.

Unit- IV

- **FUNDAMENTAL SKILLS-III:**

- Drills and Lead-up Games.
- Marking and Layout of Court.

Books & References

1. Latest Official Rule Books of International Federation
2. Coaching Manuals of International Federation
3. Official Website

Culture, Art & Literary-I (ECA-182)

Course category	:	Cultural, Art &Literary
Pre-requisite Subject	:	NIL
Contact hours/week	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Methods	:	Practical Participation
Course Outcomes	:	Students are expected to develop their soft skills and their Personality through cultural and literary activities.

UNIT-1

Workout, Warm up, Stretching, Introduction to various dance forms, Dance form – Bollywood, Footwork, Body Movement, Theatre History, Literature and Aesthetics, Introduction to Acting, Yoga(Breathing, Exercise, Voice Control and Sound Modulation).

UNIT-2

Introduction to music, Basic Terminologies related to music, Origin of sound, Historical study of musical terms, Basic Introduction to Fine Arts, Roll of FAC in cultural sub-council, Basics of Fine Arts and Types, File extension, Editing software, Resources for stock images and video.

UNIT-3

MALVIKA: Basic knowledge of designing software (I) : Adobe In Design ,Photoshop ,Notice Making, Article writing.

UNIT-4

TIRESIA: Basic knowledge of designing software (I): Adobe In Design, Photoshop, Interview skills, Vocabulary development, Knowledge about technical advancements, knowledge of campus activities.

Culture, Art & Literary-II (ECA-232)

Course category	: Cultural, Art &Literary
Pre-requisite Subject	: NIL
Contact hours/week	: 2 Hours/Week
Number of Credits	: 0
Course Assessment Methods	: Practical Participation
Course Outcomes	: Students are expected to develop their soft skills and their personality through cultural and literary activities.

UNIT-1

Intro to basics of sketching, Painting, Craft, Sculpturing.

Sketch-Tools of sketching, Types of Sketching- Pencil/ Pen/ Color Pencil/ Charcoal/ Graphite/Ink/ Chalk / Digital Sketch. History of Indian Music, About life and contributions of Indian Musician sand Musicologists.

Two forms of Indian Classical Music (Hindustani/Karnataka).

UNIT-2

Introduction to Theatre Technique and Design, Character Analysis and practical on principle of Stanislavski Method (relaxations, concentration of attention and emotion memory), Workout, Warm up, Stretching, Dance Form- Hip-Hop, Footwork, Body movement, Choreography, Equipment, Types of lenses, building web site using template.

UNIT-3

ARUNODAY: Development of thinking ability with JAM (Just a Minute), Word Building, Letter rearrangement, Knowledge of spellings, Syllables, Critical thinking skill development, Vocabulary development, Thought expressing skill development, public speaking skill development.

UNIT-4

SPELLCZAR: Word building, Vocabulary development, Decision making ability development, Coordination capabilities.

Culture, Art & Literary-III (ECA-282)

Course category	:	Cultural, Art &Literary
Pre-requisite Subject	:	NIL
Contact hours/week	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Methods	:	Practical Participation
Course Outcomes	:	Students are expected to develop their soft skills and their personality through cultural and literary activities.

UNIT-1

Photo editing (Photoshop)

Ras- (Sringar Ras, Hasya Ras, Rodra Ras, Karun Ras, Vir Ras, Adbhut Ras, Vibath Ras, Bhayanak Ras, Shaant Ras)

UNIT-2

Workout, Warmup, Stretching, Pranam, Types of classical dance forms and their outfits, Dance form-Kathak, Hand movements, Choreography, Basic knowledge of Talas for Instance Teental, Dadra and Kherwa, Practice of AUM and vocal exercises of sargam (sa, re, ga, ma, pa, dha, ni) of 45. Alankaras, Styles of Sketching-Line/ Hatching/Blending/Scribbles/Tattoo/Doodling/Cartoon/Graffiti/Typography/Calligraphy/Caricat Ure

UNIT-3

ANNUAL DEBATE COMPETITION: General Knowledge & Current Affairs, Public speaking skill development, Oratory skill development, Sense of Team spirit, Knowledge of language, Social Study, Development of presentation skills.

UNIT-4

TWIST AND TWAIN: Development of imaginative power and creativity, Development of vocabulary, Development of writing skills, Thinking skill development.

Culture, Art & Literary-IV (ECA-332)

Course category	: Cultural, Art &Literary
Pre-requisite Subject	: NIL
Contact hours/week	: 2 Hours/Week
Number of Credits	: 0
Course Assessment methods	: Practical Participation
Course Outcomes	: Students are expected to develop their soft skills and their Personality through cultural and literary activities.

UNIT-1

Video editing, Basic knowledge about musical instruments (Tabla, flute, guitar etc.) about Swarmalika and two bragas-Bhupaliand Yaman.

UNIT-2

Monologue, reciting a poem, reading short stories, developing speech skill, Mime, Working on scene with partner and in a group, Painting-Tools of painting, Styles of painting-Abstract/Imagination/Expression/Cubism/Indian/Chinese/Japanese, All the theory covered upto Praveshi ka Purna, define and explain Kataaksha,Primalu, Nartan Bhedas- Nritta Nrutya and Natya, define Tandav and Lasya, Fourty pesof neck movements according to Abhinaya Darpan, Eight types of eye movements according to Abhinaya Darpan, Define and differentiate "FolkDance" and "Modern Dance" (Uday Shankar style), Life story of: Bindadin Maharaj, Kalka Prasadji, Harihar Prasadji& Hanuman Prasadji, Specialty of Jaipur and Lucknow Gharana,Definition and uses of the following Asanyukta Hasta Mudras: Sarpsheersha, Murga-sheersha, Simha-Mukha, Kangula, Alapadma, Chatura, Bhrama, Hansasya, Hansa-paksha, Sandausha, Mukula, Tamrachuda, Vyagraha, Trishula, Sanyukta HastaMudra: Anjali, Kapota, Karkata, Swastik, Dola, Pushpaputa, Utsanga, Shivalinga, Katakawardhan, Kartari-swastk, Shakata, Shankha.

UNIT-3

VAGMITA1: Development of oratory skill, Development of poetry writing skill, Alankar, Ras, Creative thinking ability development.

UNIT-4

VAGMITA 2: How to overcome camera consciousness, enhancement of the expression and presentation of the participants, development of the public speaking skill, Knowledge of tone adjustment while presenting.

Culture, Art & Literary-V (ECA-382)

Course category	: Cultural, Art &Literary
Pre-requisite Subject	: NIL
Contact hours/week	: 2 Hours/Week
Number of Credits	: 0
Course Assessment methods	: Practical Participation
Course Outcomes	: Students are expected to develop their soft skills and their personality

UNIT-1

Types of painting-Oil painting/ Watercolor painting/ Pastel painting/ Acrylic painting/ Digital painting/Spray Painting, Basic of Contemporary Dance, Foot Position and Transference, Center Technique, Travelling Technique, Dance, Dance (A) Peter Pan, dance (B) Emergence of a Butterfly.

UNIT-2

Improvisation, Elementary knowledge of Acting, Body language, Rhythm, Clarity and fluency in dialogue delivery, Understanding the depth of character, about terms related to Hindustani music like Naad, Shuruti, Saptak, Thaat, Vaadi, Samvadi, Photography Skill.

UNIT-3

MALAVIYAN THINKER: Creative thinking, how to pen down thoughts of our mind, Development of writing skill, Development of Expression, Public Speaking skill development.

UNIT-4

ABHYUDAYA: Multidimensional skill development: Technical skill development with software like Adobe Photoshop, MS word, MS PowerPoint, MS Excel, Content Writing skill development, public addressing, public engagement, Team work Mechanism, Leadership qualities, Time management, art and craft, Pottery, Oratory skill development, Presentation skill, Event management.

Culture, Art & Literary-VI (ECA-432)

Course category	: Cultural, Art &Literary
Pre-requisite Subject	: NIL
Contact hours/week	: 2 Hours/Week
Number of Credits	: 0
Course Assessment methods	: Practical Participation
Course Outcomes	: Students are expected to develop their soft skills and their personality

UNIT-1

Cinematography, Basic knowledge of Thaat system, Raga formation rules, 5 Ragas- Bhupali, Yaman, Bihag, Kafi, Deskar.

UNIT-2

Introduction to Nukkad, Mono Act, Skit, Introduction to Comedy, Tragic Comedy, Tragedy, Melodrama, Craft- Tools of craft, Types of Craft- paperwork/ Wood work/ foam work/ Cloth work, Popping/ Introto music theory, Angles and Movement/Music Theory, Direction and Levels/Rhythms for Grooves, Twists and isolated movements/8 Count Phrasing, Footwork/Floats and Glides, Waves/Movements Dynamics, Waves 2/Musical Phrasing, Putting it all together.

UNIT-3

WRITING SKILLS: Invitation making, Notice making, Article writing.

SKILL FOR INTEVIEWER: How to take formal interview, approaching the personality, Questions preparation, management, platform selection, public engagement.

UNIT-4

INTERVIEW SKILLS FOR INTERVIEWEE: Body language, Attire, Hand gestures, voice tone, Language, General Interview Questions- How to introduce yourself.